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Edited by: Piet Kommers and Pedro Isaías



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IADIS INTERNATIONAL CONFERENCE

e-Society 2012

**PROCEEDINGS OF THE
IADIS INTERNATIONAL CONFERENCE
e-Society 2012**

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DOCTORAL CONSORTIUM

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FOREWORD

These proceedings contain the papers and posters of the IADIS International Conference e-Society 2012, which was organised by the International Association for Development of the Information Society, in Berlin, Germany, March 10 – 13, 2012.

The IADIS e-Society 2012 conference aims to address the main issues of concern within the Information Society. This conference covers both the technical as well as the non-technical aspects of the Information Society. Broad areas of interest are eSociety and Digital Divide, eBusiness / eCommerce, eLearning, New Media and eSociety, Digital Services in eSociety, eGovernment / eGovernance, eHealth, Information Systems, and Information Management. These broad areas are divided into more detailed areas (see below). However innovative contributions that don't fit into these areas have also been considered since they might be of benefit to conference attendees.

Topics related to e-Society are of interest. These include best practice, case studies, strategies and tendencies in the following areas:

- **eSociety and Digital Divide:** Connectivity may imply social coherence and integration. The opposite may result as well, when systematic measures are taken to exclude certain individuals or certain groups. Papers are welcomed on the next keywords: Social Integration, Social Bookmarking, Social Software, E-Democracy, Social Integration
- **eBusiness / eCommerce:** Business Ontologies and Models, Digital Goods and Services, eBusiness Models, eCommerce Application Fields, eCommerce Economics, eCommerce Services, Electronic Service Delivery, eMarketing, Languages for Describing Goods and Services, Online Auctions and Technologies, Virtual Organisations and Teleworking
- **eLearning:** Collaborative Learning, Curriculum Content Design & Development, Delivery Systems and Environments, Educational Systems Design, E-Citizenship and Inclusion, eLearning Organisational Issues, Evaluation and Assessment, Political and Social Aspects, Virtual Learning Environments and Issues, Web-based Learning Communities
- **New Media and eSociety:** Digitization, heterogeneity and convergence, Interactivity and virtuality, Citizenship, regulation and heterarchy, Innovation, identity and the global village syndrome, Internet Cultures and new interpretations of “Space”, Polity and the Digitally Suppressed
- **Digital Services in eSociety:** Service Broadcasting, Political Reporting, Development of Digital Services, Freedom of Expression, E-Journalism, Open Access
- **eGovernment /eGovernance:** Accessibility, Democracy and the Citizen, Digital Economies, Digital Regions, eAdministration, eGovernment Management, eProcurement, Global Trends, National and International Economies, Social Inclusion
- **eHealth:** Data Security Issues; eHealth Policy and Practice; eHealthcare Strategies and Provision; Legal Issues; Medical Research Ethics; Patient Privacy and Confidentiality

- **Information Systems:** Electronic Data Interchange (EDI), Intelligent Agents, Intelligent Systems, IS Security Issues, Mobile Applications, Multimedia Applications, Payment Systems, Protocols and Standards, Software Requirements and IS Architectures, Storage Issues, Strategies and Tendencies, System Architectures, Telework Technologies, Ubiquitous Computing, Virtual Reality, Wireless Communications.
- **Information Management:** Computer-Mediated Communication, Content Development, Cyber law and Intellectual Property, Data Mining, ePublishing and Digital Libraries, Human Computer Interaction, Information Search and Retrieval, Knowledge Management, Policy Issues, Privacy Issues, Social and Organizational Aspects, Virtual Communities, XML and Other Extensible Languages

The IADIS e-Society 2012 Conference had 261 submissions from more than 44 countries. Each submission has been anonymously reviewed by an average of four independent reviewers, to ensure the final high standard of the accepted submissions. Out of the papers submitted, 51 received blind referee ratings that signified acceptability for publication as full papers (acceptance rate below 20%), while some others were published as short papers, reflection papers, posters and doctoral papers. The best papers will be selected for publishing as extended versions in the Interactive Technology and Smart Education (ITSE) journal (ISSN: 1741-5659), also in the IADIS International Journal on WWW/Internet (ISSN: 1645-7641), and some of the best papers will also be eligible to be extended and enhanced as book chapters for inclusion in a book to be published by IGI Global.

The conference, besides the presentation of full papers, short papers, reflection papers, posters and doctoral papers, also includes a keynote presentation. Special thanks go to Dr. Conor Galvin, University Lecturer and Director MA Programme, UCD Dublin, Ireland for his keynote presentation. Also a special thanks to Professor Paul Nieuwenhuysen, Vrije Universiteit Brussel, Belgium, for presenting a tutorial. In addition, e-Society 2012 offers also a special talk by Vassilia Orfanou, European Dynamics, S.A., Greece.

As we all know, a conference requires the effort of many individuals. We would like to thank all members of the Program Committee (125 top researchers in their fields) for their hard work in reviewing and selecting the papers that appear in this book. We would also like to thank all the authors who have submitted their papers to this conference.

Last but not least, we hope that everybody has a good time in Berlin, and we invite all participants for next year's edition of the IADIS International Conference e-Society, in 2013.

Piet Kommers, University of Twente, The Netherlands
Conference Program Chair

Pedro Isaias, Universidade Aberta (Portuguese Open University), Portugal
Conference Chair

Berlin, Germany, March 2012

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William Russell, University of Central Florida, USA
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KEYNOTE LECTURE

OWNED SPACES IN DIGITAL TIMES; REFLECTIONS ON E-SOCIETY AND THE REFUDALISING TURN

**By Dr Conor Galvin, University Lecturer and Director
MA Programme, UCD Dublin, Ireland**

Abstract

Change brings challenges and also opportunities to call new realities into being. But not all of these are intended. *From the philosophically critical to the simply curious, considering these unintended impacts *can open-out key spaces that have not been as closely examined as they should.

Shifting understanding around ownership in the digital world is one such change. The collateral impacts of this include degrading of spaces within (and around) polity, knowing and belonging, and raises issues of ownership, curation, voice and activism.

This talk seeks to raise some issues around each of these and to foreground problematic aspects that need early and thorough addressing if the promise of a unique and meaningful digital commons is to be fully realised. In a sense, what I will be examining is how far the refudalisation of public spaces generally has spilled over into e-Society, what the prospects are for holding onto the genuinely private and personal in these times, and why we absolutely need to do so.

SPECIAL TALK

EPRACTICE.EU – THE COMMUNITY BUILDING PLATFORM OF EGOVERNMENT, EINCLUSION & EHEALTH PRACTITIONERS

By Vassilia Orfanou, European Dynamics, S.A., Greece

Abstract

ePractice.eu is an interactive initiative of the European Commission, designed as a web 2.0 community service, tailored to the needs of **eGovernment, eInclusion and eHealth** practitioners throughout Europe in order to empower them to discuss and influence open government, policy-making and the way in which public administrations operate.

The portal combines online activities with frequent offline exchanges: workshops, face-to-face meetings and public presentations. It carries nine information and knowledge repositories: News, cases, library items, workshops, events, people, ePractice TV, factsheets, and communities. The link of these repositories to eGovernment will be further discussed and illustrated through specific examples.

With a large knowledge base of real-life case studies submitted by ePractice members across Europe, ePractice.eu serves as a point of reference for all users, thus enabling them to quickly access up-to-date news at national and European levels; watch interviews and presentations on ePractice TV; subscribe to the ePractice newsletter; and remain informed through the valuable resources of the eGovernment factsheets of 34 European countries.

Furthermore, ePractice is built around the concept of community creation and maintenance where interested parties that aspire to create a central point of information gathering and exchanging on a particular subject, can interact with peers of similar interests either physically via workshops or virtually via blogs.

Other unique features of ePractice are “Share with ePractice” and “Assisted Workshops”. Finally, ePractice offers the services of a professional helpdesk that provides feedback on a continuous basis.

CONFERENCE TUTORIAL

INFORMATION DISCOVERY ON THE INTERNET: A TUTORIAL

by Paul Nieuwenhuysen
Vrije Universiteit Brussel, Brussel, Belgium

Abstract

Context:

Access to information is quite important. These days our e-society is more and more dependent on digital information accessible through the Internet and the WWW.

Problem statement:

We consider two target groups of persons and organizations involved in information creation, discovery and access:

1. developers/creators of information sources,
2. developers and managers of information services including hybrid and digital libraries, which support discovery and retrieval of sources, and the end-users of these information services and sources,

Of course in reality these groups overlap and borders are not sharp. In fact all of us are users as well as creators of information.

How can we improve discovery of relevant information, working within a limited time budget and financial budget?

Methodology:

This tutorial is mainly based on professional experience, published literature and empirical research in the context of academic and scientific information services.

Findings, suggestions and recommendations:

Several topics are presented that deserve attention in order to improve discovery of information:

- From print to digital,
- Disintermediation,
- Online catalogs,
- Enhancing retrieval with metadata,
- Digitization of physical documents,
- Digital search,
- Federated search,
- Merging of databases,
- Link generators,
- Advanced commercial discovery services,
- The importance of free discovery services,
- Open access to information,

- Finding information through image searching,
- Web and Search Engine Optimization,
- The social web, and
- Information literacy of users.
-

For each of these topics, we can sketch the context and state of the art in general; this forms the basis for the formulation of aspects that deserve attention and of recommendations. In practical reality, the time available for this tutorial is limited. Therefore we start with a short introduction and interaction with the audience; then the tutorial will be condensed and adapted to the profile and interest of the participants.

Keywords:

Information retrieval, access to information, disintermediation, federated search, meta-search, aggregation, Internet, WWW, management, e-publishing, digital libraries, open access.

Full Papers

DIVERSIFYING STUDENT-NOTEBOOK INTERACTION IN PAPER-TOP INTERFACE SYSTEM

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ABSTRACT

We proposed Paper-Top Interface (PTI) and developed a PTI system for note-taking support. The PTI system, which uses a visual-marker-based AR (Augmented Reality) technology and projects a digital learning material onto the corresponding page of a notebook, provides student-notebook interaction (SNI). However, the SNI is not enough to develop the PTI system's merits. Therefore, we attempt to diversify the SNI by implementing new SNI functions in the PTI system. Our ideas for the new SNI functions are to superimpose an interactive quiz to the projected learning material (digital slide), and allow students to hide and paint the visual marker on the current page.

KEYWORDS

Student-notebook interaction, paper-top interface, augmented reality, visual marker, classroom education

1. INTRODUCTION

Recently, ICT (Information and Communication Technology) has been introduced in classroom education and necessary for classes in the digital age. For example, teachers often use digital slides projected onto a classroom screen. Students often use the Internet-enabled classroom computers to survey their unknown topics. Like these examples, ICT changes the traditional classes and provides new effective styles of teaching and learning. In addition, there have been advanced ICT-based systems in classroom education. For example, TVremote (Bär et al. 2005) collects students' responses (e.g., questions, comments, and evaluating parameters) from their mobile devices. CollabPointer (Bi et al. 2005) supports multi-user collaboration using a large display and pointing devices. Handheld Review (Mitsuhashi et al. 2009) displays personalized quiz materials and handouts on a student's handheld computer after automatic attendance check (student identification) using RFID (Radio Frequency Identification).

Most students in the digital age can adapt to ICT. On the other hand, they occasionally prefer traditional manners, behaviors, tools, and equipments. It is well known that digital document has been popularized but paper document has never disappeared. Thus, digital technology does not exist exclusively but exists together with traditional things. In a traditional classroom, students will write learning outcomes (e.g., constructed knowledge, thinking process, questions, and ideas) on their notebooks—they take notes. In a recent classroom, students often take notes while viewing digital slides projected onto a classroom screen. On the other hand, some students will take notes with not ICT but their pencils and notebooks.

It has been actively investigated and discussed how note-taking influences learning effect (Kiewra 1987). Note-taking is recognized as a universal learning activity for increasing learning effect in a classroom. For example, an investigative study focusing on university students reported that high correlations were found between the quantity of notes and examination performance (Nye et al. 1984).

There have been note-taking support systems, which mainly use a digital pen and particular papers for the digital pen. For example, AirTransNote (Miura et al. 2007), which digitizes notebooks written by students with a digital pen, displays their notebooks on a classroom screen to make the class more interactive. PaperPoint (Singer and Norrie 2007) captures a student's handwriting on a particular handout (printed with digital slides) and generates digital slides with his/her handwriting (handwritten annotations). PaperCP (Liao et al. 2007), which has the functions similar to PaperPoint and is used as the intuitive handwriting interface

for a tablet PC-based classroom interaction system, enables a teacher to annotate students' digital slides during an active learning class.

We proposed Paper-Top Interface (PTI for short) and developed a PTI system for note-taking support in classroom education (Mitsuhara et al. 2009)(Mitsuhara et al. 2010). PTI aims at decreasing burdens in note-taking and increasing learning effect by note-taking. The PTI system uses a visual-marker-based AR (Augmented Reality) technology and projects a digital learning material onto the corresponding paper (the corresponding page of a notebook) on a classroom desk. AR is to superimpose digital information on the real-world environment and can be used for digital learning materials with high expressiveness and interactivity (e.g., three-dimensional objects observable from many angles). For example, Grasset et al. (2008) developed an AR-based picture book, which superimposes digital objects (2D and 3D characters with sound effects) on a picture book and enables users to interact with the digital objects.

The PTI system provides student-notebook interaction (SNI for short) for note-taking support. For example, a student can switch the projected learning material (e.g., digital slide) by turning a page. However, the SNI is not enough to develop the PTI system's merits. Therefore, we decided to diversify the SNI.

The remainder of this paper is organized as follows. Section 2 outlines the PTI system in terms of implementation. Section 3 schematically illustrates fundamental SNI functions and new SNI functions, and shows two learning scenario examples of the new SNI functions. Finally, section 5 summarizes this work and shows the future works.

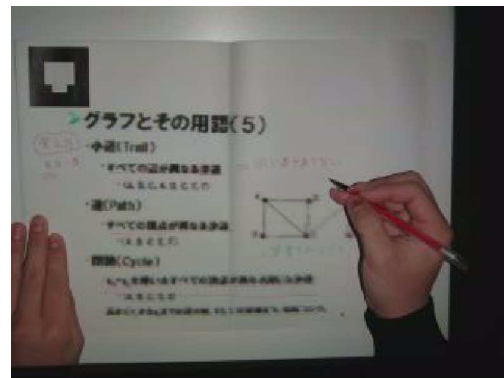
2. PTI SYSTEM

The PTI system supports note-taking in the class (classroom) where digital learning materials are projected onto a classroom screen. When using the PTI system, students do not have to significantly change their usual learning style. Figure 1 shows snapshots of the PTI system in use. The system's merits are shown as follows.

- A student can take a note easily. This is because he/she can write with his/her favorite writing tools (e.g., pencils and colored ink pens), viewing the learning material projected onto the notebook.
- He/she does not have to transcribe the learning material projected onto the classroom screen because the learning material is projected onto the notebook. Therefore, he/she can replace time for the transcription with time for consideration.
- He/she does not have to frequently move his/her directions of eyes between the classroom screen and the notebook. Therefore, his/her eye fatigue can be reduced.



A student using the PTI system



A projected material (digital slide)

Figure 1. Snapshots of the PTI system

2.1 System Composition

The PTI system consists mainly of a classroom desk, a pico projector, a video camera, a personal computer, and a particular notebook (Figure 2). The projector is mounted on a flexible metal frame above a student's head, being in a downward direction. The video camera is mounted beside the projector and shoots the desk.

The PC processes the video and generates learning material images to be projected onto the notebook (on the desk).

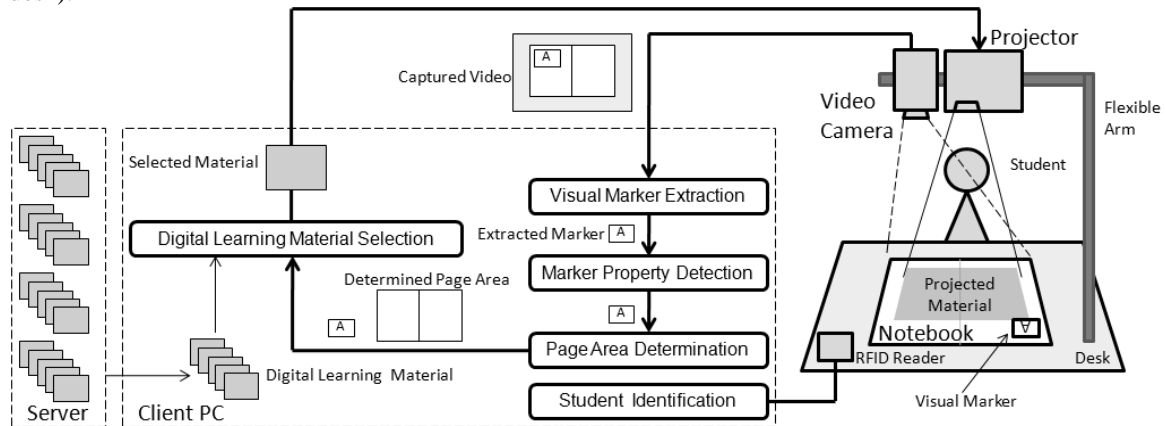


Figure 2. System composition and procedure

2.2 Procedure

The system procedure is divided into three phases: visual marker processing, learning material selection, and learning material projection. The detailed procedure is shown as follows (Figure 2).

- i. Captures the real time video from the video camera via a USB interface.
- ii. Extracts a visual marker on the current page from the captured video.
- iii. Detects the marker's properties.
- iv. Determines the page area from the detected position, largeness, and direction.
- v. Selects the learning material corresponding to the detected diagram pattern.
- vi. Projects the selected material onto the current page using the projector. The area outside the page is painted all black or white.
- vii. Returns to procedure iii.

Independently of the above procedure, the system captures the notebook at a regular interval and save it as image files so that the student can review the saved notebook images on his/her computers (e.g., a portable tablet) after the class.

2.2.1 Visual Marker Processing

A different visual marker has to be pasted (or printed) on every page of a notebook beforehand—one learning material corresponds to one page. The marker is up-down or left-right asymmetry because directions of the projected learning materials should be considered. All the colors of the marker are black and white. To obtain high detection rate, through trial and error, the marker frame is made in the ratio of 1:2:1, the upper/right black bar, the central black and white pattern area, and the lower/left black bar, respectively (Figure 3). The division number of marker recognition is set 64 x 64.

The PTI system calculates the match degree of the detected marker and the marker registered beforehand, and then executes learning material selection if the calculated degree exceeds a threshold value. The visual marker processing is implemented with NyARToolkit for C#, an AR library derived from ARToolKit.



Figure 3. Examples of visual markers pasted on every page of a notebook

2.2.2 Learning Material Selection

Learning materials are automatically downloaded and stored in the PC beforehand. Learning materials used in the PTI system are digital slide, video, animation, and 3D object. When a digital slide is used, the slide is converted into one image file. The filename (e.g., *.jpg and *.png) of a slide is linked to the ID of the marker on a page.

2.2.3 Learning Material Projection

The selected learning material is projected onto the corresponding page of a notebook. To be more precise, it is projected at the lower area of the marker position within the size of a standard notebook so that the PTI system does not fail in the marker detection due to covering the marker with the projected material. Currently, the positional calibration between the marker and the projected material is manually adjusted.

3. STUDENT-NOTEBOOK INTERACTION

The PTI system provides student-notebook interaction (SNI for short) for note-taking support and has fundamental SNI functions. However, the functions have not been utilizing enough the advantages of combining a digital learning material and a notebook. In other words, we have not yet developed the PTI system's merits. To develop the merits, therefore, we attempt to diversify the SNI by implementing new SNI functions.

There have been systems providing interaction similar to the SNI. For example, EnhancedDesk (Koike et al. 2001) provides students with direct manipulation of paper learning materials and digital learning materials projected onto a desk by using their own hands and fingers. PaperWindows (Holman et al. 2005) allows users to capture physical affordances of paper in a digital world by projecting digital information (windows) on a physical paper. In other words, the users can manipulate the digital information on the paper by their physical gestures (e.g., hold, collocate and flip). NiCEBook (Brandl et al. 2010) is a digital pen-based note-taking support system, seems to diversify SNI in terms of traditional notebook functionalities. In the system, for example, students can dog-ear a page and mark up the page margins in order to tag the page and highlight their handwriting visually. On the other hand, we aim at diversifying the SNI based on the visual-marker-based AR technology.

3.1 Fundamental SNI Functions

The fundamental SNI functions were implemented for fundamental note-taking support. Figure 4 shows the snapshots of the functions in use.



Figure 4. Fundamental SNI functions

3.1.1 Interaction by Turning Page

As soon as a student turns a page, the corresponding material is projected onto the current page (Figure 4-a). This function enables him/her to always view learning materials he/she wants independently of the learning material projected onto the classroom screen.

3.1.2 Interaction by Moving and Rotating Notebook

As soon as a student moves and rotates the notebook, this function tracks the notebook by moving and rotating the projected material from the detected markers' properties (Figure 4-b). This function enables him/her to lay out the notebook flexibly on a desk.

3.1.3 Interaction by Tilting Notebook

When a student tilts the notebook down, the projected material falls toward the desk and disappears from the current page—the current page becomes a blank page (Figure 4-c). After that, when he/she tilts the notebook (the blank page) up, the material that disappeared comes back to the current page. This function is used when the projected material is distraction for note-taking and he/she wants to take a note as usual.

Moreover, when the projected material is a 3D object, the student can view it from different directions and move it on the current page following the simple physical law.

3.2 New SNI Functions

A visual-marker-based AR technology does not allow students to influence the markers in order to prevent the marker detection failure. In the PTI system based on such a technology, if the marker is hidden, the projected material immediately disappears. In addition, the marker's graphic patterns are pre-designed and unchangeable.

In diversifying the SNI in the PTI system, we focused on new usage of the markers and thought that new SNI functions should be designed to increase learning effect further and solve problems in the PTI system. Our ideas for the new SNI functions are to superimpose an interactive quiz to the projected digital slide, and allow students to hide (cover) and paint the marker on the current page. Figure 5 shows the overview of the new SNI functions.

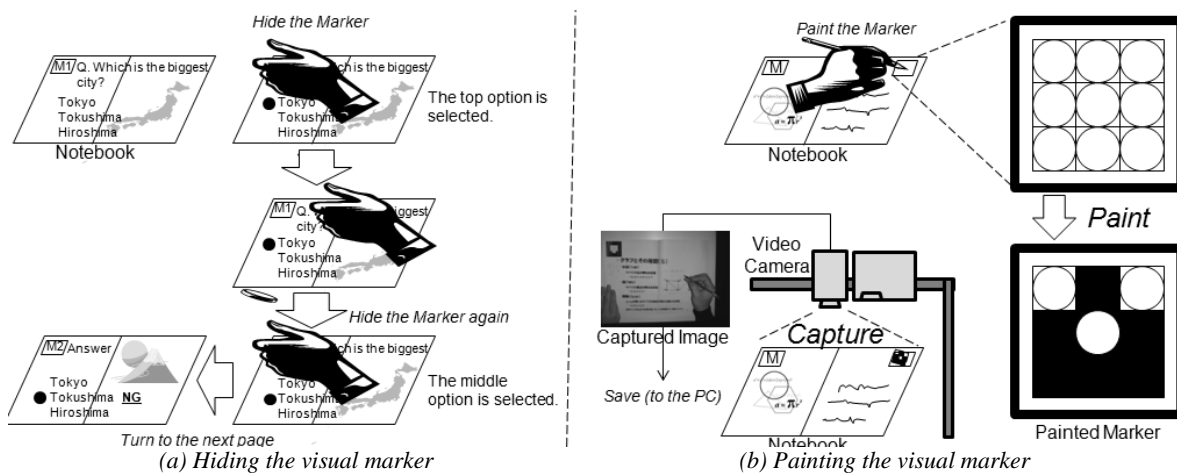


Figure 5. Overview of new SNI functions

3.2.1 Interaction by Hiding Visual Marker

This function constantly observes whether the visual marker is hidden, taking account of a certain time range to avoid the marker detection failure (instantaneous hiding) due to a frame rate issue—the marker hiding is recognized when the marker is hidden for more than about 0.3 seconds (10 frames). If the marker is hidden, this function changes the current state in predefined states.

Currently, the predefined states are associated with options in the interactive quiz (a single-choice quiz). This function enables a student to select his/her answer (one of the options) by hiding the marker. In Figure 5-a, the quiz question “Which is the biggest city?” and the three options are superimposed on the projected slide at the initial state. After that, he/she hides (and reveals) the marker and immediately the top option “Tokyo” is selected. He/she hides the marker again and immediately the middle option “Tokushima” is

selected. Then, he/she turns the current page to the next page and immediately his/her answer (the selected option) is judged and the feedback (correct or incorrect) is superimposed. He/she can turn the page back and select his/her answer again. As just described, this function aims at increasing learning effect further, focusing on interaction between a student and a digital learning material. Figure 6-a shows a snapshot of this function in use.

3.2.2 Interaction by Painting Visual Marker

This function enables a student to change the marker's graphic patterns by painting the marker with a black pencil—he/she can erase the painted area with a pencil eraser. This means that one marker can be given some meanings (associated with some functions) and reusable.

We think that this function can be used to capture the notebook with the video camera more flexibly. The PTI system captures the notebook at a regular interval and save it as image files. Therefore, many image files are saved in the PC and waste its disk space. This is a problem in the PTI system. To solve this problem, we implement the notebook capturing function based on the interaction by painting the marker.

As shown in Figure 5-b, a blank marker compartmented with lines and circles is pasted on a page. When a student wants to capture the current page (with his/her handwritten annotations), he/she paints the marker to look like a camera icon—the line pattern of the camera icon is pre-designed. If detecting the painted marker's graphic pattern, this function executes the notebook capturing function, which captures the current page after 5-second countdown. Figure 6-b shows a snapshot of this function in use.

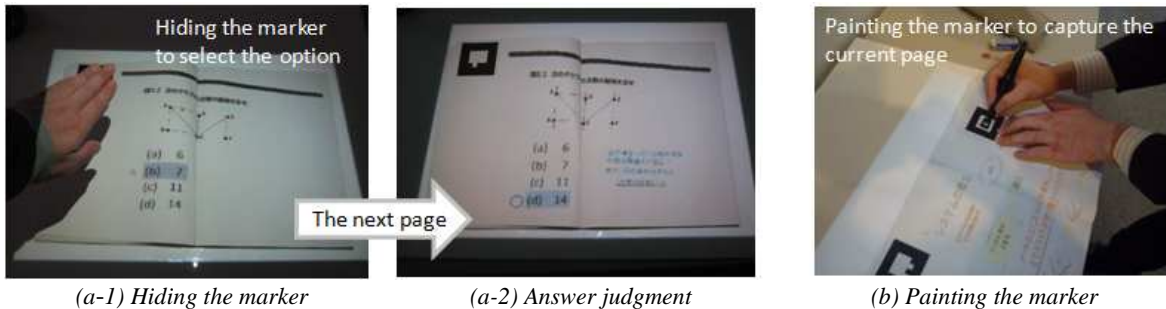


Figure 6. New SNI functions

3.3 Learning Scenario Examples using New SNI Functions

We expect that as applications of the new SNI functions, the following learning scenarios will be adopted in an elementary school class of astronomy.

3.3.1 Learning Constellations

This is a learning scenario example using the function of hiding the marker. At the initial state, the image of a starry sky is projected onto the current page and a quiz question about a constellation is superimposed (e.g., "Draw lines to form the Cassiopeia.") (Figure 7-a). A student answers the quiz by drawing lines with a pencil. After that, he/she hides the marker and immediately the correct answer (the lines forming the Cassiopeia) and the explanation are superimposed (Figure 7-b). After that, he/she hides the marker again and immediately the next quiz question is superimposed. He/she repeats answering the similar quizzes and then the current page will be filled with many constellations (Figure 7-c). Like this, students can learn constellations interactively by hiding the marker.

3.3.2 Learning Relation between Sun, Earth and Moon

This is a learning scenario example using the function of painting the marker. At the initial state, the image of a positional relation between the sun and the earth is projected onto the current page and a quiz question is superimposed (e.g., "Paint your blank marker to shape the crescent moon and then put the painted marker on the appropriate position of the crescent moon.") (Figure 8-a). A student paints his/her blank marker (separated from the page) to express the appropriate phase (shape) of the crescent moon. After that, he/she

puts the painted marker at the appropriate position around the earth on the current page and then it is judged whether the painted marker matches the graphic pattern of the appropriate phase and is located at the appropriate position (Figure 8-b). In another case, a quiz question that is more flexible can be prepared (e.g., “Put your blank marker at the position you like and shape the moon at the position by painting the marker.”) (Figure 8-c). Like this, students can learn the relation between the sun, the earth, and the moon interactively by painting the marker.

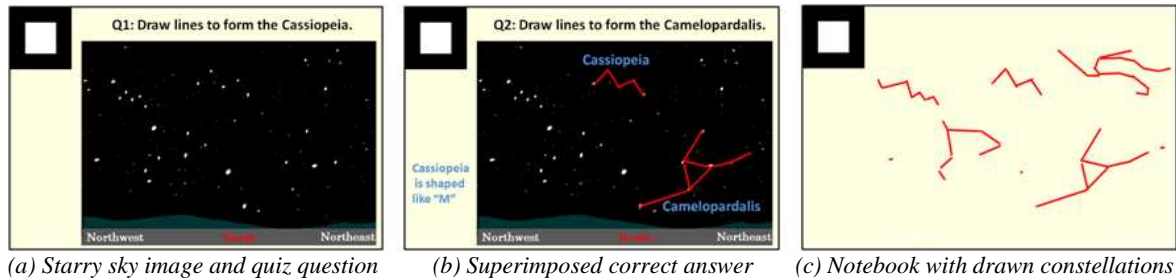


Figure 7. A learning scenario example using the function of hiding the marker

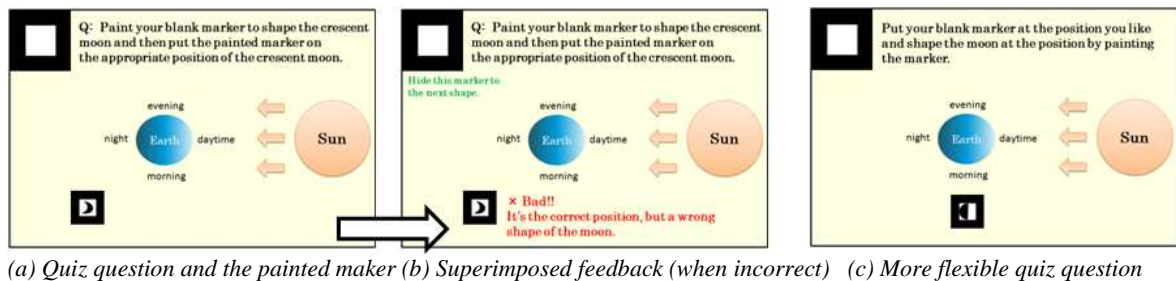


Figure 8. A learning scenario example using the function of painting the marker

4. SUMMARY AND FUTURE WORK

This paper outlined the PTI system and described the new SNI functions, which enable students to hide and paint the visual marker on the current page of the notebook. The functions are expected to increase learning effect further by the interactive quiz and make the PTI system easier to use.

We have almost implemented the functions, but they are not enough for practical use. For example, the system's latency and error in the visual marker processing cannot be ignored. The current processing speed of moving and rotating the projected material may give students irritation and stress, and the painted marker is occasionally difficult to be detected. In addition, the resolution of the projected material is low. Although these weak points depend partly on the performances of the PC and/or the projector, we have to overcome them in terms of system implementation.

Another future work is to evaluate learning effect of the PTI system including the new SNI functions. First of all, we have to consider what learning topics (classroom education) and learners (e.g., academic year) are suitable for the PTI system. To improve the usability of the PTI system is also an important future work. Although operations of the new SNI functions seem to be easy, the students cannot help but memorize additional operations (e.g., the marker's graphic patterns). We are now planning to conduct experiments for the evaluation.

ACKNOWLEDGEMENT

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TEACHING BASIC SOFTWARE ENGINEERING TO SENIOR HIGH SCHOOL STUDENTS

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Technische Universität München

ABSTRACT

Software Engineering (SE) is an increasingly important topic as software projects increase in size, budget and duration. We suggest starting to teach SE already to high school students instead of waiting until their freshman year. This paper shows principles we used for creating such courses. First we explain which software lifecycle model we use, why we use it and how it needs to be tailored for students with very little development experience. Second we discuss the educational models we apply to increase motivation and counter the inert knowledge problem often observed in lectures. We mainly focus on goal-based scenarios and scaffolding, two constructivist design methods. Finally we present a case study of one course we conducted this fall with eleven high school students between ages 16 and 18.

KEYWORDS

Software Engineering, Teaching, Goal Based Scenario, Constructivism

1. INTRODUCTION

Software Engineering is a topic that has grown more important over the years as software projects increase in size, budget and duration. This is why it takes up an increasingly large part of studies of Computer Science. But it does not only take up more time, education in Software Engineering now also start earlier.

Teaching Software Engineering (SE) is hard. Not only because of the breadth and complexity of the subject, but also because of the following inherent catch-22 teaching problem: On the one hand, for students to really be able to understand and reflect on SE theory, they need to have some experience of working in a “real” project. On the other hand, to learn successfully from a SE project course it is vital to have a sound understanding of the basic principles and practices of SE theory (Broman 2010).

This is why we think that teaching software engineering on a small, personally meaningful student project, teaching the knowledge required for the next steps along the way and reflecting on it at the end of the project is a good way to teach software engineering. In past courses we have found that working on a project with the goal of developing a working product not only leads to a level of motivation we have not seen before, but also that students deepened their understanding of theoretical concepts. Incrementally building on this newly acquired understanding, new software engineering concepts can be taught.

In this paper we describe the creation of such a course from several perspectives. First we analyze which software lifecycle can be taught in a course for students completely new to software engineering. We also explain how we help students to distinguish different software development phases and which phases might need to be taken over by the instructor.

In addition to the software engineering content to be taught we talk about the educational models used in our courses. Those models are all applied with the goal of increasing motivation while at the same time providing a more active and efficient learning environment.

After the theoretic basis we show the success of our course design in a short case study. In this study we prove that it is possible to develop a complete software project with high school students between ages 16 and 18, who do not have any prior programming or software engineering experience.

At the end of the paper we make suggestions how to adapt our design to a traditional school classroom setting instead of a short course of a few days at a university. We discuss differences between the two settings and how to overcome difficulties of such a project course within school.

2. TAYLORING SOFTWARE DEVELOPMENT PHASES

There exist a multitude of different software lifecycle models, e.g. Scrum, waterfall model, spiral model, V-Model. However teaching more than one at once at the beginning of software engineering education can be pretty daunting for software engineering students. For students who have no practical or theoretical knowledge in SE one should start out giving them some embodied experience using only one software lifecycle model. This helps the students to clearly understand the different phases that occur during the development of software. Additionally they gain deeper knowledge about one software lifecycle model and can compare it to the later ones using it as a reference point.

The instructor needs to choose the model that fits the project and target group best. We found that with beginners it works best to use short projects with a very basic software lifecycle model, concentrating on a clear distinction between the different development phases. In this context we therefore prefer to conduct projects that are using the waterfall model and are limited to a short development duration of one week. To reduce existing uncertainties the instructor prepares the course extensively and thoroughly.

Even though the disadvantages of the waterfall model are well-known it has one significant advantage: It is a good model for introducing software engineering concepts to novices, because it is possible to interleave the introduction of the deliverables [...] with the introduction to the development phases (Brügge 1992). Also the beginning and end of each phase are very clear, which makes it easier for students to distinguish between them. Conducting different phases in different rooms can increase this effect. We suggest at least changing the room once after the initial design when transitioning to implementation, which not only serves to make the cut more clear, but also to avoid that students start with programming too early.

Keeping the project short allows it for the instructor to guarantee a well-defined problem. This combined with an extensive preparation of the course helps to overcome the main disadvantage of the waterfall model, which is the minimal iteration and the lacking ability to respond to change (Gao 2010). Additionally a well-defined problem helps to produce a first quick success raising motivation as well as it provides the possibility to conduct several of those projects within one course, refining the understanding of software engineering each time.

In Figure 1 you can see the waterfall model with the succession of its different phases. Depending on the experience of the students some of those phases need to be taken over by the instructor, in other it is enough when the students are given document templates.

For example in requirements elicitation the students are given some slides with wireframes stating the most important requirements for each screen. Their task in this phase is then to refine the requirements and improve upon the wireframes. They do so by questioning some users or the client of their project and by conducting a small usability test with paper based prototypes.

As we are teaching students who are neither familiar with object-oriented programming nor with software engineering, the instructor takes over the analysis phase fully. However if there is time the instructor could create an analysis model together with the students using e.g. cognitive apprenticeship (Allan Collins et al. 1989). The phases design, implementation and testing can again be taken over by the students. Here the instructor should serve as a guide through the process. Offering a scaffold of hints and prepared document outlines. Those are described below, when we discuss scaffolding in detail. The final phase of maintenance will again be taken over by the instructor.

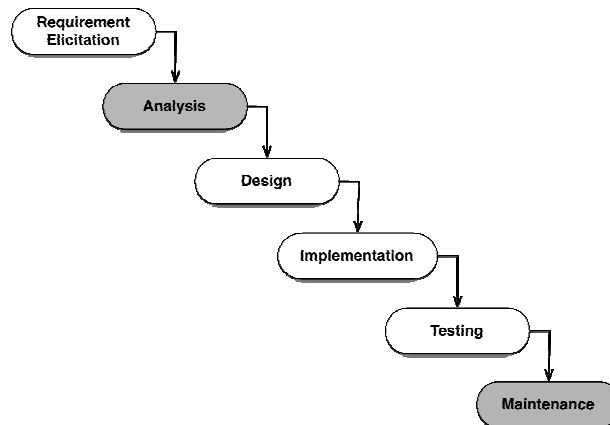


Figure 1. Waterfall Model.

This figure shows the different phases of the waterfall model. Gray phases are taken over by the instructor. The room should be switched at least once between design and implementation to make it easier for students to distinguish the different phases.

3. COURSE DESIGN PRINCIPLES FROM EDUCATIONAL TECHNOLOGIES

In our course we pursue two main objectives: First we want students to gain transferable knowledge about software engineering and basic programming skills. Second we want them to be motivated, eager to learn more about software engineering. Every design decision should be made in accordance with those goals while also taking into account our target group: senior high school students or freshmen, who have little or no knowledge about programming and software engineering. In the following section we discuss the major theories applied in designing the course. The design takes into account constructivist theories like Goal Based Scenarios and Scaffolding.

3.1 Goal-Based Scenarios

Goal-Based Scenarios (GBS) (Schank 1996; Schank 1992; Schank et al. 1994) are a situated learning environment with the goal to support a better transfer from learning settings to real world tasks (J. S. Brown et al. 1989; Allan Collins et al. 1989; Zumbach & Reimann 1999). At the core lies the idea that an interest is a terrible thing to waste. A teacher or instructor should not concentrate on teaching content directly to the student as this will only lead to a bored student who merely learns a set of unconnected facts, which he will forget quickly anyway. Instead he should think about a goal that interests his students. They acquire skills that the teacher thinks are necessary for his students implicitly, while working towards their goal.

He explains that any interest of a student can be utilized so that it relates in some way to the subjects that [one] wishes teach. For example when a student is about to learn how to read, it does not matter whether she is reading a book about trucks or animals. On the contrary, the more interested the student is in the topic she is reading about the more likely she is to spend more time on reading and pick up this skill more quickly.

The same holds true for SE: In order to learn about the existing software development phases it does not matter what kind of project is developed. Students could develop a game, a desktop program or a mobile app. The students would face similar problems to be solved with the same skill set. Therefore when selecting a project we should mainly think about feasibility and students' interest and then think about how to integrate the skills that we want the students to gain.

Schank describes in detail design criteria and components that make up a GBS. The different components are visualized in Figure 2.

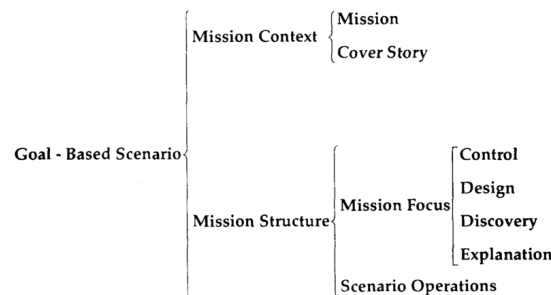


Figure 2. (Allan Collins et al. 1989) Components of a Goal-Based Scenario as described in (Schank et al. 1994)

The **mission context** describes the theme underlying the GBS. It is made up of the **mission**, which provides the primary goal and the **cover story**, which gives the premise under which the mission will be pursued. In the creation of a mission context a few design principles should be followed. The most important one is definitely that the goal is one that the students already have or the students will enthusiastically adopt. It needs to be clear, plausible, and consistent with the cover story. Progress towards the goal needs to be obvious leading to a feeling of empowerment. At the end of the course the student should have the feeling that he is capable of achieving a wide class of goals. Also there should be several different ways to achieve the goal. Finally the goal depends on the target skills and is not reachable without them.

In comparison to the mission context the **mission structure** focuses on the means by which the students will reach the mission goal. The **mission focus** includes approaches used, e.g. control, design, discover or explain. Usually a GBS should focus on a small set of approaches for the mission focus, selecting one single approach is not necessary. The **scenario operations** are the activities the student performs to reach the goal.

While some argue that GBSs take away time from learning as they can be very time consuming, Schank argues that increasing intrinsic motivation while learning is more important than teaching a denser curriculum. This advantage of creating intrinsic motivation, as opposed to extrinsic motivation, has been discussed by a number of researchers (Lepper & Greene 1978; Alto & Republic 1981).

3.2 Scaffolding

Software development is by no means an easy task. It requires a multitude of technical (object modeling, programming) and personal skills (teamwork, work distribution, delegation). Developing software on their own from scratch is usually out of reach for most students without prior knowledge in programming and software engineering. Therefore scaffolding: support of learning through tutorials, food for thoughts and other hints, is required to bridge the gap between what the students are currently able to do and the potential they can reach.

The idea of scaffolding is based on Vygotsky's (Vygotsky 1978) observation that learners have a zone of proximal development (ZPD) which describes the range between problems that the learner can solve on his own and ones he can solve with the help of a tutor. A successful scaffold offers the student help so that he can reach goal, that he would not have been able to reach otherwise. Help is only offered when the skills needed to solve the problem are over the head of the student. However with growing experience of the student the scaffold needs to fade away, finally allowing the student to do everything on his own without any external instructions. The objective of using scaffolding should always be to allow the student to reach the given goal with as little instructions as possible.

In order to design scaffolding for a project course the instructor needs to identify the major hurdles that may occur in developing the demanded software. In software development projects there are two major areas, where students usually struggle. The first is the area of project management, which contains amongst others the fair distribution of work between teams as well as allocating the given working time reasonably to the different development phases so that none of them is missed out. The second is the development of software

in general like designing analysis models without major dependencies between systems or the correct usage of syntax and semantics of programming languages.

The target group is inexperienced students, which require a bigger amount of help than more advanced students. This phenomenon is also described in (Schank et al. 1994) which also emphasizes the need for instructors to work closely with undergraduate students to provide detailed step-by-step guidance on how each milestone and deliverable should be finished, while at the same time strengthening the students abilities to learn on their own. In order to avoid issues with project management the instructor should organize a relatively strict schedule featuring the different software life cycle phases. The usage of the waterfall model allows the instructor to run through each of these phases one after another and to introduce the most important steps of the following phase right before its' beginning. If the phase requires the creation of certain deliverables an outline should be provided offering guidance for the creation of the deliverable. When developing a first project without prior programming experience the students are also very likely to run into a lot of technical problems. The instructor should try to foresee as many of those as possible and give the students the corresponding help. In our courses we usually provide three types of technical scaffolds to overcome these problems: An introductory tutorial to programming, an analysis model of the software already provided in the form of source code and finally a cheat sheet with the most important instructions for the programming language used.

The introductory tutorial merely serves as an enabler for the project giving the students a good start. The students should participate in it in an active way and not just listen passively. We often engage them by showing them a new instruction with an exemplary usage in the tutorial project. We then discuss the instruction. In the last step of introducing a new instruction the students are asked to incorporate a similar instruction into the tutorial project by themselves.

However the tutorial itself is not enough to give a group of inexperienced students the ability to develop a complete software projec. Additionally the instructor should create an object model of the system and accordingly implement a code scaffold with comments about the contents of each method. Further the instructor has to divide all tasks between the teams, as this is nearly impossible for someone inexperienced in software development. Prior courses have shown that in a basic software engineering course some decisions have to be made before the project starts to give [it] a good chance of success (Schank 1996).

3.3 Role of Instructor and Tutors

The role of instructors and tutors differs heavily between a project course organized as a GBS and a lecture featuring the same content. It is important that everyone involved understands this. Tutors should not lecture on a certain topic but primarily serve as advisor, asking questions, giving hints, managing project flow and taking over steps that are not central to the skills being learned, but are nevertheless necessary to reach the goal.

4. CASE STUDY

4.1 Course Preparation

Now that we have shown the general principles underlying our courses we want to show all steps in developing a course exemplary on a course designed for Herbstuniversität, a program with the goal to interest female high school students for studying computer science. Figure 3 shows an activity diagram of the most important steps taken towards creating the project course. In addition to those the development environment of the lab needs to be set up in parallel (e.g. with IDE and software configuration management tool).

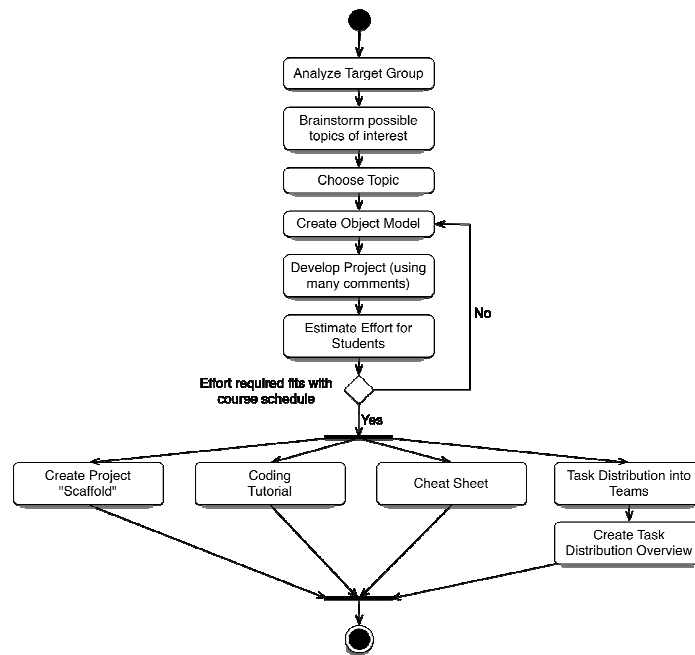


Figure 3. Steps towards creating a project course. The setup of the lab can be taken care of in parallel.

4.1.1 Analyze Target Group

The course is targeted toward female high school students from grade 10-12, age 16 to 18, with no or very little prior programming experience. They are taking the course voluntarily during the autumn school holidays. Some of them might have minor experiences in modeling object-oriented systems. However we do not assume that they know anything about Software Engineering. While the students, who have chosen our course, do have only little or no prior knowledge, they are usually highly motivated to find out more about Computer Science.

In addition to what is known for certain about the target group we tried to estimate some of their core motivations. We found out that the group likes to design and personalize things. They mostly use new technologies for communication or playing. They are highly interested in mobile devices.

4.1.2 Brainstorm Possible Topics of Interest

Because of the huge interest in mobile devices and because Apps are usually very limited in their functionality we decided that developing a small iPhone or iPad App would raise the highest interest in our target group. After asking some members of the target group and a short brainstorming session keeping in mind the wants and needs of the target group, we came up with several possible project ideas. Topics considered most interesting for the students were a chat client, tending towards the goal of communication, doodle jump, a game very popular among students asked for their favorite games and a quiz game, which gives a high degree of design freedom and personalization increasing the feeling of ownership over the result.

4.1.3 Selecting a Topic

As soon as we had a list of interesting projects, that could be turned into a GBS, we made a decision matrix, taking into account the design criteria listed above and technical feasibility. Doodle jump and especially the chat client were ruled out, because they were harder to implement than a quiz game. Also they left only little room for design. We therefore settled on the mission of creating a quiz game.

4.2 Project Schedule

The course is designed to run through a complete software lifecycle within three days. The group of students starts out with a short training phase, which consists mainly of the introductory tutorial. This phase should equip them with the basic programming knowledge required for successfully conducting the project. After this they are introduced to the project, which is to design and implement a quiz application for iOS devices. They then discuss the requirements for this application and create their own paper prototypes to evaluate their user interface design. After this they have about 1½ - 2 days to implement their game. Whenever possible a working version is already deployed to the device so that the students can try it out for themselves. At the end of the project the students test their final product and present it to potential users. At the end of the course the resulting quiz application is distributed in the Apple's App Store.

4.3 Results

The students were overall very proud of their achievement. Two students were even asking how they could set up the development environment at home to continue development. Three students said that we increased their interest in SE and computer science and that they are now thinking about studying it.

5. TRANSFER TO CLASSROOM SETTING

The project was highly successful when taught at the university as a block course. However it is unlikely that the course can be transferred right away to the context of a school classroom without any modifications, as there are several differences between the two learning environments.

Students at a university have a large pool of courses to choose. In a school classroom the teacher mostly chooses the content and students are expected to learn what they are shown. Working on a software project like the one described in this paper requires a lot of work from the students. If they are not willing to invest it, the project is prone to failure. There are three possibilities to get them interested

- try and find a topic that is most likely interesting to the target group
- have the class vote between different projects
- separate the class into teams with different projects

Furthermore in our course there are always at least two instructors for 12 students. This proved very important, as questions can be clarified more quickly, speeding up the learning progress and avoiding frustration with otherwise simple problems, e.g. syntax errors. In our opinion those instructors are essential, however in school there is usually one teacher for the whole class with about 20 to 30 students. Instead of asking a colleague the teacher could try to recruit two or three students with programming experience. Those usually can follow the course much more quickly even if they are not familiar with the programming language used. If the course is taking place repeatedly, the teacher can also ask previous students to tutor.

The teacher should try to have one of those students for every team of 3 students. If that is not possible, he could also try to use the existing students as tutors, which then jump from team to team. However he needs to make sure that the tutors do not just go ahead and program everything for the team they are currently helping. Instead they should help them by giving hints towards the steps required to get to a good result.

Additionally the size of the project needs to be manageable for students inexperienced with software development. School classes with around 20 to 30 people are too large for one project. Instead we suggest splitting up the class into at least two groups. At this point the teacher has two different choices: have each of the groups work on the same problem statement, which can generate an environment of friendly competition for the best result or create several entirely different projects. The second suggestion has the advantage that students can choose between different project and is more likely to find one which is inherently interesting to them, which in turn leads to higher motivation and a better learning outcome. However the work required by the teacher is much higher as he needs to prepare several projects, which leads to a lot of additional work.

The main problem lies in the structure of Computer Science classes in school. Usually high school students only have one or two classroom hours with 45 minutes a week to spend on Computer Science. The whole project takes up about 21 hours, which would correspond to 28 classroom hours, which would mean

14 to 28 weeks, therefore taking up a large proportion of the whole school year. This would have detrimental effects on the feeling of achievement and progress created by a three-day course.

The course could be packed more tightly by cooperation between different subjects. For example considering the quiz game developed in our case study the design of the user interface could be done during art lessons where the teacher shows how one can create a clear and understandable design. The creation of questions also takes up about 2 to 3 hours. Those could be created in basically any class, where the focus and topic of the quiz is then identical to the topic currently studied in that class. Testing and playing the game could then also be part of a lesson in this subject. Narrowing down the topic of the quiz to one within a specific school subject could reduce the feeling of ownership for the idea. This feeling can be reestablished by giving the students a choice of different topics within the subject. Such cooperation between different subjects should be possible for a large number of projects.

6. CONCLUSION

Our approach of teaching Software Engineering to high school students through Goal-Based Scenarios offering them a scaffold when needed has proven highly successful. The students have shown a high level of motivation, triggered by clear goals and visible progress. However while we think it is a great way to get in contact with SE topics the approach presented also has some drawbacks. It requires a lot of work by the tutors, which might not be necessary in a more traditional course. Also someone might argue that those courses demand a large portion of the total students available time and reduce the time for other subjects. It is true that it can take away time from teaching theories in a traditional way through direct instruction. But this does not mean that the learning objectives in even the theoretical subject necessarily will be lower. While we only demonstrated the applicability of our approach within a block course at the university, we believe that with some changes a similar approach will work in a school class as well.

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REPROTOOL, A SOFTWARE TOOL FOR THE ECTS AND BOLOGNA PROCESS RE-ENGINEERING OF UNIVERSITY PROGRAMMES

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ABSTRACT

This paper presents the project ReProTool which has been selected to be co-financed by the European Regional Development Fund and the Republic of Cyprus through the Research Promotion Foundation. The project entails the development and pilot use of ReProTool, a software tool that will support the design and development of university academic programmes using Learning Outcomes and the European Credit Transfer System (ECTS) of the Bologna Process. A rapid prototype of ReProTool has already been developed by the authors of this paper in order to exemplify the functionality of the proposed tool. This prototype will be utilized within the more traditional waterfall lifecycle development approach that will be used within this project to create a fully functioning tool. The paper briefly describes the developed prototype and the various stages of the project namely (a) Identification of User and System Requirements, (b) System Analysis and Design, (c) Software Development, (d) Testing and Beta Release and (e) Pilot Use and Public Release.

KEYWORDS

Learning outcomes, ECTS, Bologna Process, and Software Tools.

1. INTRODUCTION

The Bologna process (European Commission Education and Learning, 2008) aims at developing a European Educational Framework of standards, definitions and concepts so as to provide the basis for European countries to transform their educational system according to this framework. This will result in comparability/compatibility of the various European educational systems which will then result in collaborations amongst educational institutions, exchanges of students and teachers within Europe and transparency and transferability of qualifications, all being very important when looked from the point of view of students, faculty, Erasmus co-ordinators, prospective employers and ENIC/NARIC networks.

One of the first and most important concepts developed by the Bologna process is the European Credit Transfer System (ECTS) that provides the framework for measuring the student workload in courses/modules/programmes and thus calculating the credits of these courses/modules/programmes. Another important concept recently introduced is the concept of the Learning Outcomes (LOs) (Kennedy et al. 2006), which allows courses/programmes to be expressed in terms of what a learner/student is expected to know by the end of the course/programme. Employers will thus be able to identify what students are able (or at least should be able) of doing after completing their programmes/courses. Furthermore, by studying descriptions of studies expressed in terms of LOs and thus comparing with what they expect graduates to be able to do, employers could provide input for the re-engineering of programmes taking into consideration industry requirements. When it comes to Erasmus co-ordinators, LOs assist in the comparison of programmes and courses since they provide a common framework/platform for expressing the programmes/courses aims and objectives looked at from the student point of view. Last but not least, ENIC/NARIC networks are also provided with a common framework/platform for evaluating levels and degree qualifications.

The European Qualifications Framework (EQF 2010) provides the basis for mapping the National Qualifications Framework (NQF) of each European country to this framework, thus transitively, mapping each country's educational system to another country's system. Examples of such NQFs are the Irish NQF

(Irish 2010) and the UK NQF (UK 2010). EQF and NQFs describe in terms of LOs, the various levels of education starting from the pre-primary level and reaching the doctorate level. EQF caters for eight such levels, whereas NQFs may cater a different number of levels.

The rest of the paper is organized as follows. Section 2 briefly explains the concept of Learning Outcomes. Section 3 explains the need for ReProTool and how we envisage it as a web-based application. Section 4 presents a prototype version of ReProTool that has been developed by the authors of this paper (Pouyioutas et al. 2009, 2010). Section 5 lists the development stages of the tool and explains the first stage, namely Identification of User and System Requirements. Section 6 explains the System Analysis and Design Stage. Section 7 explains the Software Development Stage. The usefulness and expected use of prototype is addressed in each of the tool aforementioned development stages. Section 8 addresses the Testing, Beta Release, Pilot Use and Public Release of ReProTool. Finally, Conclusions address our current and future work.

2. LEARNING OUTCOMES

Learning Outcomes (LOs) and the writing of programme and course syllabi using ECTS provide the chance for teachers to rethink the course/programme curriculum from the student perspective and reconsider the content of the course as well as the delivery (teaching/learning) and assessment methods, soliciting feedback from various stakeholders, amongst others industry, employers and professional associations. Rethinking of the curriculum and its delivery is a lengthy process carried out periodically by universities in order to adapt programmes of study with current research issues, state-of-the-art developments and industry demands. This process is usually carried out manually without using a customized software tool. The tool proposed herein is a tool which aims at automating many tasks carried out manually and thus improves the re-engineering process of programmes of study.

One recently developed methodology for programme re-engineering and quality assurance is the Tuning Methodology (Gonzalez and Wagenaar, 2008). The methodology conforms to the Bologna Process directives and provides the framework for design and development of academic programmes. According to the Tuning Methodology, the first stage in designing a new programme is to build its profile, which includes among others, its aims and objectives, as well as the LOs. In order to make sure that the LOs are achieved, the Tuning Methodology utilizes various matrices that relate the LOs with the various courses.

Currently, the Tuning Methodology has been adopted by many universities both in Europe and in Latin America (Beneitone et al., 2007). TunTool (Pouyioutas et al. 2009; Pouyioutas et al. 2010), is the first software tool that was proposed to support the methodology and automate some of the tedious tasks that the users of the methodology have to perform. ReProTool (Pouyioutas et al. 2009, 2010) basically is a new version of TunTool that incorporates LOs as defined in EQF in terms of knowledge, skills and competences.

3. THE NEED FOR AUTOMATION AND REPROTOOL

When building the degree profile of an academic programme, one needs to define its LOs. Ideally, existing definitions could be utilized rather than reinventing the wheel. Thus, one could select as many LOs (Knowledge, Skills, Competences) from a pool of such resources and then modify and add new ones accordingly. This not only would reduce the effort needed for building the programme profile, but also and more importantly perhaps, it would create programmes that are compatible to a certain extent (of course one may argue that this compatibility would have a drawback such as reducing creativity and innovation). There is currently no database of LOs that would allow downloading of these resources. The creation of such a database would allow one to select and use them as part of the programme profile under development, thus benefiting from the aforementioned advantages.

Another time-consuming and tedious task one faces is the verification that the programme's LOs are met by at least one course of the programme. Matrices could be constructed and checks could be made in order to accomplish this. Furthermore, if one needs to find the LOs achieved by a course or the courses that achieve a particular LO, s/he should consult the hard copy or electronic matrices and produce manually in both cases

the required information. This happens because there is no database to store the relationships between LOs and courses. A software tool based on such database could produce automatically the required information.

Furthermore, the database could store for each course its own LOs, its assessment methods, its learning methods and the expected student workload. This basically would automate the completion of the student forms which are used to calculate the student workload and thus the number of the ECTS of the course, reducing even more the time and effort needed for building further the programme components. The automation would also allow what-if analysis and perform workload and ECTS recalculations very fast and error-free. The system would also check the semester breakdown of the programme of study in terms of the 30/60 ECTS requirements per semester/year. When it comes to the student calculations of their workload during a course and therefore the course ECTS, the system would allow the fast processing of all student forms and would produce average workloads for each course and each LO of a course, and the average ECTS of the course, as estimated by the students.

All the aforementioned advantages of automating the application of the methodology used for designing/developing academic programmes clearly indicate the need for the tool. ReProTool will be mainly a web-based application that will be freely available to any University that would like to use it. So each university can have access to its own copy of the tool. The underlying database of the tool will be loaded with data that can be exported from the University's Information System (UIS). These will be the data needed to perform the tasks provided by the tool. Data and information could also then be exported to the UIS if needed. An XML schema will be defined that specifies the format that is needed by the ReProTool import/export script. Each University will be responsible for providing the interface required between its UIS and ReProTool.

ReProTool will provide three access methods. The first is through a web service that will support open access to a limited set of the data. Example of such data is information on programs and courses along with their associated information such as learning methods, learning outcomes, etc. Such data can be useful to other Universities who may want to use such resources in order to build their own programmes or compare their programmes with programmes of other Universities. The second access method will be also through the web-service interface and will be restricted to students that are currently taking courses from the specific University. This will be an authenticated access method, i.e. the students will need to provide their credentials in order to log into the system. Through this interface the students could view all the courses that they are currently taking. In addition, they will have write access to part of the data in order to record the weekly number of hours that they are spending on the various courses per week. The last access to the ReProTool will be through the ReProTool client application that will be installed on the faculty computers. This will also be an authenticated access method; hence faculty must provide their login credentials first. The client application will communicate directly with the database, and will allow faculty to modify and add data to the database tables that they are authorized for. There will be multiple roles for the faculty such as program coordinator, course leader, and teacher. The expected functionality of the tool is depicted in Figure 1.

4. THE REPROTOOL PROTOTYPE

A rapid prototype of the proposed tool has been developed (Pouyioutas et al 2009, 2010). The authors acted both as users and system developers. As users they were involved in re-engineering academic programmes using LOs and ECTS. One of the authors is a Bologna expert and thus has a deep knowledge of the subject area. In a sense the authors extracted from themselves the user and system requirements and developed rapidly a system prototype. A database was designed and the system was built based on the developed database. In this section we explain the functionality of the prototype in order to exemplify the expected functionality of the fully functioning ReProTool to be developed as part of this project.

The ReProTool prototype supports three main user types, and thus provides three password-controlled authorized areas, namely programme coordinators, faculty members and students. The system also supports a system administrator area. The welcome screen interface allows users to login using their login name and password in one of the aforementioned areas.

4.1 System Administrator Area

The System Administrator area provides the administrator the tools for managing (creating/editing) the end-users of the system and assigning them authorization privileges. Thus, the administrator is responsible for the maintenance of the data pertaining to institutions, programmes of studies, faculty, co-ordinators and students.

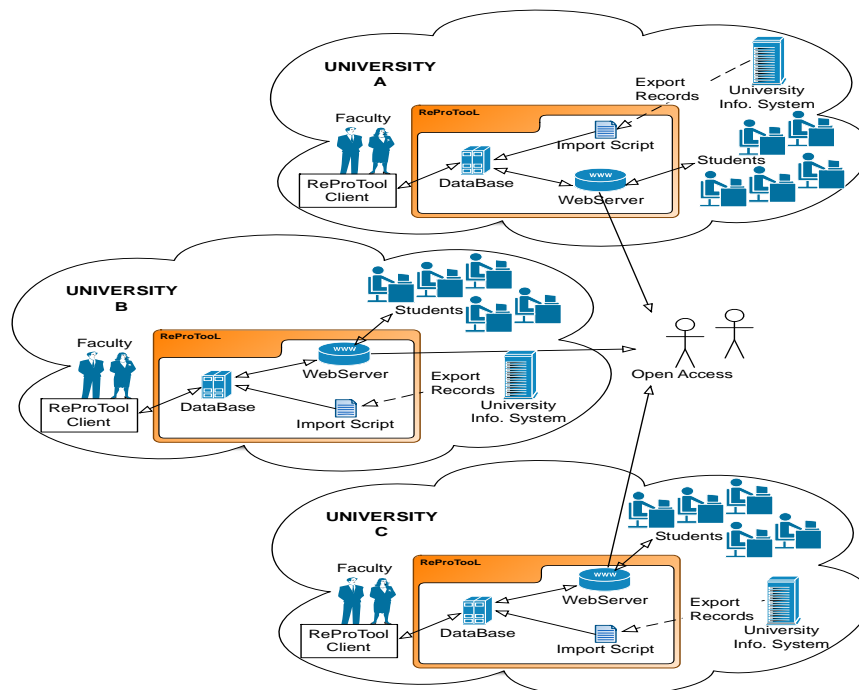


Figure 1. The Expected Functionality of ReProTool

4.2 Programme Coordinator Area

The Programme Coordinator area assists academic faculty to set up programmes. The first interface screen provides programme coordinators a list of programmes for which they are responsible. Once selecting one of the programmes, the coordinator is redirected to the specific programme's screen interface that allows one to create/edit courses and assign them to the programme under consideration. The tool allows the co-ordinator to select LOs or create new LOs and assign them to the programme (Figure 2). Furthermore the screen interface supports a Reports menu choice that allows the generation of reports including amongst others, LOs of a course, LOs of a programme vs. the programme's courses, LOs of a programme not covered by any course and a Programme's total ECTS and Semester's total ECTS.

4.3 Faculty Member Area

The Faculty Member area provides a screen interface that allows faculty to access the courses that they teach (Figure 3) and thus they are authorized to modify. Once a faculty member chooses a course, s/he is redirected to the screen interface shown in Figure 4 that prompts the completion of the Course ECTS Calculation Teacher form. This form lists the course's LOs, the associated educational activities (teaching/learning methods), the assessment methods and the estimated student workload (number of hours) that students are expected to spend on each LO. The total student workload in hours and thus the total ECTS of the courses are automatically calculated. The Reports menu choice allows one to access and compare with the student estimated workload and ECTS and hence make any amendments if needed.

4.4 Student Area

The Student Area mainly provides a screen interface, which allows students to record the number of hours they spend every week in a course. The total number of hours is automatically calculated by the system and displayed on the form. The system also calculates the average total number of hours spent by all students in the course and thus calculates the average student workload that is translated into the course ECTS as estimated by the students.

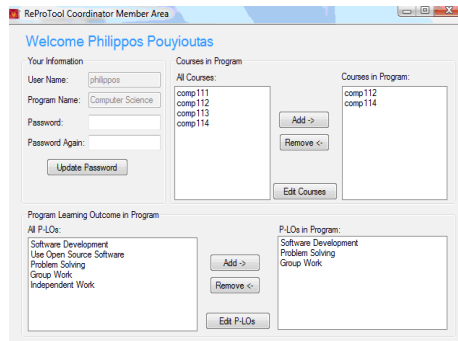


Figure 2. Setting Programme's Courses and LOs



Figure 3. The Faculty Member Area for Selecting a Course.

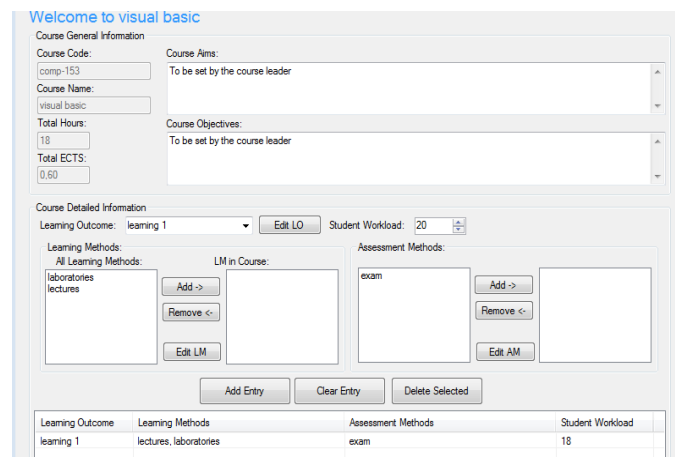


Figure 4. The Faculty Member Area for Assigning Learning Outcomes.

5. IDENTIFICATION OF USER AND SYSTEM REQUIREMENTS

The development of the tool, being a software engineering project, will follow the software lifecycle stages, namely (a) Identification of User and System Requirements, (b) System Analysis and Design, (c) Software Development, (d) Testing, Beta Release, Pilot Use and Public Release. In this Section we address the first of these stages. As pointed out before the prototype was developed by extracting the user requirements from the authors of the paper that have been carrying out manually the process that the tool will automate. Clearly the limited number of users consulted and lack of experience of the user means that the prototype has limitations with respect to functionality and usability. In order to develop a sound and fully functioning tool, a long stage of identifying user requirements through various users need to be followed. This is indeed the purpose of this stage. The prototype will be “thrown away eventually”, however during this stage it can serve a very important purpose. In many occasions users of a manual processes fail to understand the envisaged functionality of a software tool that will automate the process. The prototype is very useful for illustrating

this to the users, and thus help identify their requirements. A comprehensive collection of correct requirements forms a solid basis for the system design and implementation. This will be achieved through:

- interviews with the international Bologna Experts and ECTS Label Evaluators/Trainers
- interviews with academicians who have apply a process of ECTS re-engineering of programmes
- questionnaire survey to academicians and students
- iterated use of the prototype
- studying of the methodology itself.

During this activity the major shortcomings of the existing manual system will be surfaced, as user requirements are not addressed by the manual process. The collected requirements will be modelled using Use-case behaviour diagrams in UML; those will illustrate the behaviour of the system, thus they will show functionality of the system based on the user requirements. The prototype will serve as a vehicle for receiving feedback from the users and will be enhanced according to the feedback received; this iteration of feedback/enhancements will terminate once users are happy with the expected system functionality.

6. SYSTEM ANALYSIS AND DESIGN

The System Analysis and Design will be based on the previous stage and will result in the functionality, graphical user interface and database design of ReProTool. It will entail the following activities:

a. Functional Specification Analysis: The functionality of a system will be expressed in terms of data and its processing, with special attention on the transformations it must perform on data; the user requirements will be mapped to system functions by deriving a set of logical data flow diagrams that describe what the proposed system will do.

b. Technical Architecture: The system architecture defines the overall structure of the system in terms of hardware, software, tools, and the logical distribution of the system components across this architecture. During this activity the following will be addressed:

- the system architecture model and overall architectural considerations regarding how technical requirements (e.g. performance, security) are addressed by the architecture
- the system architecture components (e.g. database server, client application)
- the graphical user interfaces including screen design, usability design, and operational design
- the database design including Entity-Relationship modeling, normalisation and database relations.

We next provide in Figures 5 and 6 a relational database design that has been used for the prototype and will be used during the interaction with the users in order to finalize the database design of the tool.

P(Pid, Ptitle, Paims, Pobjectives)

PCA (Pid, Cid)

PLOA (Pid, PLOid)

CLO (CLOid, CLOtitle, CLOdescription)

LM (LMid, LMtitle)

LMA (Cid, CLOid, LMid)

C (Cid, Ctitle, Caims, Cobjectives, CECTS)

PLO (PLOid, PLOtitle, PLOdescription)

CPLOS (Cid, PLOid)

CLOA (Cid, CLOid, CLOstudentworkload)

AM (Amid, AMtitle)

AMA (Cid, CLOid, AMid)

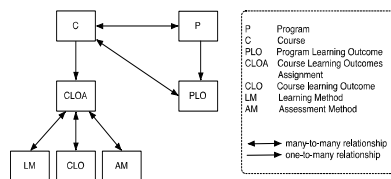


Figure 5. The ER Model

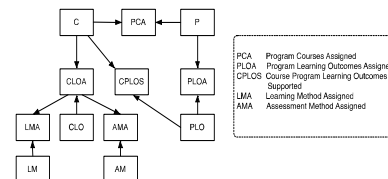


Figure 6. The Decomposed ER Model

7. SOFTWARE DEVELOPMENT

In order to build the database presented in the previous section, we plan to use MySQL as the back-end database management system. The client application will connect to the database through ODBC connectors

of the .Net framework. The application will be written in the C# programming language, which provides for rapid prototype development and reuse of the .Net components like WYSIWYG (What You See Is What You Get) GUI building, database connectors, and LINQ (Brooks, 2008) for specifying queries.

The dataservice component will consist of a MySQL database service. The choice of using MySQL as the back-end database system is because it is an open-source service that supports a wide variety of platforms with respect to both programming languages and operating systems. Future client applications could be developed in Java and targeted to run on Linux or Mac OS X. The client component of the proposed architecture has a three-layer design. The lowest level consists of the ODBC connection driver that is provided by MySQL for remotely access to the MySQL database service. The second level is the .Net framework including the LINQ query language that is provided by Microsoft. Although the implementation for the framework is provided by Microsoft for the Windows platform, there exists an open source project, Mono (Avery and Holmes, 2006) that provides implementation for the .Net framework on other platforms. The top level is the client application, which is implemented in C#, and provides two access methods. The first is through the web-service that provides access for the students and the general public via a web browser. The second access method is by using the client application, which is for the faculty. Regardless of the access method, the top level provides an intuitive user-friendly GUI that the user interacts with in order to populate the database as well as retrieve data from the database. The end-users will not directly specify the LINQ queries, but instead they will choose from options when generating the forms. The client-end will generate the appropriate queries based on what the users specify.

8. TESTING, BETA RELEASE, PILOT USE AND PUBLIC RELEASE

8.1 Testing and Beta Release

Testing of the ReProTool system will be performed in order to ensure that the developed system meets the user requirements and performs as expected based on the analysis and design of the system. Once the system passes successfully the required tests, a beta release of ReProTool will be made available.

Testing is a very important aspect of the lifecycle of a software system and requires considerable time and investment and will entail:

- compliance testing in order to test if the application conforms to the specification and expectation of the users
- functionality testing in order to test if the functionality of the application works correctly
- documentation and help system testing in order to make sure that the instructions are complete and accurate, catch erroneous information, or ambiguous information.

Based on the above testing, changes/corrections/enhancements will take place and a beta release of the tool will be prepared. Beta deployment packages will be built that will make it easy for both an end-user to install the application and a DBA to set-up the back-end MySQL service.

8.2 Pilot Use and Public Release

The pilot use of the tool will be carried out at the University of Nicosia during a semester. Selected programme co-ordinators, faculty members and students will test the tool. Thus all the functionality of the tool will be tested. The pilot use by the three types of users will take place in parallel and it will be based on different academic programmes. Programme co-ordinators will use the tool to build the degree profile of their programme. Faculty members of these programmes will use the tool to build the course syllabi. The programme co-ordinators will then use the syllabi in their programmes. Finally, students will use the tool to report the hours they spend on the various activities in the courses that they are taking. Based on the feedback and the reports produced by the different types of pilot users, changes/corrections/enhancements will take place and the public release of the tool will be prepared. Release deployment packages will be built and will be made freely available to anyone from the sourceforge.net web site and the project web site.

9. CONCLUSIONS

This paper has presented the prototype version of ReProTool which can be used for the re-engineering of academic curriculum using the Bologna Process directives. The use of the tool in designing and developing academic programmes using Learning Outcomes (LOs) and ECTS syllabi, forces academicians to rethink from the student perspective the curriculum content and the teaching/learning methods and techniques and from the employers perspective, the expected knowledge, skills and competences that graduates should have in order to enter the job market. LOs play a crucial role in the understanding and comparability of programmes and courses across institutions. Furthermore, LOs are also very important when it comes to recognition of qualifications across Europe. Therefore any tool that supports LOs indirectly provide help to Employers, Erasmus Co-ordinators and NARIC/ENIC networks.

The paper has exemplified the functionality of the tool by using some screenshots of the prototype, illustrating how the different types of users namely students, faculty and programme co-ordinators can benefit from using the tool. The paper has also discussed the development stages of the final full functioning version of the tool and indicated how the prototype can be utilized within the development process. The database design the screen interfaces and the code of the prototype will be utilized in all development stages.

ACKNOWLEDGEMENTS

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A SUPPORTING MECHANISM FOR DRAWING LEARNING BASED ON THE DRAWING PROCESS MODEL

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ABSTRACT

The purpose of this study is to develop an online drawing learning support system. In this paper, firstly, we describe the results of a potential assessment for our system. Two assessment approaches are shown. One assesses the possibility of using a digital pen as a drawing tool. The other assesses the effectiveness of the drawing learning support based on the reuse of the drawing process of both learners and experts. Secondly, the drawing process model for supporting individual drawing learning is also discussed. Finally, we show three examples of learning with our system.

KEYWORDS

Drawing Learning, Learning Support System, Online Class, Drawing Process Model, Digital Pen.

1. INTRODUCTION

Art education in a networked environment has been introduced recently. However, there are some limitations about functions and contents for basic skill learning such as drawing, painting, and sculpturing [Draw23, Drawspace, Ferraris2000, OpenDictionaly, Tweddle2008, Univ. of the Arts London]. Drawing is one of the fundamental skills in art education. All beginners must acquire these kinds of skills first [Sato2004, Sekine1984]. Learning related to art requires repeated practice with a trial-and-error process [Bernstein1967, Latash1998, Latash2002, Takagi2003]. Therefore, to learn drawing is categorized as skill-learning [Furukawa2004]. In this type of learning, novices cannot recognize whether or not they draw correctly and appropriately. As a result, their proficiency becomes slower and more redundant.

The purpose of this study is to explore an online support system for beginners in drawing. Learners can receive advices and assessments from art experts without time and/or place constraints by using the proposed system. We investigate the possibilities of online supporting drawing learning. Two key factors are introduced: A digital pen as a drawing tool, and a drawing process model (DPM).

In this paper, firstly, we will discuss the possibility of using a digital pen [AnotoGroupAB] as a writing tool and the effectiveness of drawing learning support in a networked environment. Secondly, we consider the DPM and its application to individual learning support. Finally, the system interfaces are shown.

2. ONLINE DRAWING LEARNING SUPPORT

The major difference between an offline drawing class and an online drawing class is the availability of instruction during learners' drawing. The instruction for the learners' drawing process is more important than instructional comments for his/her work. Therefore, quick and personalized feedback from a tutor is an indispensable function for a networked learning environment. In this study, the learner's drawing process that is recorded by a digital pen is reused in order to replay and refer his/her drawing process. To generate an evaluation for the drawing process automatically, this data is also reused in the system we propose.

A learning activity is started after the tutor defines a learning task in the learning management system. The following flows are ideal learning processes in our learning environment:

1. A learner draws his/her work with a digital pen.
2. Both of the learner's drawing process data and his/her work are registered in the learning management system after his/her drawing.

[Interaction with Learner and Tutor via System]

3. A tutor evaluates a learner's work by replaying his/her drawing process. Then the tutor adds some advices to both the learner's drawing process and his/her work. This information is registered in the learning support system.
4. A learner takes the comments that are annotated for his/her own drawing process and work by the tutor from the system.

[Interaction with Learner and System]

5. The learning management system diagnoses the learner's drawing process based on the DPM. The instructional rules that are defined by tutors are used in this evaluation.
6. The learner is given an auto-evaluated result that is the annotated drawing process based on the instructions for the relevant drawing lesson.

3. BASIC STUDY

3.1 Reviewing from Art Experts

We interviewed five experts who are teachers in an offline drawing class as well in order to clarify the effectiveness of the drawing learning support in a networked environment. All the experts tried using the prototype model of the system before this investigation. Previously, some students drew the same motif with both pencils and digital pens. An example of these results is shown in Figure 1. Experts replayed and reviewed the learners' process data by using our system. The following are comments from them:

- Tutors are able to review the learners' drawing process and work after they finish their work. Therefore, tutors can give adequate guidance that each student wants. Tutors can avoid inappropriate assessment since they can check the learners' entire drawing process and work.
- Tutors are able to present the specific assessment directly to learners. Learners would not forget what was discussed in their class because the learners can repeatedly confirm what tutors corrected.
- Learners are able to recognize the incorrect way of using the digital pen when they replay their own drawing.

The learners' drawing processes were replayed and reused for detailed analysis by experts. That is to say, the need for reviewing the learners' drawing process is confirmed and the demand for drawing learning support in a networked environment is shown.

3.2 Reviewing for Digital Pen as a Drawing Tool

A standard digital pen is used as a drawing tool to record the learners' drawing processes. Four items were examined to evaluate the possibility of using a digital pen as a drawing tool. These results were shown to five experts, and then they tried to express some drawings with this pen. We conducted interviews with these experts about the possibility of the digital pen. All the experts accepted the fundamental capability of this writing tool.

At the same time, they also pointed out the need of adequate drawing tasks to suit those limitations. Moreover, the following demerits of the digital pen were discussed in comparison with a pencil:

- Not able to erase once learner draws
- Width of line is fixed

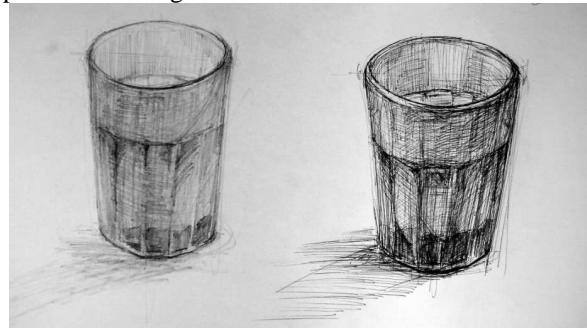


Figure 1. Examples of drawing picture with a pencil (left) and a digital-pen (right).

- Ways of expression is limited

As a result, all the experts agree that this pen could be used as a drawing tool if users of this system are only beginners. The demerits previously mentioned would work well in beginner level lessons. Thus, the possibility of a digital pen as a drawing tool is shown.

4. DRAWING PROCESS MODEL

In this study, the learner's drawing process is reused in two evaluations. One is the tutors' evaluation, and the other is the system's evaluation. For the latter, we implemented the automated evaluation function based on the DPM. This model consists of 3 types of parameters. They are the drawing step, the drawing phase and the features of the drawing strokes.

4.1 Seven Drawing Steps

In an interview with five art experts, we collected the drawing process of experts. Then, we found the seven step model as a hypothesis for simplification of an artist's drawing process.

"Drawing is seeing"[5]. Hence, the first step is carefully observing to see the drawing subject. The relationship between the light source and the drawing objects is also checked in this step. Then, at step 2, the relative locations of the objects are confirmed based on the vanishing points. In the next step, the composition of this picture is defined. The drawing area is fixed on the drawing paper. At step 4, the outlines of the drawing subject are expressed in simple lines in a balanced way. The rectangle, the oval, triangle, straight line, and simple curve are used consciously in this step. The size, the location, and the direction of each object are also pictured in this step. At step 5, shading is added. Various values of light and dark are expressed in a drawing. The shading techniques become complex for a square pillar, a cylinder, and a sphere in this order. Shading should be added first to objects whose outline shapes are square pillars, second to cylinder shapes and then finally to spheres. At step 6, a learner checks the material of each object, and then expresses its texture in drawing. Finally, the finishing touches are added. A learner draws details of each object. A learner shall regard the design of each object. The balance of the total subject is also considered in this step.

4.2 Three Drawing Phases

We found three different drawing phases in the time variation of the drawing strokes and the pen pressures of a digital pen from the quantitative investigation for the art experts. Two criteria are used to divide each phase. One is when both the number of strokes and the pen-pressure become zero. The other is the difference in the number of strokes or the average pen-pressure.

According to the quantitative features of the drawing process and the drawing results, the features of each phase can be described as follows:

Phase-A [Outlining]: A learner interprets the drawing composition and the outlines of the whole object by using simple lines to define the proportion in a perspective way.

Phase-B [Shading]: A learner draws the drawing subject totally and adds shade for whole parts.

Phase-C [Texturing]: A learner adds the texture of the subject in detail. He/she fixes the balance of the subject on the drawing paper.

The boundary of each phase in the drawing process is determined mainly based on the changes in pressure. In this study, the state of the pressure changes in writing a stroke of a drawing is called "changes in pressure". In an ideal drawing process, the artist outlines the motif in the first stage of his/her drawing (see Step 3 in drawing steps). At this stage, an ideal artist draws a rough line using low pen pressure, and draws the outline of motif using a high pressure line. Therefore, the pressure at this stage tends to be lower, and the state of change is not constant. So, the drawing section which satisfies the following three conditions is identified as Phase-A.

- There are multiple sections where the average pressure is zero or close to zero.
- The state of pressure change does not tend to be constant.
- The ratio of the area of the drawing in that section to the area of the final draw is more than 75%.

The process parts for Phase-B and Phase-C are selected from the whole drawing process other than the section which is assigned to Phase-A. At first, our system divides the selected parts into 10 blocks in the same time span. In each block, if its state of pressure change does not show a constant trend, the block is assigned to Phase-B. Also, if it shows a constant trend, the block is assigned to Phase-C. Then, the sequential blocks in the same phase are grouped.

4.3 Seven Parameters of Drawing Stroke Features

We have to define concrete and objective features of each phase in order to define these three phases of the drawing process. Seven parameters are the number of strokes, the stroke pressure, the changes in pressure, the line types, the degree of assembled stroke size, the dispersion of the drawing area, and the ratio of the drawing area. The number of strokes and the pen pressure are relative values in the drawing process. The size and the dispersion of the stroke sets are relative values on the drawing paper (or entire drawing area).

Each parameter is expressed in more than two levels. The number of strokes is expressed as small, medium, or large. The pen pressure is expressed as low, medium, or high. The changes in pressure are expressed as non constant or constant. The line types are point, straight-line, simple curve, or complex line (includes curve). The size of the stroke sets is large or small. The locality of the stroke sets is sectional or total. The ratio of the drawing area is high or low.

4.4 Relationship between the Drawing Steps and Phases

Phase A corresponds to steps 1, 2, 3, and 4. Phase B comprises steps 1 and 5. Phase C covers steps 1, 6 and 7. Phase A tends to appear in the beginning of whole drawing process. Phase B appears after phase A and/or before phase C. This phase commonly does not occur at the beginning or end. Phase C often appears at the end of the drawing process.

4.5 DPM based Drawing Evaluation

Our DPM is developed by an inference engine that is able to detect the appearance of the three drawing phases based on the geometrical features of drawing process. Our system arranges the learners' drawing processes by using six parameters. Then they were divided into the three phases. The proposed system is able to provide some advice for learners based on the DPM. For instance, if a given task is to draw a glass on a table, many beginners tend to start drawing from the configuration of the glass. Advice for this case is to explain to a learner that you had better draw a simple rectangular solid in the perspective way. In addition, the lines of a simple rectangular solid are auxiliary lines, therefore tutors should instruct learners not to draw those lines thickly. The final work has a very small effect on the draft if learners draw incorrect lines with less pen pressure.

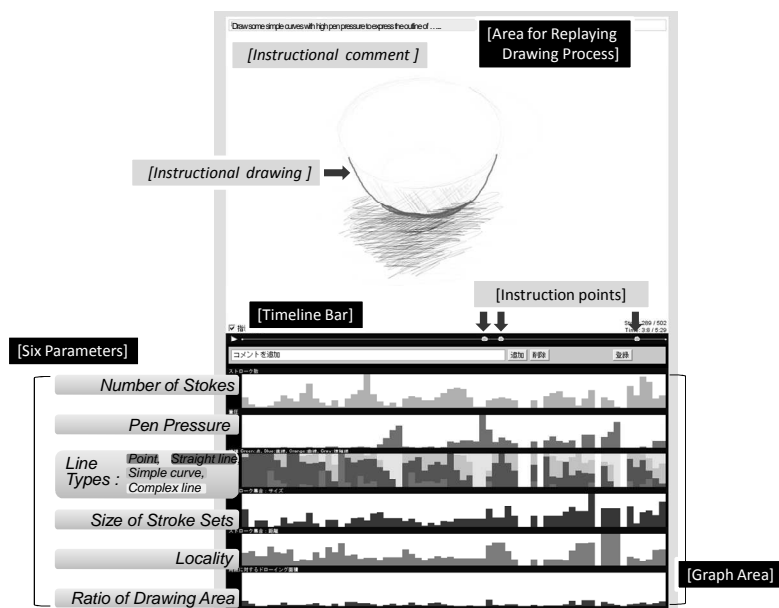


Figure 2. An example of the drawing process viewer (A tutor adds red lines for pointing out error position, and add comment "represent the outline of the vase".)

Figure 2 shows a drawing process viewer that our system provides. The upper part of this viewer is an area for replaying the drawing process and showing the instructional information. Two types of advice are added in this drawing. These are an instructional comment and an instructional drawing. The former is shown in the timeline bar in the viewer. A comment is linked to a specific point in time when the learner performs an inadequate drawing action. The latter is also connected to a point in time. In this case, an instructor adds red lines to point out error positions, and adds the comment "represent the outline of the vase". The lower part is a graph area. This area includes six graphs that indicate the seven features of the drawing process. They are the number of strokes, the pen pressure, the line types, the size of stroke sets, and the drawing locality and ratio of drawing area.

The red arrow on the far left shows the first instructional comment for this drawing. Learners obtained the following advice from our system: "Draw some simple curves with high pen pressure to express the outline of the subject. Observe the drawing objects more carefully. Capture each object as a simple configuration."

5. DRAWING LEARNING BASED ON THE DPM

5.1 Classroom Learning

Figure 3 shows the drawing learning support functions of our system. Learners upload their drawing process data to our system after their drawing. The tutor of this class and all of the class members are able to access the portfolio pages for today's results (Fig.3 upper left). A member of this class is able to refer to the drawing pictures and these process data in this portfolio. A drawing process viewer page is shown to him/her when a learner chooses a learner's drawing result (Fig.3 upper right). A learner can replay the drawing process from anytime. This viewer is able to show graphical evaluation results for six parameters in time series graphs.

Our system generates some advice for the drawing process based on these results. The tutor's comments are also confirmed on this page. The evaluation results from both the system and the tutor are added to the time series. The learner can recognize which points are wrong and correct the drawing.

Referring to experts' and others' drawing processes helps a learner understand the advice from the system and the tutor. Moreover, comparing one's drawing process with others could help them find new techniques and/or drawing methods. Learners hand in their drawing processes and then obtain the tutors' feedback as individual learning support tools (Fig.3 lower part).

5.2 Individual Learning

This function is used the between the time when a learner finishes his/her drawing and the time when a teacher gives this learner some direct instructions. To support the individual drawing learning, learners' drawing processes are analyzed based on the DPM. At first, our system separates the learner's drawing process into three drawing phases. Then, the geometrical features of each phase are compared with the DMP. Based on this analysis, our system generates advice for that learner. Timing and content of that advice are determined. There are two types of advice: instructional comments with short sentences and the instructional drawings as models.

The supporting functions for individual drawing learning are as follows:

- Replaying one's own drawing process.
- Synchronous replaying of one's own drawing process with those of other learners / art experts / instructors.
- Showing the location of the 3 drawing phases in a learner's drawing process.
- Total advice comments for the whole drawing work.
- Instructional comments and drawing for a sectional drawing.

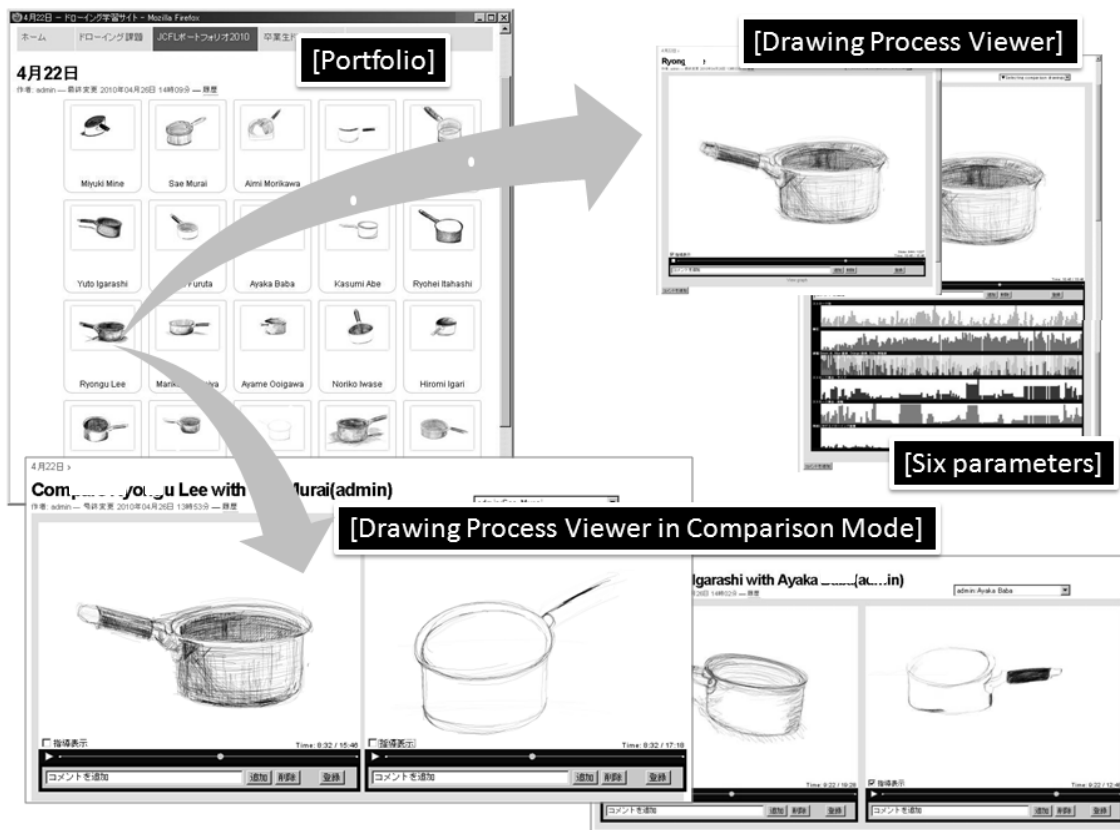


Figure 3. Examples of the System Interfaces

(The portfolio viewer [upper left], the drawing process viewer with/without six graphs of drawing process parameters [upper right], and the drawing process viewer in comparison mode [lower part].)

- Introduction to some drawing techniques and exercises which should be mastered by this learner.
- Introduction to the drawing work of other learners / art experts / instructors as a model.

The educational effectiveness of those functions was examined at an art school. The subjects were 18 students who had been at the school for 1 month. The knowledge and experience about drawing for each student was different. From the preliminary survey, we found that the 15 students were beginners. The subjects were asked to use our tool for a month for their individual learning. The frequency of use was not specifically mentioned. The works in Figure 4 are the final drawings of one student before (work in the left side of Fig.4) and after (work in the right side) the experiment.

In this experiment, we focus on the appearance of Phase-A in the learners' drawing processes. Phase-A is the most important part to sketch a motif. However, many instructors in art school do not tend to teach this matter explicitly to their learners. Before this experiment, Phase-A appeared in the drawing processes of 3 students who were not novices. The drawing processes of the other 15 students, by contrast, did not show Phase-A. Figure 5 shows the drawing results in each phase of one student of these. The upper part of the figure shows a graph of the changes in pressure in a time-line and the detected phases. The lower part shows drawing results in each phase. In this result, two problems can be point out.

- Learners wrote some clear lines with high pressure from the beginning.
- Learners did not draw the whole shape of the motif at the beginning.

Thus, without making an outline, this learner was trying to show the form of a motif immediately.

During the experiment, our system checked for the appearance of Phase-A. If Phase-A did not appear, some text comments (for example "You should learn the techniques so as to form a composition by drawing a simple shape.") are given to the learner at an appropriate time. The system also introduces a link to the related exercises. In these exercises, a learner is asked to draw some lines with the indicated pen pressure, and/or to draw the whole outline of the motif with low pressure. At the same time, the system suggests to refer to an expert's drawing process to form the composition in simple shapes.

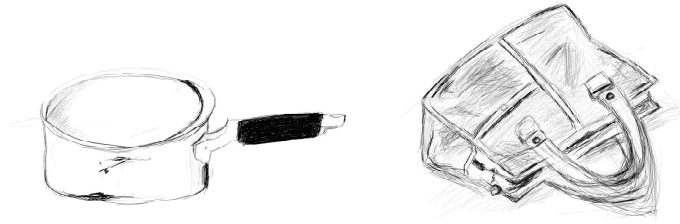


Figure 4. The final works prior to experiment (left) and after the experiment (right)

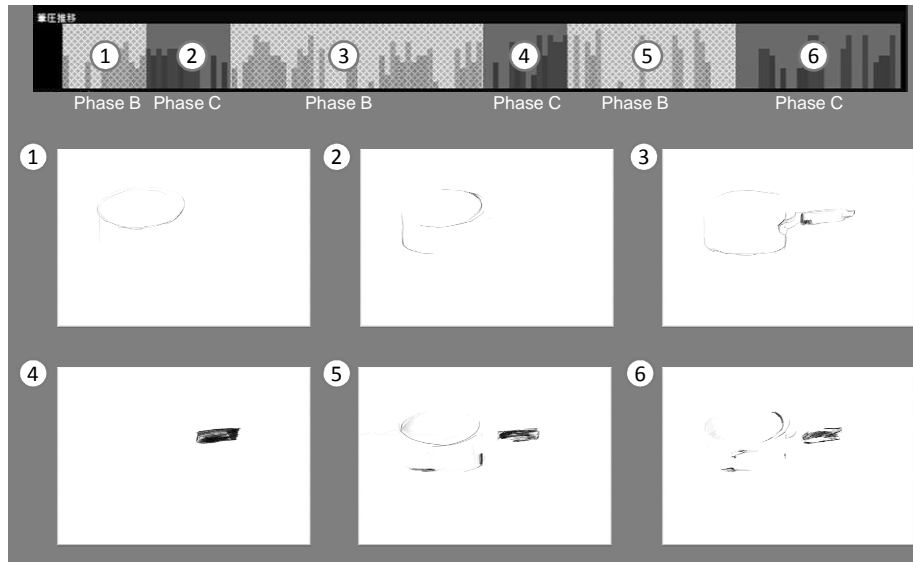


Figure 5. The drawing results at each phase prior to the experiment

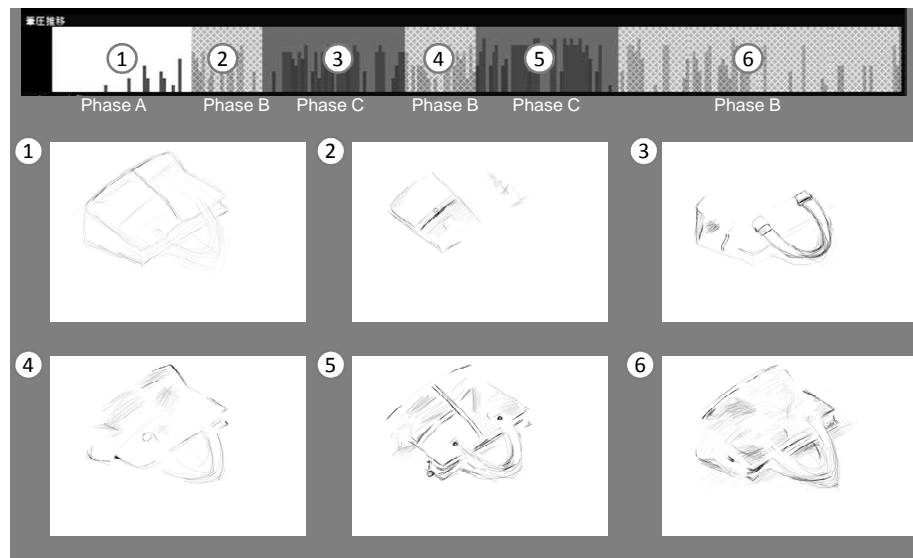


Figure 6. The drawing results at each phase after the experiment

After the 1 month experiment, in 6 out of 15 students whose drawing process did not include Phase-A, a section of Phase-A began to appear in their work. These students certainly used our system in their individual learning. The other 9 students could not draw an outline of the motif at the beginning of their drawing yet. The frequencies of use of our system were lower than the students who were able to improve their drawing. Figure 6 shows the drawing results of each phase for one student (the same students as Fig.5). The qualities of the final works are not high (almost the same level as 1 month before), but in these results, learners try to

make the outline of the motif using low pressure at the beginning of their drawing. Similar results were seen for other subjects.

The following comments were collected from the subjects after the experiment.

- I can replay my own drawing process by using this tool, so I can carefully and repeatedly check my bad habits.
- I can view and replay the drawing processes of others, so I can better understand the necessary techniques.
- The timing of advice and the timing of bad drawing is synchronized, so I can easily recognize my drawing points which need amendment.

From these results, we can see the potential for educational effectiveness of the DPM based individual drawing learning support.

6. CONCLUSION

In this paper, we describe the possibility and benefit of a drawing support system in a networked environment. The digital pen has a high potential as a drawing tool. Drawing learning in a networked environment is also useful and available if the users of the system are limited to beginners of drawing. Additionally, we discussed some features of a drawing process and the DPM. Then, its application for the individual learning support system is shown. Also we describe the overview of our drawing support system in a networked environment, then the concept and the functions of the DPM are shown. Its application to classroom learning and individual learning are also considered. Finally, the educational effectiveness of our system is examined. From an experiment with students in an art school, we can see that our drawing learning support system is useful if the users are limited to beginners of drawing.

In future work, we will find adequate drawing tasks to suit constraints and limitations of the digital pen. During the operation of this system in practice, we try to arrange and revise the DPM and formalize more instructional rules for drawing learners.

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LECTUTAINMENT: AN ENTERTAINMENT COMPUTING APPROACH TO MOTIVATING STUDENTS IN CLASSROOM LECTURE

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ABSTRACT

This paper describes ‘Lectutainment’, which is a coined term from ‘lecture’ and ‘entertainment’ and aims at increasing students’ learning motivation in a classroom lecture. To realize the Lectutainment, we attempt to make atmosphere like a theatrical performance (stage show) in the classroom lecture by executing audiovisual effects. We developed the prototype system and conducted a preliminary experiment on a small scale. The results of the experiment indicated that the Lectutainment could increase university students’ learning motivation.

KEYWORDS

Entertainment, classroom lecture, learning motivation, audiovisual effects.

1. INTRODUCTION

Learning motivation is important for successful learning. Therefore, teachers are considering methods to improve classroom lectures in terms of learning motivation. One of the methods must be to use ICT. For example, digital equipments (e.g., a digital projector and Internet-enabled computers) are installed in a classroom to increase not only learning efficiency and efficacy but also learning motivation. Pedagogical design and practice of ICT-based classrooms have been studied a lot (e.g., (Smeets 2005)(Selwyn 2007)). In addition, advanced ICT-based classroom systems have been developed such as collecting students’ responses using mobile devices (Bär et al. 2005), supporting multi-user collaboration using a large display and pointing devices (Bi et al. 2005), enabling students to annotate digital slides displayed on their tablet PCs and share the annotations on the classroom screen (Anderson et al. 2004), and providing personalized quiz materials on a student’s PDA after automatic attendance check using RFID (Mitsuhara et al. 2008).

The purpose of this study is to increase learning motivation in a classroom lecture. A classroom is a principal learning space in school. The classroom design covers a wide variety of issues (e.g., desks, chairs, black/white boards, lights, electric (digital) equipments, and learning support software) and can influence not only learning efficiency and efficacy but also students’ learning activities, attitudes, and motivation (Oblinger 2006). We think that the conventional classroom design has not focused much on “learning is fun” and the future classroom design should focus more on entertainment. Therefore, we regard a classroom as a theater and attempt to make atmosphere like a theatrical performance (stage show) in the classroom lecture through an entertainment computing approach. In other words, our idea is the fusion of classroom lecture and entertainment. We call the fusion ‘Lectutainment’, which is a coined term from ‘lecture’ and ‘entertainment’.

The remainder of the paper is organized as follows. Section 2 shows our proposed learning motivation model. Section 3 describes the concept, prototype system, and examples of the Lectutainment. Section 4 describes a preliminary experiment for examining whether the Lectutainment can increase university students’ learning motivation. Section 5 summarizes the paper and shows the prospect.

2. LEARNING MOTIVATION MODEL

Learning motivation is discussed actively from the standpoints of instructional design and psychology. For example, Keller (1998) identified the categories of ‘attention’, ‘relevance’, ‘confidence’, and ‘satisfaction’ as a design basis called the ‘ARCS model’ for increasing learning motivation. Malone and Lepper (1987) identified the factors of ‘challenge’, ‘curiosity’, ‘control’, and ‘fantasy’ in the intrinsic motivation of learning.

Our proposed model represents stepwise learning motivation in a classroom lecture and consists of three layers. Students in the upper layer are interpreted as the students with the higher learning motivation. Figure 1 shows the model overview.

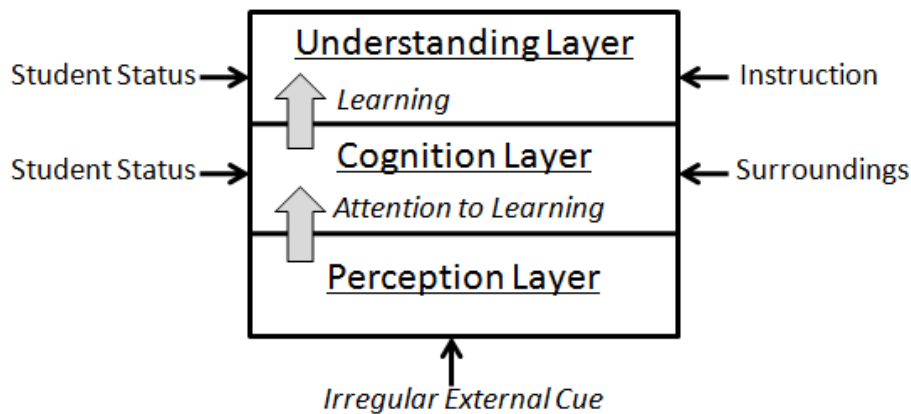


Figure 1. Proposed learning motivation model

(1) Perception Layer

This layer is positioned at the model’s bottom and handles whether a student pays attention to the classroom lecture by an irregular external cue that stimulates his/her perception (e.g., ears and eyes). Here, the attention is not necessarily paid to the content of learning (the lecture). For example, when suddenly a teacher begins to explain in a loud voice, the student will be surprised and pay attention to the teacher. This layer can be associated partly with ‘attention’ in the ARCS model.

(2) Cognition Layer

This layer is positioned at the model’s middle and handles whether the student’s attention transitions to learning actions. Here, the leaning actions mean listening to the teacher’s explanation, looking at the content of the blackboard or learning material (e.g., textbooks and digital slide show projected onto the classroom screen), note-taking, asking a question, etc. In this layer, the student recognizes his/her internal states (e.g., understanding level, learning process, and curiosity) and surrounding situations (e.g., the teacher’s facial expression and other students’ learning attitude) and then judges whether he/she takes a learning action.

(3) Understanding Layer

This layer is positioned at the model’s top and handles whether the student can understand the content of learning as a result of his/her learning actions. Here, his/her understanding depends on his/her internal states and the teacher’s instruction. Once the student feels confidence and satisfaction of understanding, he/she will pay attention to learning continually without an irregular external cue. This layer can be associated partly with ‘confidence’ and ‘satisfaction’ in the ARCS model.

3. LECTUTAINMENT

To realize the Lectutainment, we focus on the perception layer in the above-mentioned model and ‘fantasy’ in the Malone and Lepper’s identification. The three factors in their identification, ‘challenge’, ‘curiosity’, and ‘control’, can be associated with the cognition layer or the understanding layer. On the other hand, ‘fantasy’ can be associated with the perception layer because it is the factor causing surprise and applicable to many lectures independently of learning topics.

3.1 Concept

The Lectutainment aims at increasing students' learning motivation in a classroom lecture by making atmosphere like a theatrical performance in terms of 'fantasy'. We believe that the classroom atmosphere different than usual influences many students and their learning motivation will be increased from the perception layer. The classroom atmosphere may not be the core issue in education but should not be ignored in terms of learning motivation caused by senses of exaltation (excitement), joy, relaxation, tension, etc. In a different standpoint, the Lectutainment aims at helping teachers conduct a classroom lecture different than usual, that is, use irregular external cues for 'fantasy'. Note that the current Lectutainment does not necessarily cover increase of learning motivation in the every layer—not necessarily ensure that the students take learning actions and understand the lecture.

A classroom resembles a theater. Black/white boards and screens, room lights and speakers, a teacher, and students are associated with stage backdrops, stage equipments, a performer, and audience, respectively. In addition, both a teacher and a performer act while transferring a certain kind of information to and occasionally interacting with students or audience. Design of drama covers not only performers' acts but also audiovisual effects such as BGM, SE, light, and projected image. From the resemblance between the two, we attempt to make the classroom atmosphere by executing these audiovisual effects as irregular external cues.

3.2 Prototype System

3.2.1 System Composition

The prototype system has a client-server architecture and is composed roughly of the three subsystems: effect manager (EM for short), effect executor (EE for short) and effect bank (EB for short).

Figure 2 shows the system composition. For the Lectutainment, a classroom needs digital projectors, screens, speakers, wireless network (WLAN router), an EM-installed computer, EE-installed computers, PDAs, and RFID readers. In addition, a teacher and students have to carry RFID cards containing their ID codes. The EM-installed computer, which communicates with the EE and the EB via the wireless network, equips an RFID reader and an infrared unit. The RFID reader is attached to the classroom door (beside the doorknob) and used to detect the teacher attendance—a teacher has to put his/her RFID card on the reader when entering the classroom. The infrared unit is used to send infrared commands (e.g., on/off) to the equipments with a remote control feature such as the projectors. Each EE-installed computer is connected to one projector and one set of speakers. The PDA, which equips an RFID reader and a wireless network interface, is put on every student's desk to detect the student attendance—a student has to put his/her RFID card on the reader when having a seat. The prototype system can be installed in as many classrooms as possible. For example, the equipments other than the PDAs and the RFID readers can be mounted on a movable metal frame.

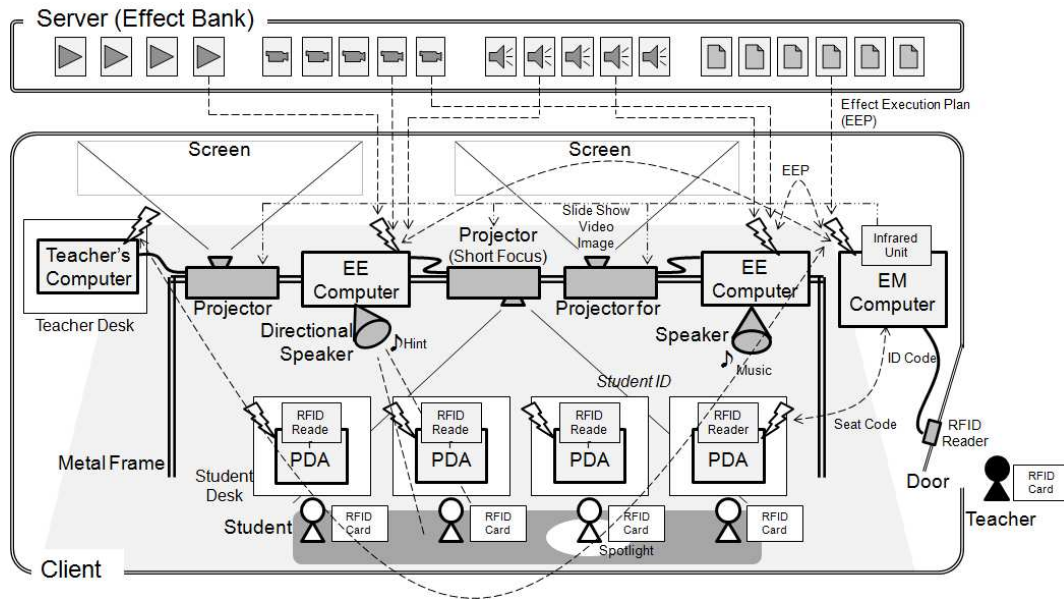


Figure 2. Composition of the Lectutainment prototype system

3.2.2 Sub Systems

(1) Effect Manager

Before the start of the lecture, first, the EM receives an effect execution plan from the EB. Immediately after that, the EM distributes the plan to every EE. In the plan, conditions for effect execution—how and when the effects are executed—are written in XML. When receiving a teacher's or a student's ID code, the EM checks whether he/she is allowed to attend the lecture. If he/she is the allowed teacher, the EM informs every EE of the teacher attendance by sending the received ID code. If an allowed student, the EM sends the received ID code and the seat ID code (PDA's ID code) to every EE. From these two codes, the EM (and the EE) grasps which seat the student has. When the teacher requests effect execution at an arbitrary time, the EM sends the request to a corresponding EE.

(2) Effect Executer

Basically the EE works according to the effect execution plan. The EE waits for the ID code or the request from the EM and simultaneously it checks the timing for effect execution at a regular interval. When the current situation matches a condition in the effect execution plan (e.g., when the current time matches the execution time of an effect), the EE executes the corresponding effect immediately.

(3) Effect Bank

The EB working on the server stores effect execution plans, digital material files (e.g., PPT/PPS, MPEG, and MP3) used for the effects, classroom spatial information (e.g., the dimensions of the classroom and seat positions), and fundamental settings of the lecture (e.g., starting and ending time) registered by teachers.

3.3 Examples of Audiovisual Effects

3.3.1 Before Start of Lecture

This is an example in the lecture about Hawaii. Five minutes before the start of the lecture, pictures of Hawaiian beautiful nature (e.g., beach and mountain) are projected and a Hawaiian music is played. We hope that the students will get interested in Hawaii and motivated to learn intrinsically by atmospheres of exaltation and relaxation. In the learning topics of geography and history, the audiovisual effects are easier to be executed because these learning topics are often illustrated with audiovisual materials.

3.3.2 Teacher's Entry to Classroom

A teacher enters the classroom and immediately an opening music is played. We hope that if a cheerful music is played, the students will get interested in the teacher and motivated to learn with a sense of affinity. If a coercive music like 'The Imperial March (Darth Vader's Theme)' is played, on the contrary, the students will get motivated to learn by an atmosphere of tension.

3.3.3 During Lecture

When the teacher requests a student to answer a quiz (or question), a spotlight is cast on the student. The student has to answer the quiz under pressure. At the same time, many of the other students will look at the student and also feel a sense of tension—"What if the spotlight is cast on me next?" This effect can create an atmosphere of tension and motivate the other students rather than the answerer to learn on a routine basis to become good answerers. The left picture in Figure 3 shows a snapshot of the spotlight effect.

When the quiz is difficult for the answerer, a verbal hint is given in a synthesized whisper that only he/she can hear. By this audio effect (support), the answerer will be able to find the answer while more or less a sense reducing a sense of tension. To realize this audio effect, the EE computer is connected to directional speakers (parametric speakers) whose directions are adjusted to the answerer's position by controlling two servo motors (pitching and yawing) via the USB interface. The teacher prepares the verbal hints and determines the timing of effect execution as occasion may demand. The right picture of Figure 3 shows the directional speakers mounted on the frame.

3.3.4 End of Lecture

At the ending time of the lecture, an ending music is played to culminate the lecture with profound atmosphere.

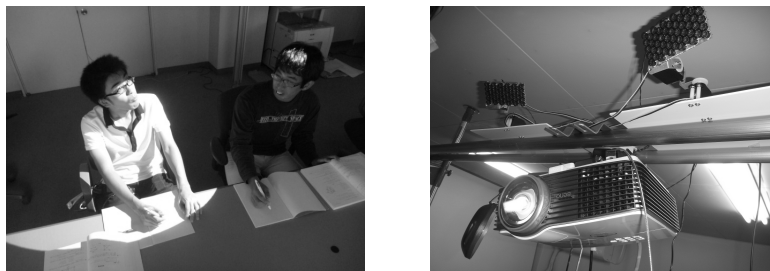


Figure 3. Spotlight effect (left) and directional speakers attached to the two motors above a projector (right)

4. PRELIMINARY EXPERIMENT

We conducted a preliminary experiment to examine whether the Lectutainment could increase university students' learning motivation. This is because learning motivation decline is occasionally true for university students. Another examination focus is on impact of the audiovisual effects on the students' feelings.

4.1 Settings

This experiment was conducted in an experimental small classroom where four projectors, two screens (available as whiteboards), and one set of speakers were installed. Three of the projectors were used for the audiovisual effects and two of the three were used for the spotlight effect.

4.1.1 Participants and Groups

The participants were 16 graduate and 8 undergraduate students whose major were information technology. We divided the participants into two groups homogeneously based on the participants' grades. Group A, which consisted of 12 participants, attended a 30-minute lecture where a teacher transmitted knowledge one-

sidedly with a digital slide show. Group B, which also consisted of 12 participants, attended a 30-minute Lectutainment where the same teacher conducted the lecture.

4.1.2 Learning Topic

We selected ‘Hawaiian tourism resources’ as the learning topic in the experiment because it was easy to execute the audiovisual effects in terms of its content. In the lecture, the teacher talked about some famous tourism resources and their related topics by using a digital slide show. For example, when talking about ‘Iolani Palace’, the teacher introduced the history of the Kingdom of Hawaii founded by Kamehameha I.

4.1.3 Audiovisual Effects

Table 1 shows the audiovisual effects executed in the experiment. In the experiment, the verbal hint effect was not executed and the spotlight effect (E-6) was executed manually by an experimenter.

Table 1. Audiovisual effects executed in the experiment

| Effect No. | When | What effect |
|------------|---|---|
| E-1 | The first attendee has a seat | A Hawaiian traditional music is played. |
| E-2 | The teacher enters the classroom | The teacher’s favorite sweet chime is played. |
| E-3 | The slide about the north shore is presented | A picture of the north shore is presented and sound of waves is played. |
| E-4 | The slide about ‘Iolani Palace is presented | A picture of ‘Iolani Palace is presented. |
| E-5 | The slide about Kingdom of Hawaii is presented | A picture of Kamehameha I is presented and music representing the king is played. |
| E-6 | The teacher requests a student to answer a quiz | A spotlight is cast to the student. |
| E-7 | The student answerer is thinking the answer | A music that speeds answering is played. |
| E-8 | The slide about Kīlauea is presented | A movie of the lava flowing from Kīlauea like a river is played. |

4.1.4 Procedure

The participants came to the same experimental classroom at the appointed time different for each group.

(1) Before Lecture

The participants of Group A waited for the teacher while having seats and a chat. On the other hand, when the first attendee of Group B had a seat, the first audiovisual effect was executed. The participants of Group B had been instructed to put their RFID cards on the reader (PDA) when having seats, but they did not know the audiovisual effect.

(2) During Lecture

The participants of Group A learned while basically hearing the teacher’s talk. On the other hand, the participants of Group B learned while hearing the teacher’s talk and perceiving the audiovisual effects.

(3) After Lecture

Immediately after the 30-minute lecture, the participants of Group A and B were given a same test and a same questionnaire without notice. The test consisted of 10 single-choice quiz questions about the lecture contents (e.g., “What palace was founded by Kamehameha I in 1882?”). The questionnaire was about learning motivation and consisted of 5-degree questions shown in Table 2. The participants of Group B were given the Q2-1, Q2-2, and Q2-3 (the below question) about the audiovisual effects.

● [Q2-3] What did you feel for each effect? Please choose one of the contradistinctive alternatives representing a lecture atmosphere you felt. (You can skip the item you did not feel anything.)

[Item 1] Excited or Bored [Item 2] Joyful or Depressed [Item 3] Smooth or Stagnant

[Item 4] Concentrated or Distracted [Item 5] Relaxed or Tense [Item 6] Wakeful or Sleepy

(4) One Week Later

The participants of Group A and B were given the same test again and the Q1-5 and Q1-6 about learning motivation without notice.

4.2 Results and Considerations

Table 2 shows the questionnaire results and Table 3 shows the participants' feeling to the audiovisual effects.

Table 2. Questionnaire results (mean value and standard deviation)

| Question | | Group A | | Group B | |
|----------------|---|---------|------|---------|------|
| | | AVG | SD | AVG | SD |
| Q1-1 | Did you get motivated to learn during the lecture? | 2.92 | 0.90 | 4.0 | 0.95 |
| Q1-2 | Did you enjoy the lecture overall? | 3.0 | 0.85 | 4.17 | 0.58 |
| Q1-3 | Did you get interested in the lecture? | 3.67 | 0.77 | 4.08 | 1.00 |
| Q1-4 | Do you want to continue to learn the today's topic? | 2.83 | 1.11 | 4.25 | 0.62 |
| Q2-1 | Do you accept such audiovisual effects executed in the experiment? | -- | -- | 4.0 | 0.95 |
| Q2-2 | Do you want to attend a lecture with such audiovisual effects again? | -- | -- | 4.17 | 0.58 |
| One week later | | | | | |
| Q1-5 | Even now do you have learning motivation about the topic, "Hawaiian tourism resources"? | 3.17 | 0.83 | 3.17 | 1.19 |
| | | Yes | No | Yes | No |
| Q1-6 | Did you learn the topic autonomously after the experiment? (Yes/No) | 1 | 11 | 2 | 10 |

4.2.1 Learning Motivation

The mean values of Q1-1, asking about learning motivation directly, were 2.92 and 4.0 in Group A and B. This indicates that the participants of Group B got motivated to learn more than Group A. The mean values of Q1-2 and Q1-3, asking about learning motivation indirectly, were 3.0 and 4.17, and 3.67 and 4.08 in Group A and B. The mean values of Q1-4, asking about expected retention of learning motivation, were 2.83 and 4.25. The values of Group B exceeded Group A in all of these questions and can be regarded as the evidences for increased learning motivation, compared to the conventional classroom lecture.

The mean values of Q1-5, asking about actual retention of learning motivation, were 3.17 in both Group A and B. In Group A, this mean value was higher than the mean value (2.83) of Q1-4. On the other hand, in Group B, this mean value was quite lower than that (4.25) of Q1-4. This indicates that the participants of Group B decreased their learning motivation rapidly. The numbers of Q1-6 indicate that almost all of the participants in the two groups did not learn the topic after the experiment.

The mean values of Q2-1 and Q2-2, asking whether the participants accepted the audiovisual effects, were 4.0 and 4.17. These values can be regarded as necessity and feasibility of the Lectutainment.

From the above questionnaire results, we think that the Lectutainment can be accepted by university students and increase learning motivation during a classroom lecture, but has difficulty in retaining their learning motivation after the lecture.

4.2.2 Students' Feelings (Classroom Atmosphere)

Overall, from the numbers in Table 3, we think that the participants (Group B) basically had positive feelings for every audiovisual effect. The participants did not feel bored and depressed to all the audiovisual effects. This indicates that the audiovisual effects met the minimum requirement for the Lectutainment, that is, the fusion of classroom lecture and entertainment.

The participants felt positive especially to the item 1 (excited), 2 (joyful), and 6 (wakeful). We think that this is because all the audiovisual effects provided the participants with novel experiences. Concerning the item 6, three participants felt negative (sleepy) to E-1 because of the peaceful melody of the music played.

For the item 3, 4, 5, and 6, some of the participants felt negative to the audiovisual effects except for E-3. This indicates that the audiovisual effects can decrease learning motivation unless used appropriately. For the item 5, the participants felt tense to the audiovisual effects except for E-1 and E-3. In the experiment, E-6 and E-7 had been prepared to make an atmosphere of tension and therefore it can be said that these audiovisual effects worked as we had expected. Although E-2 was not intended to make an atmosphere of tension, four participants felt tense when the teacher entered the classroom. This is because the teacher's entry intrinsically makes students tense and the atmosphere was highlighted by E-2.

E-7 had the most cumulative number of positive feeling and E-1 had that of negative feeling. E-7, which was an audio effect, focused on one student answerer. However, it reached to not only him/her but also all the participants in the classroom. We think that the participants other than the answerer treated the effect as

someone else's problem and had room to feel it positive. E-1 was also an audio effect but executed before the start of the lecture. We suppose that the participants wanted nothing to interfere with their free time and felt the effect negative such as distracting (noisy) and sleepy. There were the participants' opinions about the negative feeling more than the positive feeling, such as "When the audiovisual effects happened, I was confused about what I should have focused on.", "Music during the lecture interrupts learning.", and "This is not for university students but for elementary school students."

From the above questionnaire results, we think that though not completely intended, the audiovisual effects worked as irregular external cues to change a classroom atmosphere.

Table 3. The participants' feelings for the audiovisual effects executed in the experiment

| Item | Feeling | E-1 | E-2 | E-3 | E-4 | E-5 | E-6 | E-7 | E-8 |
|------|--------------|-----|-----|-----|-----|-----|-----|-----|-----|
| 1 | Excited | 7 | 9 | 4 | 5 | 7 | 5 | 9 | 5 |
| | Bored | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | Joyful | 7 | 7 | 4 | 5 | 7 | 4 | 8 | 6 |
| | Depressed | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3 | Smooth | 3 | 5 | 3 | 5 | 4 | 3 | 7 | 5 |
| | Stagnant | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | Concentrated | 3 | 6 | 3 | 5 | 3 | 4 | 7 | 5 |
| | Distracted | 4 | 1 | 0 | 0 | 2 | 0 | 0 | 2 |
| 5 | Relaxed | 9 | 3 | 3 | 4 | 4 | 3 | 4 | 4 |
| | Tense | 0 | 4 | 0 | 1 | 1 | 5 | 6 | 1 |
| 6 | Wakeful | 3 | 7 | 3 | 5 | 5 | 5 | 8 | 6 |
| | Sleepy | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

4.2.3 Understanding

Table 4 shows the mean accuracy rate of the tests. There was not much difference between the two groups. From this result, we think that the Lectutainment has difficulty in improving the university students' understanding. In other word, it has not yet increased learning motivation in the understanding layer.

Table 4. Mean accuracy rates of the tests

| | Group A | | Group B | |
|------------------------------|---------|------|---------|------|
| | AVG | SD | AVG | SD |
| 1st post-test | 0.79 | 0.09 | 0.76 | 0.21 |
| 2nd post-test (1 week later) | 0.77 | 0.23 | 0.75 | 0.10 |

5. CONCLUSION AND PROSPECT

This paper described the Lectutainment, which executes audiovisual effects to increase students' learning motivation in a classroom lecture. We developed the Lectutainment prototype system and conducted a preliminary experiment. From the questionnaire results, we found out that the Lectutainment could increase learning motivation in comparison with the conventional classroom lecture. Currently, however, we cannot conclude that the Lectutainment is effective for a variety of classroom lectures and students. To clarify and generalize the effectiveness, therefore, we have to install the system in a general classroom and use it in some real lectures for a long time. In addition, we should consider the cost effect issues—whether learning motivation is enough increased in comparison with hardware cost, teacher's burden, etc.

Not all students will accept the Lectutainment. Our concern is that some students may consistently refuse it and lose their learning motivation. Therefore, we have to pursue the Lectutainment where all students do not lose their learning motivation and as many students as possible get motivated to learn. Another concern is that students may become insensitive to the audiovisual effects in long-term use of the Lectutainment. Humans adjust to new environments. If monotonous audiovisual effects are executed repeatedly, the students will be bored and may fall asleep. In other words, the Lectutainment for increasing their learning motivation may decrease it. Therefore, we are now considering how to untangle these concerns from conceptual and technological points of view. For example, we should develop a teacher support system where teachers can easily create audiovisual effects and share the effects with others.

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A MEASURE THEORETICAL EVALUATION MODEL FOR E-LEARNING PROGRAMS

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ABSTRACT

This paper deals with a measure theoretical model for evaluation of e-learning programs. Based on methods of general measure theory an evaluation model is developed which can be used for assessment of complex target structures in context of e-learning programs. With the presented rating function target structures can be evaluated by a scoring value which indicates how the targets in sense of a given logical target structure has been reached. A procedure is developed for the estimation of scoring values for target structures based on adapted assessment checklists.

KEYWORDS

E-learning, evaluation, scoring, target structure, assessment checklist, evaluation model.

1. INTRODUCTION

Quality of e-learning programs is a very intensive and controversy discussed topic of recent time. Background is the worldwide challenge for the development of methods and tools for lifelong learning that becomes more and more realistic by the fast progress on all areas of e-tools and especially of Internet. In this context the call for adapted education standards, a corresponding quality evaluation and process management of e-learning tools becomes always louder. However no approach for evaluation of e-learning programs could reach a general acceptance until now. For a corresponding overview we refer to the report of Swedish National Agency for Higher Education (2008). This report contains an excellent survey on the European view on e-learning and quality assessment. Concise further overviews on quality research in e-learning are given by Ehlers & Pawlowski (2006), Ruhe & Zumbo (2009) and Phillips (2010). For some additional or special aspects we refer to Khan (2005), Kirkpatrick (2007), Stufflebeam (2002) and Zaharias & Poulymenakou (2009), for instance.

The quantitative models for the assessment of e-learning quality considered usually are additive models. That means, depending on the considered aspects, which are measured based on a defined scale, a linear function containing corresponding weight factors is used like, e.g.,

$$Q = \sum_{i=1}^k a_i x_i$$

Here denote $a_i, a_i \geq 0$, given weight factors for the obtained measure values $x_i, i = 1, \dots, k$, for the considered aspects. The advantage of this formula is, it is very easy. The disadvantage is that the choice of proper weight factors is subjective. Moreover, positive evaluation values can be obtained even in such cases if the targets of certain quality aspects have been failed. A possible logical inner structure of target structures remains out of consideration.

In contrast to linear approaches we develop here a measure theoretical model for the assessment of an e-learning program. We consider an e-learning program whose quality is determined by $k, k \geq 1$, several aspects or characteristics M_1, \dots, M_k . We assume that the quality of the single aspects can be measured by means of a given scale where the corresponding observation variables are ordinal or metrical ordered variables. Our aim is to develop an evaluation model for e-learning programs whose quality is characterized as above by k several aspects M_1, \dots, M_k . For it we will construct a corresponding measure in sense of general

measure theory. This requires in the context considered here two steps. First we will construct k corresponding efficiency measure spaces for description of quality of single aspects M_1, \dots, M_k . After that we will combine these spaces to a corresponding product space. This space will describe the considered aspect structure as a whole. The via the obtained product space defined product measure will be then our quality measure for evaluation of an e-learning program. For the implementation and application of our assessment approach the paper is rounded off by a statistical procedure for the estimation of scoring values for target structures based on adapted assessment checklists.

The advantage of the model considered here in comparison with linear models is that by the multidimensional consideration via the product measure the logical structure of a target structure is evaluated as a whole.

2. THE MODEL

2.1 Measure Spaces for the Single Aspects

For description of quality of a single aspect M_i , $i = 1, \dots, k$, we consider a measure space $(\Omega_i, \mathcal{A}_i, Q_i)$. Each measure space consists of three objects Ω_i , \mathcal{A}_i and Q_i which can be defined here as follows:

1.) Let $\Omega_i = \{\omega_{i1}, \omega_{i2}\}$ be a two-element set - the set of *elementary targets*. In this sense the element ω_{i1} is standing for: the target in sense of aspect M_i has been reached (is reached), the element ω_{i2} is standing for: the target in sense of M_i has not been reached (is not reached). The set Ω_i is denoted as *target space* with respect to the aspect M_i .

2.) Let \mathcal{A}_i be the set of all subsets of Ω_i . Then we have

$$\mathcal{A}_i = \{ \emptyset, A_{i1}, \bar{A}_{i1}, \Omega_i \}$$

where A_{i1} and \bar{A}_{i1} are defined by $A_{i1} = \{\omega_{i1}\}$ and $\bar{A}_{i1} = \{\omega_{i2}\} = \bar{A}_{i1}$, for instance. The elements of set system \mathcal{A}_i can be interpreted as *target structures* as follows:

| | | |
|----------------|---|---|
| A_{i1} | - | target in sense of aspect M_i has been reached, |
| \bar{A}_{i1} | - | target in sense of aspect M_i has been not reached, |
| Ω_i | - | any target in sense of aspect M_i has been reached, |
| \emptyset | - | nothing has been reached. |

The set \mathcal{A}_i is in sense of measure theory a σ -algebra. We denote the elements of \mathcal{A}_i as *target structures* and the set \mathcal{A}_i itself as *target algebra*. In this context we say: the target in sense of a target structure $A \in \mathcal{A}_i$ has been reached (is reached) if an $\omega \in A$ has been observed (is observed). The structure of a target algebra \mathcal{A}_i is very simple and posses more a formal meaning here. The target algebras are needed if we will go over to the corresponding product space for a common description of all aspects M_1, \dots, M_k .

3.) Let $Q_i: \mathcal{A}_i \rightarrow [0,1]$ be an additive map from our target algebra \mathcal{A}_i into the interval $[0,1]$ where to any given real number $q_i, 0 \leq q_i \leq 1$,

$$Q_i(A_{i1}) = q_i \quad \text{and} \quad Q_i(\bar{A}_{i1}) = 1 - q_i$$

holds. The values of numbers q_i and $1 - q_i$ are or can be interpreted as evaluation values for the target structures A_{i1} and \bar{A}_{i1} . In this sense the values q_i and $1 - q_i$ form an evaluation distribution over the target algebra \mathcal{A}_i . The function Q_i is a normalized measure on $(\Omega_i, \mathcal{A}_i)$. We denote $Q_i(A_{i1})$ as *score* that the target in sense of aspect M_i has been reached, analogously $Q_i(\bar{A}_{i1})$ is the corresponding score that the target in sense of M_i has not been reached.

The triples $(\Omega_i, \mathcal{A}_i, Q_i)$, $i = 1, \dots, k$, are elementary measure spaces. We now will combine the so obtained spaces for the aspects M_1, \dots, M_k to a product space. By this product space an evaluation of more complex target structures with respect to the aspects M_1, \dots, M_k becomes possible. For the measure theoretical background used in this paper we refer to Bauer (2001).

2.2 A Product Space for the Aspects

Describing more complex target structures we now consider the product space over the measure spaces $(\Omega_i, \mathcal{A}_i, Q_i)$ for $i = 1, \dots, k$. This space consists of three elements Ω , \mathcal{A} and Q again which are defined as follows.

1.) Let $\Omega = \Omega_1 \times \dots \times \Omega_k$ be the cross product over the target spaces $\Omega_1, \dots, \Omega_k$. The elements of Ω are $\omega = \{\omega_1, \dots, \omega_k\}$ with $\omega_i \in \Omega_i$ for $i = 1, \dots, k$. We denote these elements as *k-dimensional elementary targets* and Ω is then the *k-dimensional target space*.

2.) Let \mathcal{A} be the set of all subsets of *k-dimensional target space* Ω . This set of subsets forms again a σ -algebra over the target space Ω . The elements of σ -algebra \mathcal{A} are denoted as *k-dimensional target structures*. The σ -algebra \mathcal{A} is then *k-dimensional target algebra*.

Some examples of target structures:

- $A = \{\{\omega_{11}, \omega_{21}, \dots, \omega_{k1}\}\}$ - all single targets A_{11}, \dots, A_{k1} in sense of aspects M_1, \dots, M_k have been reached,
- $B = \{\{\omega_{11}, \dots, \omega_{k-11}, \omega_{k1}\}, \{\omega_{11}, \dots, \omega_{k-11}, \omega_{k2}\}\}$ - the single targets A_{11}, \dots, A_{k-11} have been reached,
- $C = \{\{\omega_{11}, \omega_{21}, \dots, \omega_{k-11}, \omega_{k2}\}\}$ - the targets A_{11}, \dots, A_{k-11} have been reached, but not the target A_{k1} ,
- $D = \{\{\omega_{11}, \omega_{22}, \dots, \omega_{k2}\}\}$ - only the single target A_{11} has been reached,
- $E = \{\{\omega_{11}, \omega_{2i_2}, \dots, \omega_{ki_k}\}, i_2, \dots, i_k \in \{1, 2\}\}$ - the single target $A_{11} \in \mathcal{A}_1$ has been reached.

The last target structure E is a special target structure which is directed only to the single target or aspect M_1 . Our target algebra \mathcal{A} contains of k such single target structures which are given by

$$\begin{aligned} A_1 &= A_{11} \times \Omega_2 \times \dots \times \Omega_k, & A_{11} &= \{\omega_{11}\} \in \mathcal{A}_1, \\ A_2 &= \Omega_1 \times A_{21} \times \dots \times \Omega_k, & A_{21} &= \{\omega_{21}\} \in \mathcal{A}_2, \\ &\dots & & \\ A_k &= \Omega_1 \times \Omega_2 \times \dots \times A_{k1}, & A_{k1} &= \{\omega_{k1}\} \in \mathcal{A}_k. \end{aligned} \quad (1)$$

We denote these target structures as *simple target structures* or *simple targets*.

Beside of the simple target structures a further class of special target structures is of interest. This is the class of composed target structures. A target structure B is said to be a *composed target structure* if a subset of simple target structures $\{A_{i_1}, \dots, A_{i_j}\} \in \mathcal{A}$, $1 \leq i_1 < i_2 < \dots < i_j \leq k$, $1 \leq j \leq k$ exists such that

$$B = \bigcup_{r=1}^j A_{i_r}$$

holds. Composed target structures are directed to subsets of targets in sense of the given target or aspect set M_1, \dots, M_k . Our target algebra \mathcal{A} contains $2^k - 1$ different composed target structures. These are

$$A_1, \dots, A_k, \quad A_1 \cup A_2, \dots, A_{k-1} \cup A_k, \quad A_1 \cup A_2 \cup A_3, \dots, \quad \bigcup_{i=1}^k A_i = \Omega.$$

Because of the set system \mathcal{A} as the set of all subsets of Ω is a σ -algebra it holds:

$$(i) \quad A_1, \dots, A_r \in \mathcal{A} \Rightarrow \bigcup_{i=1}^r A_i \in \mathcal{A} \quad \text{and} \quad (ii) \quad A \in \mathcal{A} \Rightarrow \bar{A} \in \mathcal{A}.$$

This implies moreover $A_1, \dots, A_r \in \mathcal{A} \Rightarrow \bigcap_{i=1}^r A_i \in \mathcal{A}$. So beside the union of target structures and the complement of a target structure also the intersection of target structures is again a target structure. That means, the target algebra \mathcal{A} is logical closed or consistent with respect to application of set theoretical operations to target structures.

3.) Let $Q: \mathcal{A}_i \rightarrow [0, 1]$ be a map from the target algebra \mathcal{A} into the interval $[0, 1]$ with the following property. For any $A = A'_1 \times \dots \times A'_k$ with $A'_i \in \mathcal{A}_i$, $i=1, \dots, k$, it holds

$$Q(A) = \prod_{i=1}^k Q_i(A'_i). \quad (2)$$

Then, in sense of measure theory, Q is the so-called product measure of measures Q_i , $i = 1, \dots, k$. This is according to the Hahn-Kolmogorov-Theorem of general measure theory a unique defined measure on measurable space (Ω, \mathcal{A}) .

Hence by the product measure Q a measure value $Q(A)$ is defined for each target structure $A \in \mathcal{A}$. The value $Q(A)$ can be interpreted then as an evaluation number for it how the targets in sense of target structure A have been reached (can be reached). In this sense big values $Q(A) \approx 1$ are a hint that the targets in sense of target structure A have been reached essentially, whereas a value $Q(A) \approx 0$ is a signal that targets in sense of target structure A has been failed essentially. In this sense we will denote $Q(A)$ as *score for it that the targets of target structure A have been reached* or, more short, simply as the *score of target structure A* .

Collecting this together, the triple (Ω, \mathcal{A}, Q) , forms a corresponding product space which allows an evaluation of all target structures of target algebra \mathcal{A} by means of a score value Q defined by (2).

2.3 Calculation Rules for Scores

We will consider now some calculation rules for the computation of score values for target structures. The score function Q defined by (2) is a normalized measure on (Ω, \mathcal{A}) . Each normalized measure posses the following basic properties.

1. Additivity: According to the addition axiom of measure theory the following rule holds. Let $A_1, \dots, A_n \in \mathcal{A}$ be pairwise disjoint target structures such that $A_i \cap A_j = \emptyset$ for $i \neq j$ and $i, j = 1, \dots, n$ holds then we have

$$Q(\bigcup_{i=1}^n A_i) = \sum_{i=1}^n Q(A_i).$$

2. Normalization rule: It holds

$$Q(\Omega) = 1.$$

Basing on these two properties further calculation rules can be obtained. The most important rules are the following. These are standard properties of each normalized measure. They hold correspondingly for the score measure Q considered here. We give a short survey.

3. Complement rule: Let $A \in \mathcal{A}$ be an arbitrary target structure. Then it holds

$$Q(A) = 1 - Q(\bar{A}).$$

Proof. This is a property of any normalized measure.

4. General addition rule. Let $A_1, \dots, A_r \in \mathcal{A}$ be arbitrary target structures. Then it holds

$$Q(A_1 \cup A_2) = Q(A_1) + Q(A_2) - Q(A_1 \cap A_2)$$

as well as

$$Q(\bigcup_{i=1}^r A_i) = \sum_{i=1}^r Q(A_i) - \sum_{\substack{i,j=1 \\ i < j}}^r Q(A_i \cap A_j) + \sum_{\substack{i,j,k=1 \\ i < j < k}}^r Q(A_i \cap A_j \cap A_k) - \dots + (-1)^{r+1} Q(A_1 \cap \dots \cap A_r)$$

Proof. This rule corresponds the general addition rule of measure theory. \square

Now we will consider some calculation rules which are of special interest in context of evaluation of target structures.

5. **Product rule for simple target structures.** Let $A_1, \dots, A_r \in \mathcal{A}$ be different from each other simple target structures in sense of relation (1) with $Q(A_i) = q_i$, $0 \leq q_i \leq 1$, for $i = 1, \dots, r$, $r \leq k$. Then we have

$$Q(\bigcap_{i=1}^r A_i) = \prod_{i=1}^r q_i.$$

Proof. Without of any loss of generality we suppose that the simple target structures $A_1, \dots, A_r \in \mathcal{A}$ are directed to the first r aspects M_1, \dots, M_r . Then we have

$$\bigcap_{i=1}^r A_i = A_{11} \times \dots \times A_{r1} \times \Omega_{r+1} \times \dots \times \Omega_k \text{ with } A_{i1} \in \mathcal{A}_i, i = 1, \dots, r.$$

By (2) we get

$$Q(\bigcap_{i=1}^r A_i) = Q_1(A_{11}) \dots Q_r(A_{r1}) Q_{r+1}(\Omega_{r+1}) \dots Q_k(\Omega_k). \quad (3)$$

For simple target structures it holds $Q(A_i) = Q_i(A_{i1})$. With $Q(A_i) = q_i$ for $i=1, \dots, r$ and $Q_i(\Omega_i)=1$ for $i=r+1, \dots, k$ this implies

$$Q(\cap_{i=1}^r A_i) = \prod_{i=1}^r Q(A_{i1}) = \prod_{i=1}^r Q(A_i) = \prod_{i=1}^r q_i. \quad \square$$

6. Addition rule for simple target structures. Let $A_1, \dots, A_r \in \mathcal{A}$ be different from each other simple target structures where A_i is only directed to aspect M_i with $Q(A_i) = q_i$, $i = 1, \dots, r$. Then it holds

$$Q\left(\bigcup_{i=1}^r A_i\right) = 1 - \prod_{i=1}^r (1 - q_i). \quad (4)$$

Proof. By means of the complement rule and de Morgan's rule we obtain

$$Q(\cup_{i=1}^r A_i) = Q(\overline{\cap_{i=1}^r \bar{A}_i}) = 1 - Q(\cap_{i=1}^r \bar{A}_i) = 1 - Q(\cap_{i=1}^r \bar{A}_i)$$

With product measure property of Q and again by the complement rule we get

$$Q(\cap_{i=1}^r \bar{A}_i) = \prod_{i=1}^r Q(\bar{A}_i) = \prod_{i=1}^r (1 - Q(A_i)) = \prod_{i=1}^r (1 - q_i)$$

Collecting this together we get relation (4).

A special case is the case $r = 2$. Then we have

$$Q(A_1 \cup A_2) = 1 - (1 - q_1)(1 - q_2) = q_1 + q_2 - q_1 q_2.$$

7. Product rule for composed target structures. Let $B_1, \dots, B_r \in \mathcal{A}$ be r , $1 \leq r \leq k$, disjoint composed target structures with

$$B_i = \cup_{j=1}^{n_i} A_{ij}, \quad (5)$$

generated by n_i simple target structures $A_{ij} \in \mathcal{A}$ with $Q(A_{ij}) = q_{ij}$ for $i = 1, \dots, r$, $j = 1, \dots, n_i$, $\sum_{i=1}^r n_i \leq k$. Let $C \in \mathcal{A}$ be a target structure defined by

$$C = \cap_{i=1}^r B_i = \cap_{i=1}^r \cup_{j=1}^{n_i} A_{ij}. \quad (6)$$

Then it holds

$$Q(C) = Q\left(\bigcap_{i=1}^r B_i\right) = Q\left(\bigcap_{i=1}^r \bigcup_{j=1}^{n_i} A_{ij}\right) = \prod_{i=1}^r Q\left(\bigcup_{j=1}^{n_i} A_{ij}\right) = \prod_{i=1}^r (1 - \prod_{j=1}^{n_i} (1 - q_{ij})). \quad (7)$$

Proof. For each composed target structure $B_i = \cup_{j=1}^{n_i} A_{ij}$, $i = 1, \dots, r$, we consider the corresponding product measure space $(\Omega^{(i)}, \mathcal{A}^{(i)}, Q^{(i)})$ generated by the measure spaces $(\Omega_{ij}, \mathcal{A}_{ij}, Q_{ij})$ for the aspects M_{ij} , $j = 1, \dots, n_i$. As above, the product measures $Q^{(i)}$ are defined by

$$Q^{(i)}(A_{i1} \times \dots \times A_{in_i}) = Q_{i1}(A_{i1}) \dots Q_{in_i}(A_{in_i}), \quad A_{ij} \in \mathcal{A}_{ij}, \quad j = 1, \dots, n_i.$$

Let $A_1^{(i)}, \dots, A_{n_i}^{(i)} \in \mathcal{A}^{(i)}$ be simple target structures of target algebra $\mathcal{A}^{(i)}$ directed to the aspects M_{i1}, \dots, M_{in_i} with $Q^{(i)}(A_j^{(i)}) = q_{ij}$, $j = 1, \dots, n_i$. Then for a composed target structure $B_i = \cup_{j=1}^{n_i} A_j^{(i)} \in \mathcal{A}^{(i)}$ according the addition rule for simple target structures holds

$$Q^{(i)}(B_i) = Q^{(i)}\left(\bigcup_{j=1}^{n_i} A_j^{(i)}\right) = 1 - \prod_{j=1}^{n_i} (1 - q_{ij}). \quad (8)$$

If we now consider the product of measure spaces $(\Omega^{(1)}, \mathcal{A}^{(1)}, Q^{(1)}), \dots, (\Omega^{(r)}, \mathcal{A}^{(r)}, Q^{(r)})$ then we obtain again the measure space (Ω, \mathcal{A}, Q) . The corresponding product measure Q is then defined as follows. For any

target structure $C = B_1 \times \dots \times B_r \in \mathcal{A}$, $B_i \in \mathcal{A}^{(i)}$, $i=1, \dots, r$, we have $Q(C) = Q(B_1 \times \dots \times B_r) = Q^{(1)}(B_1) \dots Q^{(r)}(B_r)$. This, together with (4) completes the proof. \square

Of course the product rule (7) holds too if we consider $r, 2 \leq r \leq k$, disjoint composed target structures where the included simple target structures form only a subset of all simple target structures of target algebra \mathcal{A} . Hence it is possible to evaluate by formula (7) also target structures in sense of (6) which refer itself only to a subset of all possible simple target structures.

2.4 Graphical Representation of Target Structures

Target structures in sense of product rule for composed target structures can be visualized by means of logical diagrams as they are used in reliability theory, for instance.

Let C be a target structure given by

$$C = B_1 \cap B_2 \cap B_3$$

with

$$B_1 = A_{11} \cup A_{12} \cup A_{13}, \quad B_2 = A_{21} \quad \text{and} \quad B_3 = A_{31} \cup A_{32}$$

where $A_{11}, A_{12}, A_{13}, A_{21}, A_{31}$ and A_{32} are different simple target structures. Then the targets in sense of target structure C are reached if at least one of simple targets A_{11}, A_{12} or A_{13} and the target A_{21} and at least one of the targets A_{31} or A_{32} is reached. Figure 1 shows the associated target diagram. The composed target structures are described by a parallel circuit, the intersection of the composed target structures is visualized by a series circuit.

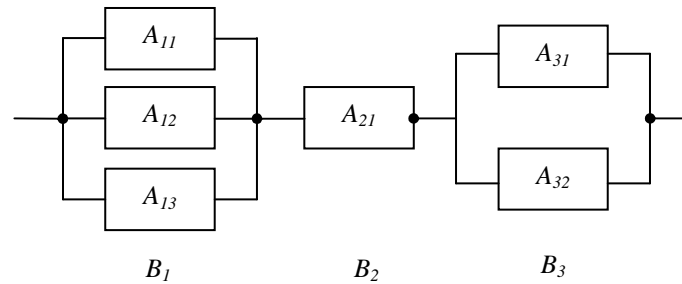


Figure 1. Visualization of target structures in sense of product rule for composed target structures.

By repeated application of the addition rule for simple target structures and the product rule for composed target structures very complex target structures can be evaluated. The logical background of these target structures can be visualized by corresponding target diagrams.

3. ESTIMATION OF SCORES FOR TARGET STRUCTURES

In the previous section it has been shown how scores can be calculated for complex target structures. By the calculation rules considered there the scores can be reduced to the scores q_1, \dots, q_k of the simple target structures of target algebra \mathcal{A} . Unfortunately, as a rule these scores are not given a-priori and we need corresponding estimation methods for these scores as well as for the scores of composed target structures.

We assume that aspects M_1, \dots, M_k can be observed indirectly by means of ordinal or metrical ordered observation variables X_1, \dots, X_k . Let $\mathcal{X}_i = [x_i^{(0)}, x_i^{(1)}]$ be the domain of i -th observation variable X_i for $i = 1, \dots, k$. Big values of X_i in the neighborhood of $x_i^{(0)}$ are an indication of that the target in sense of aspect M_i has been reached, essentially. Small values in the neighborhood of $x_i^{(0)}$ a corresponding signal that the target has been failed, essentially. The observation values $X_i = x_i^{(1)}$ or $X_i = x_i^{(0)}$ indicate that the target in sense of aspect M_i has been completely reached or failed, respectively. The scales which are used for

observing the variables X_i can be continuous or discrete, must be ordered and can be, for instance, rank places too.

We now consider a sample of size n of our observation vector (X_1, \dots, X_k) . Such a sample can be obtained, e.g., by a corresponding interrogation of participants of an e-learning program via an assessment checklist after the course is finished. This would be a-posteriori-interrogation. Or, one could interrogate experts which evaluate the course based on the course materials before the course is held. This would be an a-priori-interrogation.

Let $\bar{X}_i = (X_{i1}, \dots, X_{ik})$ be the i -th element of our sample $\vec{X} = (\vec{X}_1, \dots, \vec{X}_n)$. Then at first we have to normalize the sample values X_{i1}, \dots, X_{ik} by transforming of these values to the interval $[0,1]$, the domain for our scores q_1, \dots, q_k . This can be reached by the following transformation. For $i = 1, \dots, n$ and $j = 1, \dots, k$ let $q_j^{*(i)}$ be defined by

$$q_j^{*(i)} = (X_{ij} - x_j^{(0)}) / (x_j^{(1)} - x_j^{(0)}). \quad (9)$$

Then $q_j^{*(i)}$ is an estimation for the score q_j based on the observation X_{ij} . That means, each observation vector $\bar{X}_i = (X_{i1}, \dots, X_{ik})$, is transformed first by the normalization rule (9) into a score vector

$$\vec{q}^{*(i)} = (q_1^{*(i)}, \dots, q_k^{*(i)}).$$

By means of these transformed or normalized sampling values the score of composed target structures can be estimated as follows. We consider a composed target structure C in sense of relation (6) with a score according (7). For each sample element $\vec{q}^{*(i)} = (q_1^{*(i)}, \dots, q_k^{*(i)})$, $i = 1, \dots, n$, of our normalized sample $\vec{q}^* = (\vec{q}^{*(1)}, \dots, \vec{q}^{*(n)})$ we obtain an estimation value $Q^{*(i)}(C)$ for $Q(C)$ if we substitute in formula (7) likewise the scores q_{ij} by the estimation values $q_{ij}^{*(i)}$. We get

$$Q^{*(i)}(C) = \prod_{j=1}^r (1 - \prod_{i=1}^{n_j} (1 - q_{ij}^{*(i)})) \quad (10)$$

for $i = 1, \dots, n$. The vector $(Q^{*(1)}(C), \dots, Q^{*(n)}(C))$ is then a sample of size n for $Q(C)$. By means of the method of moments we obtain via the arithmetic mean

$$Q^*(C) = \frac{1}{n} \sum_{i=1}^n Q^{*(i)}(C)$$

finally an estimation function for the score $Q(C)$ by

$$Q^*(C) = \frac{1}{n} \sum_{i=1}^n Q^{*(i)}(C) = \frac{1}{n} \sum_{i=1}^n \prod_{j=1}^r (1 - \prod_{i=1}^{n_j} (1 - q_{ij}^{*(i)})). \quad (11)$$

This is the main formula for estimating of the score of a composed target structure based on a sample of size n in context of an interrogation.

Special cases are again the composed and simple target structures. For a single composed target structure $B = \bigcup_{j=1}^r A_j$ we get according the addition rule for simple target structures as estimation function for $Q(B)$:

$$Q^*(B) = Q^*(\bigcup_{j=1}^r A_j) = \frac{1}{n} \sum_{i=1}^n (1 - \prod_{j=1}^r (1 - q_j^{*(i)})). \quad (12)$$

For simple target structures $A_1, \dots, A_r \in \mathcal{A}$ we get by the product rule for simple target structures as estimation for the score of $B = \bigcap_{j=1}^r A_j$

$$Q^*(B) = Q^*(\bigcap_{j=1}^r A_j) = \frac{1}{n} \sum_{i=1}^n \prod_{j=1}^r q_j^{*(i)}. \quad (13)$$

The score $q_j = Q(A_j)$ of a single simple target structure $A_j \in \mathcal{A}$ can be estimated by

$$Q^*(A_j) = \frac{1}{n} \sum_{i=1}^n q_j^{*(i)}. \quad (14)$$

In case of missing values in the sample the missing values for $q_{ji}^{(1)}$ in (11) can be substituted then by the estimation values $Q^*(A_{ji})$ which are obtained based on the incomplete sample. This corresponds a 'neutral' evaluation of missing values in the sample.

4. CONCLUSION

The measure theoretical evaluation model considered here is an alternative to the frequently considered additive models. The advantage of the model is that the logical structure of a target structure is included into the scoring process. By the measure theoretical background the model is more objective than other models so. All steps of our evaluation procedure are traceable via the scoring function which is defined or given only by the logical structure of target under consideration. With assessment checklists which are adapted to the logical structure of target to be evaluated the scores can be estimated on the basis of the obtained checklist data. The model is easy to implement. It can be used for into an e-learning process embedded on-line evaluation by the learners as a feedback possibility for the lecturers too. Finally, the model and its statistical realization is applicable in more general evaluation or scoring situations if the targets to be reached can be described logically.

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CREATING MEDICAL RELATED LEARNING RESOURCES USING REPURPOSING PROCEDURES AND SEMANTIC WEB FUNCTIONALITIES

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ABSTRACT

The development of new, high quality e-Learning resources has become increasingly important in medicine, as the online learning approach is used in most of the disciplines, specialties and teaching levels. Either a theoretical presentation or a clinical case, the creation process of any valuable didactical material involves a lot of effort and usually high costs. Research and educational communities in medicine, as well as in other disciplines, have tried different approaches on maximizing the quality of the resources while maintaining the costs at a low level or even reducing them. Most promising solutions used at present involve materials sharing between different content providers (either automatically or based on human content editors) and the creation of new materials based on already existing ones, in an approach named repurposing. However, the application of these methods raise another issue related with how to identify relevant resources, how to codify the changes one makes in order to create the new materials and how to integrate all the new available resources without creating confusion (ex. some repurposed materials seem to be duplicates of the initial ones). In this paper we suggest some solutions to these problems based on social networks and semantic web functionalities.

KEYWORDS

Semantic web, social networking, repurposing, e-Learning.

1. INTRODUCTION

The eLearning platforms are very widely used in the present, in different domains, as a feasible alternative to the most of the classical teaching techniques. Medical related fields are no exception to this trend, expanding each day to new specialties and incorporating new learning materials, either theoretical or clinical studies. One of the best motivations for the extensive use of eLearning applications is their ability to provide teaching resources in a flexible, cost effective and scalable manner, replacing the well-known face-to-face didactic approach. Although it is not possible yet to entirely replace the classical pedagogical methods, these applications have a significant contribution to the improvement of information exchange between instructors and learners (and between learners) through solutions that enable synchronous (text based chat, voice and video conferences, collaborative sessions, etc.) and asynchronous communication (forums, emails, off-line messages, etc.).

During the last few years, in the medical field have been developed a large amount of teaching resources, especially due to the increasing number of cross-domain research projects. As a result, the classical curriculum is very often outdated, so more and more specialists and students are acquiring last minute information from the online e-Learning applications. The amount of available data over the Internet allows almost any trainee to study a specific subject with very little involvement from the teacher. As a result, the role of the teacher as a mediator between student and knowledge has been affected, being significantly reduced and mostly transformed into a supervising activity. At the same time, the quality of the internet materials is often poor and some of the results presented are insufficiently documented.

Some of these problems have been addressed through the Web 2.0 paradigm that changed essentially how people are interacting over the internet. Making use of social networks, the e-Learning systems managed to provide some mechanisms for content evaluation and control, reducing the amount of poor resources

(Australian Flexible Learning Network, 2012). However, together with the new efforts of automate content sharing between different providers and with the consequently increase of available materials, the effort of identifying the good and valuable ones has become significant.

The development of new materials has also become a very costly activity, due to the high standard requirements in information quality, user interaction techniques or data presentation methods (images, videos, interactive 3D models, simulators etc). Reusing some of the already existing high quality materials in order to create new ones, has proven to be an effective solution (Wang et al, 2007), but implies often an extensive research for identifying these resources.

As a proposed solution, in this paper we present a method of describing and sculpting the profile of a teaching resource through the blend of its social attributes and web semantic capabilities. We will make use of these enhanced descriptions in the context of creating new resources based on the repurposing approach. Presented solution aims the improvement of resources retrieval and reuse mechanisms by medical specialists without advanced technical knowledge in their efforts to create new high quality learning resources.

2. RELATED WORKS

In the past few years, scientific community, especially from medical domain, has involved many efforts and resources in the development of eLearning technologies and materials. At first, the development efforts have been isolated and focused on independent solutions, having as a result separate functionalities and learning materials that could not be shared with other applications or users without important modifications. As this was a major setback for teachers who were bound to a specific eLearning system with limited functionalities and did not had the ability to easily distribute their materials into new platforms, the researchers developed standards for content packaging and sharing, like Learning Object Metadata - LOM (IEEE, 2002), IMS Content Packaging (IMS, 2004), Sharable Content Object Reference Model – SCORM (ADL, 2009) and others.

The integration of new types of data presentation has required also the development of new user interaction techniques, for a more efficient information analysis. For example, applications like eTrace (Gorgan et al, 2007), Web-Trace (Giordano and Leonardi, 2007) or Dokeos (<http://www.dokeos.com/>) have researched on graphical annotation based user interaction with teaching materials, while other platforms are experimenting on voice based communication.

Although in the resource presentation part of the e-Learning systems and in data sharing capabilities important advancements have been recorded, tools specialized in creating learning resources are very few. Most of the applications used in medical teaching materials development have been created for other purposes (ex. HTML editors, image processing applications, 3D modelling software, etc.) and require technical skills from their users or are restrictive and limited in functionalities (i.e. it is very difficult to specify the available student interaction techniques). At the same time, none of these resources provide a solution for creating new materials through repurposing or for managing and describing the repurposing process.

3. REPURPOSING CONTEXTS

Next to the lower production costs, the creation of new materials based on the repurposing approach has also the benefit that it can provide automatically valuable information about the new resource in terms of context, quality, related domains and specialities, pedagogical approaches and so on. Nevertheless, not any transformation process preserves any or all of these attributes, so it is necessary to define the possible relations that can occur between the two types of resources (original and repurposed one).

During the mEducator project (mEducator, 2012), the research had revealed the following main repurposing contexts that are involved in creating new medical teaching resources (Kaldoudi, Dovrolis, Konstantinidis and Bamidis, 2011):

- Changes in the content itself
- Repurposing to different languages
- Repurposing to different cultures

- Repurposing for different pedagogical approaches
- Repurposing for different educational levels
- Repurposing for different disciplines or professions
- Repurposing to different content types
- Repurposing for different technology
- Repurposing for people with different abilities
- Repurposing to Educational Content

Usually, when creating a new resource through repurposing procedures, more than one of these contexts is used at the same time. Saving and tracking this information in the resource metadata description, together with some specification about how the changes that have been applied will provide valuable information about the new material: quality, user interactions, pedagogical approach etc.

Moreover, through the repurposing history it can be easily identified how and where a resource has been used to create a new one or what series of transformation have been applied to which resources in order to obtain the current version of a certain learning material. To some extent, repurposing history codifies also information related to similar resources through the idea of common ancestor, enabling a very specific exploratory search that could return quickly relevant results.

4. CREATING NEW RESOURCES THROUGH REPURPOSING

The process of creating new teaching resources through repurposing procedures involves usually a certain level of technological knowledge from the trainers. Depending on the complexity of the representations included in the materials (videos, 3D modelling, serious games etc.) their creation could require even an IT specialist rather than a medical one. All these reasons determine a higher cost for teaching material creation and also represent a very important issue when comes to the development of highly interactive resources that could present better some types of information.

For some of the types of repurposing mentioned above we propose a solution that allows a medical specialist to reuse previously created elements (images, videos, 3D models, interactive quizzes etc.) in new resources, without the necessity of low level technical intervention. The profile of our target user has the following main characteristics:

- is a medical specialist that intends to create e-learning content for his/her trainees
- knows the basic concepts of teaching materials and e-learning environments, including basic understanding of user interaction types, pedagogical approaches, information presentation methods, etc.
- has no (or very little) technical knowledge about technologies like HTML, CSS, XML, JavaScript, etc. or concepts like distributed databases, mash-ups, web services and others
- has medium level computer operating skills that include internet browsing, basic knowledge about file formats (ex. image formats), files management operations, etc.

In order to create a new teaching material through repurposing procedures, it is necessary to follow a few general steps:

- Search and acquire existing learning materials
- Repurpose found material
- Describe the new resource through mEducator Metadata Schema

4.1 Search and acquire existing Learning Materials

Searching for existing learning materials can be a challenging task due to the large amount of available information over the Internet and also because of the difficulty in quickly identifying relevant and good quality resources. Addressing these issues, in mEducator project has been developed a metadata description schema (MDC, 2012 & Mitsopoulou et al, 2011), specialized on describing medical teaching resources, that enables the educational content from the domain to be discovered, retrieved, shared and re-used. The schema addresses different aspects of the resource, from general elements (ex. title, description, authors, reference to the resource) to pedagogical aspects (learning outcomes, knowledge level, pedagogical approach, etc.),

specialized technical information (media types included, technical recommendations) and also repurposing related data (what resources have been used in the creation of this resource).

Based on this schema, in the mEducator project has been developed an e-Learning platform for sharing medical educational content, named Metamorphosis+ (Dietze et al, 2011). This application has been implemented based on ELGG Social Network Engine (Elgg Foundation, 2012) in order to benefit from the social characteristics that can provide valuable information about the quality of a resource (Kaldoudi, Dovrolis, Giordano, Dietze, 2011) (ex. how was rated by the users, what kind of resources are similar, etc.). In order to maximize search results relevancy, the metadata descriptions are enriched with semantic information gathered from Linked Data Cloud (LOD) and stored in a SESAME RDF framework (Dietze et al, 2012 & Yu et al, 2011), as can be seen in Figure 1.

As a result, any resource from Metamorphosis+ Platform has a profile created from blending the social information with semantically enriched data. This complex representation allows better search results and enables new ways of data harvesting like exploratory search based on similar attributes of the resources (Marchionini, 2006). When a specific resource is considered appropriate (ex. image, video, 3D model, serious game etc.), the user has the possibility to save the direct reference of the material, which is usually a URL.

4.2 Repurpose Found Material to create New Learning Resources

After the required existing material has been identified, the trainer can login into the eGLE application (Ștefănuț et al, 2010) that will provide the necessary functionalities for data retrieval, and visual information representation.

The visual structure of an e-Learning Resource described in eGLE is presented in Figure 2. At the template level the general format attributes for all the content is specified (default text size and colour, background settings, etc.). On the next level, the visual structure has patterns, which are logical containers that represent one row into the template and group related information: picture and its' description, 3D model and a related video presentation, etc. One pattern can hold one or more tools, which are the atomic elements of the eGLE visual structure.

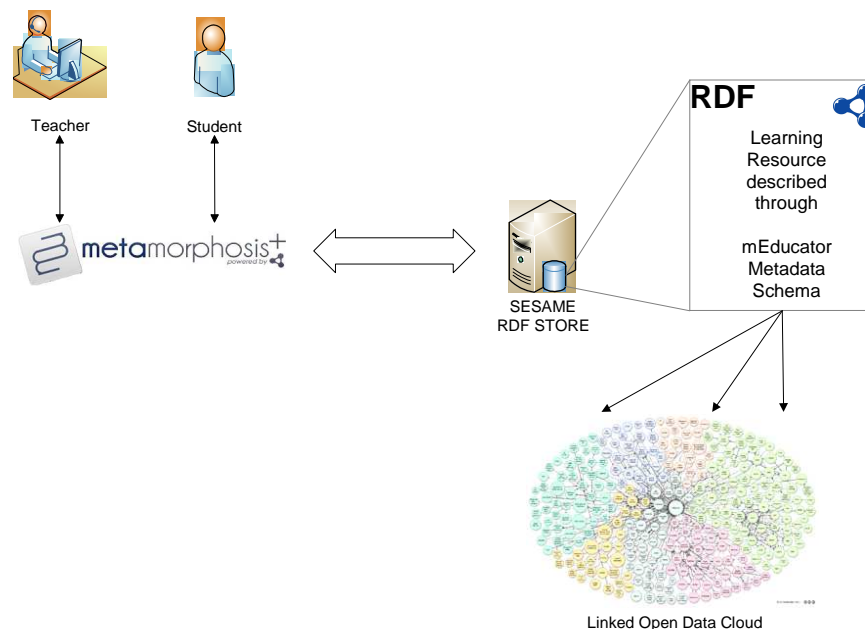


Figure 1. Metadata description contains semantic information from LOD and is blended with social information from Metamorphosis+

Each tool provides a specialized interface for data retrieval (ex. over HTTP, from an FTP connection, from a web service etc.) data type presentation (image, video, 3D model, text, etc.) and implements specific user interaction techniques (ex. graphical 3D annotation, text formatting functionalities, etc.). All trainers have the possibility to create new patterns and add tools to them through drag and drop interaction. Later, the patterns can be reused as many times as necessary either in the same resource or in different ones (see Figure 2).

Through eGLE functionalities, the teacher has the ability to retrieve automatically the resources found at the previous step by providing only the identifier in the form of an URL. Then, the platform allows the integration of this content in any section of a learning resource, the reuse of the data in the same or in different materials, and offers the ability of selecting different user interaction techniques over the same content, even in the same resource. For example, if the same 3D model is integrated in a material in three different sections, for each section the trainer can specify different user interaction techniques: no interaction for the first instance (the user can only view the model), visualization control for the second (the user can change zoom level, rotation or translation) and graphical annotation based user interaction for the third instance.

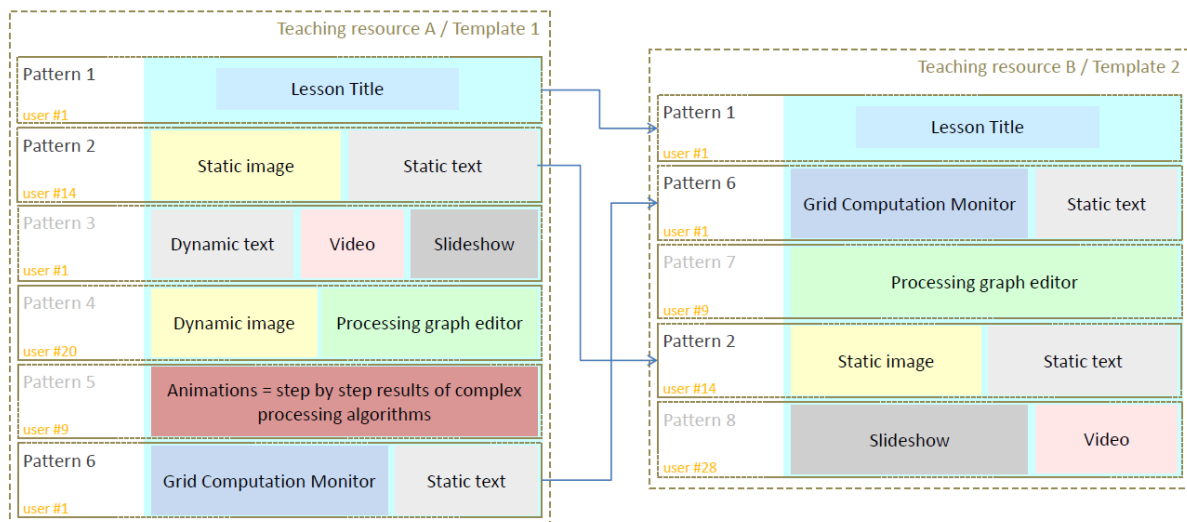


Figure 2. Repurposing content in eGLE Application

4.3 Describe the New Resource through mEducator Metadata Schema

After the creation process has been finalized, the teacher has the possibility to publish his new resource towards his colleagues by describing it through mEducator Metadata Schema. This purpose can be easily achieved through Metamorphosis+ application as it provides the visual interface and the necessary mechanisms to create a complete resource description:

- mEducator schema taxonomies integration (for defining media types, resource types, learning outcomes etc.)
- dedicated interface for creating semantic connections towards the LOD in the keywords, disciplines and discipline speciality properties. The terms will be selected by the user from specific ontologies, while the connection details (reference numbers etc.) will be automatically handled by the application
- specialized user interface for creating repurposing related connections between the resources, for defining repurposing contexts and describing the changes that have been made.
- the possibility to reference other learning resources as companions, using only their URL

Through this metadata description, the resource will be indexed into the platform and will be made available to the other users with an initial set of information and with some properties “inherited” from the original resources. This profile will be enriched through social characteristics over time, building the complete description of the resource.

5. CONCLUSION

The development of new medical e-learning resources through repurposing methods represents a solution for creating valuable and high quality resources at lower costs. One of the major challenges on this approach is to identify relevant materials that can be reused. For this purpose we have presented Metamorphosis+ application that blends the social information about a resource with semantically enriched data, for a more relevant search results organization.

At the next development phase the trainer needs to apply the repurposing activities on the selected elements, action which usually requires advanced technical knowledge. As a possible solution we have described eGLE application, that offers specialized functionalities for data retrieval, user interaction setup and information presentation. Furthermore, the platform allows the medical specialist to define his own layout and control its structure in an interactive and visual manner, without requesting any technical knowledge.

One of our main research directions in the present is represented by the automatic integration of Metamorphosis+ social and search capabilities with eGLE functionalities aiming to create a specialized development environment that will assist all medical trainers in creating new e-Learning teaching resources.

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WHY BLOG?: AN ACTIVITY SYSTEMS ANALYSIS OF DIARISTIC ACADEMIC BLOGGERS

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ABSTRACT

This paper uses an activity systems analysis approach to examine a complex online practice, specifically diaristic style blogging among academics, to determine the relationship between elements of the practice and its outcomes. The focus is on outcomes related to informal learning and professional development that occur as these individuals share their life narratives and their process-oriented career knowledge in an informal community of practice. Findings show that despite barriers such as privacy concerns and tensions between norms of the blogging and academic worlds and initial participation goals that focus on personal journaling and social networking, outcomes of the system include professional networking, knowledge brokering, and support networks, all of which help the participants better attain their professional goals.

KEYWORDS

Activity theory, blog, community of practice, informal learning, professional development

1. INTRODUCTION

Why blog? That's a simple question, but one which yields complex answers. Blogging has become a fairly mainstream activity, and numerous genres of blogging have emerged. Newspapers feature blogs. Consultants, authors, researchers, inventors, musicians, and others promote their businesses and expertise using blogs. Families share their travels, photos and accomplishments on blogs. Hobbyists use their blogs to share ideas and show off what they have created, and some people use blogs as diaries or journals.

This last category of bloggers is the focus of this study. Diaristic blogs are forums in which individuals share their activities, thoughts, and experiences in an open forum. They are not a new invention, but rather are a variation on the traditional journal form (Herring, Scheidt, Wright, & Bonus, 2005). The differences between these blogs and traditional journals are due to the affordances of the technology, which in turn form a genre that is not quite the same as its antecedent because blogs exist in a public space (McNeill, 2009). Further, they allow reader interaction. Thus technology-enabled access and interactivity allows readers – who may be known or unknown to the bloggers in other contexts – to contribute to the journal, although in a different capacity than the blogger herself. The presence of commenters, who may be positive (e.g., offering affirmation or suggestions and ideas for improving situations) or negative (e.g., disagreeing with the blogger) creates a virtual space that is simultaneously supportive and vulnerable.

Why would people keep a public online journal? There are obvious benefits, such as having an audience who will provide feedback. This dynamic, dialogic type of journal may foster mentoring relationships and promote self-efficacy by providing individuals with role models and supporters. However, there are also drawbacks, such as loss of privacy and vulnerability related to sharing personal information online (see Dennen, in press for a fuller discussion of this phenomenon). People have lost jobs and damaged relationships because of items posted on blogs, and so whenever an individual blogs about her work in an unofficial capacity an element of risk is present.

1.1 Purpose

This study is part of a larger longitudinal ethnography examining the culture of academic blogging as it relates to informal learning, professional development, and attainment of career goals. This particular analysis focuses on the practice of blogging itself, attempting to capture the way in which elements of the activity – both positive and negative – interplay to generate or impact different outcomes. Additionally, this analysis had a second purpose: To see if activity systems analysis would be a useful approach for describing the complex practices within a blogging community of practice.

In this study, I use activity systems analysis to examine blogging practices among individuals who identify as academics and who blog in a diaristic style about both personal and professional elements of their lives. In an earlier study, a community of practice framework (Wenger, 1998) was applied to ensure that these bloggers should logically be grouped for analysis (Dennen & Pashnyak, 2008). That same study noted that within the blogs and their comments there appeared to be a substantial amount of content that could lead to informal learning and professional development. This study seeks to answer the following research questions:

- What are the goals of academic diaristic bloggers? Are these goals being met?
- What barriers may prevent these goals from being met?
- What elements facilitate meeting these goals?
- Is diaristic blogging a valuable form of informal learning and professional development?

Although this particular study is descriptive in nature and focused on one particular community, it has implications for other similar communities who interact in online environments.

2. METHODS

2.1 Participants

The primary participants in this study were three academic bloggers. They were selected from a larger group of bloggers (n=40) whom I have been actively following as part of a longitudinal ethnography. These three bloggers were chosen specifically for their diversity. They each represent a different career point (graduate student, adjunct, assistant professor), and have different lifestyles. At the same time, they have some similarities. All three are female, which is fairly representative of the community in which they blog and representative of diaristic bloggers in general (Herring et al., 2005). They are active bloggers who both post new messages about both their personal and professional lives at least once a week and who comment on other related blogs. Finally, they write under pseudonyms and mask certain details of their everyday lives. An additional five participants were randomly selected from among the interviewed bloggers to serve as points of triangulation for the composite activity systems model.

2.2 Data Collection

Two data sources were used in this study, blogs and interviews. The blogs are an authentic artifact representing the practice being studied, and exist as archives. Additionally, I have been observing these blogs and the narrative that unfolds on them in real time, keeping field notes to document subtle shifts, noteworthy events, and how the blog reflects, reacts to, and influences the other blogs in the community at any given time. My engagement within the community has been that of participant observer, and thus my field notes also include reflections on the experience of posting and commenting on blogs, the vulnerability of sharing personal details in public spaces, and the rewards of having an audience and receiving positive feedback.

Interviews were conducted by telephone or Skype and recorded for accuracy. They lasted between 45 and 90 minutes, depending on the verbosity of the blogger. All interviews were based on a common set of 12 questions inquiring about how the individuals started blogging, why they blog, their posting, reading, and commenting practices, and perceived impact on their careers.

2.3 Data Analysis

The data were analyzed using an Activity Systems Analysis approach as described by Yamagata-Lynch (2010). This approach, built on Cultural Historical Activity Theory and derived from the work of Vygotsky and Engeström (2000), can be used to help describe complex real-world learning contexts (Yamagata-Lynch, 2010). Using interview data and blog observations, the ongoing narratives of each blogger were coded individually for activity theory function. Table 1 provides an overview of these functions. Then activity theory diagrams were constructed for each individual and key tensions among elements were identified.

Table 1. Overview of activity systems analysis elements, adapted from Yamagata-Lynch (2010).

| Element | Brief Description |
|-------------------|--|
| Subject | The person who engages in the activity |
| Rules | The laws, guidelines, and principles that affect how the activity is conducted |
| Tool | The artifacts that support the activity |
| Community | The larger social group of the subject |
| Division of Labor | The way in which tasks are shared by a community |
| Object | The goal of the activity |
| Outcome | The end result of the activity |

Once activity system diagrams were created for all three bloggers, these diagrams were compared and combined into a composite diagram. This master diagram will be used in the next phase of the larger ethnography project as a device to facilitate member checking. During interviews, participants will be asked to comment on how the diagram does or does not reflect both their own experiences as bloggers and their perceptions of other peoples' experiences as bloggers. Finally, another set of composite activity system diagrams were created for three other community roles, commenter, lurker, and character. These diagrams were based on observed behaviors on the blogs as well as descriptions from the bloggers of both themselves and others as they engaged in these roles.

3. FINDINGS

For the sake of brevity, in this paper I focus primarily on the composite activity diagram (see Figure 1) and related findings. When the individual activity system diagrams were compared and the composite diagram was created, a great deal of overlap was found among the three bloggers. When data from the additional five bloggers were used for triangulation, they all fit readily into the categories generated by the initial analysis. While everyone's specific experiences are a bit different, they share common ground. That common ground is due to their co-existence in two constellations of practice, academe and diaristic blogging. When these constellations are merged, the result is a group of people who have, effectively, formed a community of practice (see Figure 2). Although the Internet supports the development of relationships among diverse peoples whose paths might not cross in everyday life (Wellman et al., 1996), bloggers do tend to seek homophilous relationships on at least some dimension (Bisgin, Agarwal, & Xu, 2011; Karlsson, 2007; Lauw, Shafer, Agrawal, & Ntoulas, 2010). For these bloggers, the connection is their academic practices, although they may differ in discipline, current position (e.g., student or faculty), and type of institution.

Table 2 provides a detailed overview of the specific composite findings in each area. Despite the specific differences in their current individual situations, the categorical nature of what individuals experience, seek, and find within the blog-based community is similar. Norms and hierarchies, which form the rules of the activity, are shared among participants even though they may have different underlying reasons for adhering to a rule. For example, one person may enact privacy measures for fear of losing a job if she were to blog under her real name, whereas another may simply wish to keep her blogging identity and professional teaching and publishing identities separate. Similarly, for some the privacy measures may be deeply personal and highly important to maintain, whereas for others they may be upheld out of courtesy to those community members who feel them so necessary.

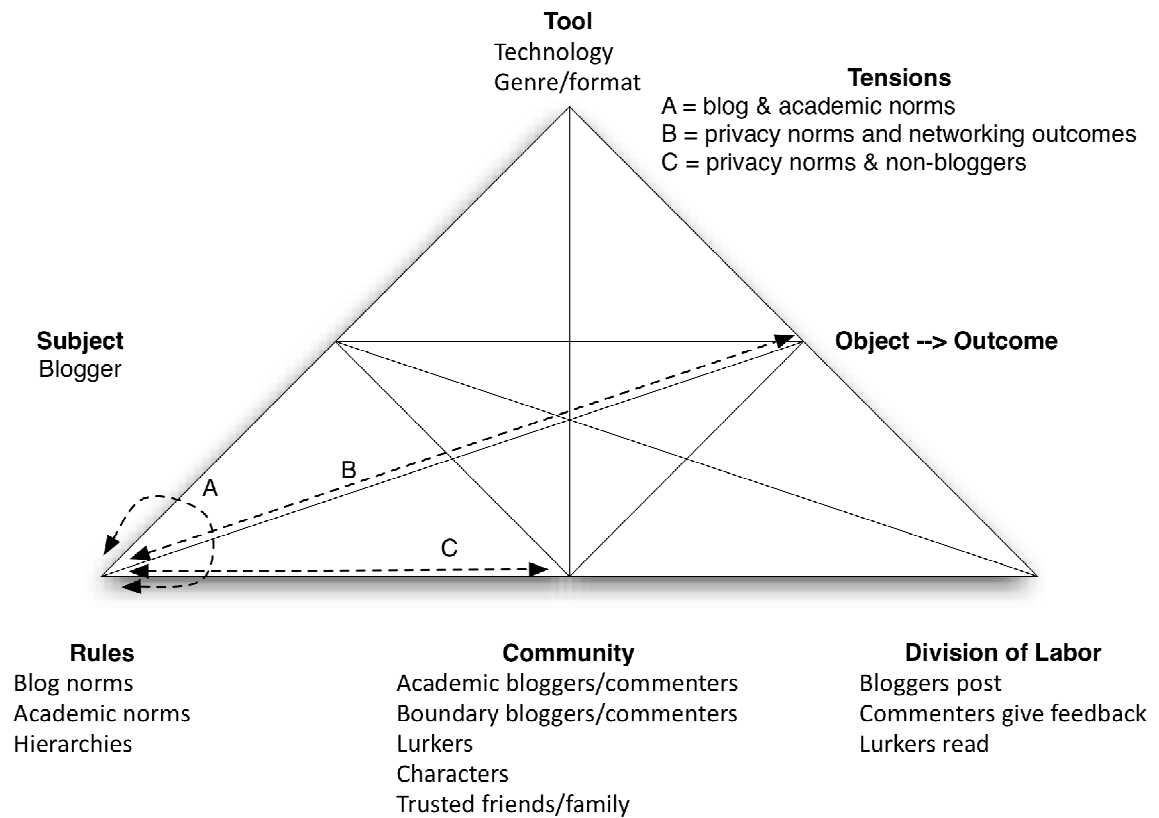


Figure 1. Composite activity analysis framework

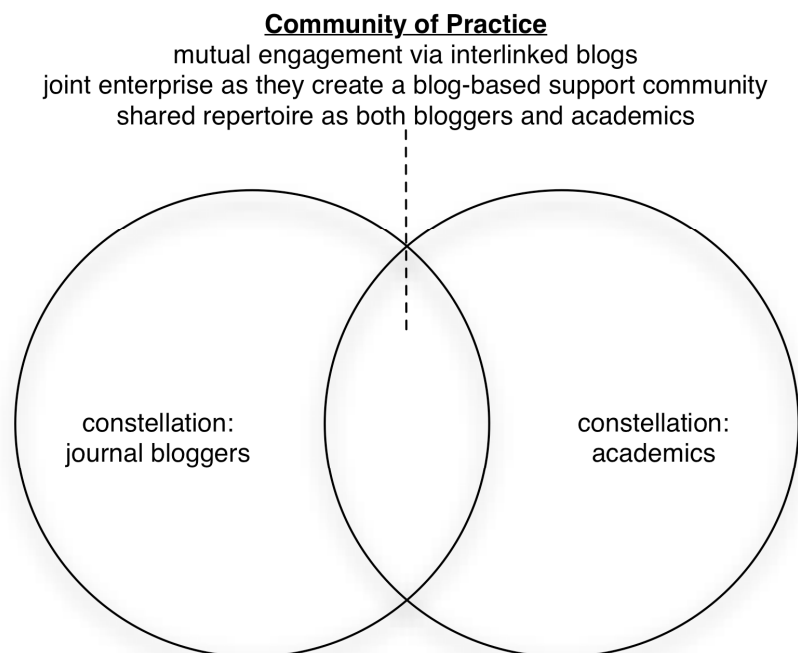


Figure 2. The overlap of two constellations of practice, creating a community of practice in the intersection

Table 2. Elements of blogging activity system

| Function | Brief Description | Expanded Description/Example |
|-------------------|---|---|
| Subject | Blogger | The person writing the blog; may also be a commenter or lurker on other blogs. |
| Rules | Blog norms | Protect privacy Cultivate a voice Reciprocate comments |
| | Academic norms | Crediting authorship Engaging in debate of ideas |
| | Hierarchies | Relationships among people may be impacted by their status in the real world (e.g., graduate student versus faculty) or the blog world (e.g., established versus new blogger) |
| Tool | Technology | Blogger, RSS feeds, email, site statistics |
| | Genre/format | Storytelling, memes, to do lists |
| Community | Academic bloggers/commenters | Academic bloggers and commenters form the immediate community of the subject. |
| | Boundary bloggers/commenters | Boundary bloggers and commenters are bloggers from other communities (e.g., mommybloggers, hobbyist bloggers) whose interests cross over with a particular blogger. They may engage in reciprocal linking and commenting. |
| | Lurkers | There are unknown numbers of lurkers on each blog, only noticed via site counters or the rare comment |
| | Characters | Characters are people featured within a blog. They may or may not be readers or commenters, but rather people in the blogger's everyday life. |
| | Trusted friends/family | Some bloggers share their blog with friends and family, while others do not. |
| Division of Labor | Bloggers post Commenters give feedback Lurkers read | Both posting and commenting on a regular basis are considered responsibilities within the community. Lurkers have a responsibility as well; their position as an invisible audience influences blogger and commenter actions. |

The division of labor within this community is as would be expected for each subject, but the interesting part of that division is a related rule or expectation based on frequency and timeliness of posting. Bloggers and commenters will apologize to each other and make explanations for extended absences or delayed responses to each other.

In terms of objects and outcomes, there is a clear match between them, although the outcomes of blogging practice are, for some bloggers, exceeding their initial goals (See Table 3). These bloggers did not necessarily anticipate how wide and powerful their networks and knowledge sharing would become, particularly when such activities are heavily interspersed with social activities. Initial objects for some bloggers were not at all interaction oriented, or they only anticipated interacting with friends from other (non-blog) contexts. Over time, as they developed a reader base and discovered over blogs, their object may have shifted to include more social and interactive goals.

Table 3. Objects and outcomes for academic bloggers

| Function | Brief Description | Expanded Description/Example |
|----------|------------------------------------|---|
| Object | Journaling | Whether an individual is documenting events, engaged in reflection, or simply venting, journaling is a key object of blogging activity. |
| | Networking/Socializing | Some bloggers began out of an explicit desire to be part of the existing blog network. Others started with the purpose of journaling, but were pleased to join the network and make their blogging experience more social. |
| | Support | Although not an initial object of blogging, many bloggers have found support through the network and thus support is a reason for maintaining their blog connections. Second and third wave bloggers may intentionally begin blogging for this purpose. |
| Outcome | Increased support network | Support is a fairly constant and consistent outcome of this practice. Both emotional and professional development support tend to be offered by commenters and fellow bloggers. |
| | Learning about the profession | The bloggers learn from each other's experiences and feedback. The learning covers most areas of the profession except for subject matter area: scholarship practices; teaching practices; service; advising; interpersonal skills. |
| | Self-reflection | Through ongoing documentation of their work toward both major and minor academic milestones, the participants are pushed to reflect on their processes. |
| | Knowledge management and brokering | The blogs, with their ongoing narratives of academic life and individual professional development, have become a large repository of useful information. Many bloggers actively broker this information back and forth between the blog community and their everyday communities. |
| | New opportunities | Some bloggers have used the blog network to find collaborators and outlets for teaching and scholarship projects. |

Within this discussion, the focus has been on objects and outcomes that may impact the learning process, and most people would agree that the ones outlined in Table 3 are positive ones. However, I would be remiss as a researcher if I did not mention the potential for negative outcomes. The same behaviors that happen in the physical world can happen in the online world, and the actions of other people can leave bloggers feeling unsafe, distressed, and even attacked. On occasion, bloggers have quit the practice or shifted to a protected (e.g., password restricted) medium for these reasons.

3.1 Tensions

Although this is clearly a system in which positive outcomes are occurring, it is not without its tensions. Tensions are noted on Figure 1 using dashed arrows. There is a recursive tension loop surrounding rules (see Figure 1, marking A), in which blogging norms and hierarchies can be at odds with traditional academic norms and hierarchies. Similarly, protecting privacy (a rule) and networking (an object and outcome) can be at odds (see Figure 1, marking B). Other tensions exist between rules (privacy) and certain community members (see Figure 1, marking C), specifically lurkers who are unknown and characters whose privacy may be violated unbeknownst to them (Dennen, in press).

3.2 Comparison to other Subjects

The activity system also was examined from the perspective of three other subjects, commenters, lurkers, and characters. In the cases of commenters and lurkers, both of whom are active participants within the blogging activity, the various elements of the activity system and how they interact are quite similar. The role of commenter is most like that of blogger, with both creating and sharing an identity online and opening themselves up to the vulnerability that is inherent in public discourse. However, for commenters the outcomes tend to be a bit muted in their impact. Lurkers, in contrast, are not as vulnerable, but the same rules and vulnerabilities of blogging potentially apply to lurkers and may in fact be the impetus for their silence. Additionally, another set of objects and outcomes rises to the forefront in this population. Some lurkers are primarily present to be entertained through vicarious participation in others' lives, much like watching reality television, which may also be an objective of bloggers and commenters, although a secondary one. Alternately, they may be using the online narratives produced by the bloggers and commenters to support a variety of types of learning and motivation, including boosting their own sense of self-efficacy via comparison and using the blogs to learn the culture of academe before entering that world. Lurkers may serve as one-way knowledge brokers, taking what they have learned through reading to non-bloggers.

Characters play a different role in the activity system. Unlike bloggers, commenter, and lurkers, they do not have a clear task within the division of labor. Instead, their likeness is invoked by the blogger and shared with the blog audience. Whereas the others all participate in the activity system of their own volition, characters may not be aware that they are being presented on a blog. Unless they are aware and choose to become a fellow blogger or commenter, characters are voiceless. They have no object within the activity system, but they potentially can be affected by an outcome.

4. IMPLICATIONS & CONCLUSIONS

Academic diaristic bloggers are engaged in a risky and complex practice that on the surface may appear more social than anything else. Despite these appearances, the bloggers have underlying goals – both explicit and tacit – that relate to and result in informal professional development activities and other learning. The strong sense of community and the adherence to norms along with careful use of tools has allowed these bloggers to overcome barriers such as privacy concerns and limitations imposed by traditional academic hierarchies so that they might engage in a fairly open and vulnerable discourse on the profession and how it impacts their lives. In essence, these bloggers have found what might be called either “a public-private space (that) constitutes a virtual home” (Lieber, 2010, p. 633) or a virtual version of Oldenburg’s third place (Oldenburg, 1989; Soukup, 2006).

Lessons learned from these bloggers have two major implications for mentoring both graduate students and faculty within the profession via informal means as well as in a more formal manner. First, these types of interactions should be valued and neither denigrated nor feared. Academic bloggers form a self-governing community that provides knowledge and support that individuals cannot always find or comfortably access elsewhere. Young scholars who need additional support might be encouraged to at least read these blogs (which places them in a valued community role), and then they might determine for themselves if they would like to play a greater role in this community. Second, these bloggers illuminate many of the needs and trade-offs they experience as their careers develop; this information could be used to improve more traditional mentoring programs as well as policies governing faculty life. Further, the narratives shared on these blogs may provide both comfort and illumination for all academics – comfort in that among all of the narratives it is possible for many people to find a blogger with whom they identify and share struggles, and illumination in that it becomes possible to understand better the struggles of colleagues who may not share their narratives but who have similar lifestyles to a given blogger.

In closing, I will return to the question that opened this paper: Why blog? Analyzing the activity system surrounding academic diaristic blogging shows that it is a community activity that yields many rewards for its participants. Further, the range of people who may benefit from these blogs extends beyond the population of bloggers. The commenters and readers directly engaged in the system, the characters indirectly engaged in the system, and the colleagues of people engaged in the system who then choose to act as knowledge brokers

between the blog world and another setting all gain from the stories that are shared, the support that is offered, and the knowledge that is co-constructed and then archived via this public-private activity.

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THE OPEN UNIVERSITY OF THE NATIONAL HEALTH SYSTEM: A BLENDED LEARNING STRATEGY TO IMPROVE THE HEALTH CARE SYSTEM IN BRAZIL

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ABSTRACT

Brazil is a large, multicultural and federalist country. It bears enormous social, economic and political differences amongst its different regions. This diversity has been the scenario of a huge health system reform that began about thirty years ago. One of the greatest challenges of the National Health System is the provision of qualified health professionals all over the country. Since 2008 the Ministry of Health has been investing in the creation of an educational system for continuing education of health workers, based on active learning using information technology as a central tool. This paper presents this system, which is called Open University of the National Health System (UNA-SUS). UNA-SUS began in 2008 and has fifty-thousand health professionals involved in its continuing educational programs, a third of which in family health specialization courses. UNA-SUS is based in three core elements: a collaborative network of public universities, an open access repository of learning resources for health (ARES) and an integrative curricular platform (*Plataforma Arouca*).

KEYWORDS

Elearning, ehealth, egovernment, open access, data mining, content development

1. BRAZILIAN HEALTH CONTEXT

Brazil faces major inequities in wealth and misdistribution of health services. Southeastern states concentrate three quarters of National Gross Product and there is still poverty to be faced in the outskirts of our metropolitan areas and in rural and amazonic regions. Health care facilities are quite concentrated in those developed regions as well.

The health system is now coordinated by the Ministry of Health (MoH) in cooperation with states and municipalities, supported by a national health council with representatives of civil society. This leads to a highly decentralized system in which health is mostly delivered by the five thousand six hundred (5,600) municipalities. The decentralization makes it possible for the system to function, but has a side effect of maintaining inequity, as the more developed regions can provide better health care – not only because of facilities, supplies and human resources, but also due to different levels of managerial capacity in local governments.

The National Health System has as its main characteristics the universal coverage and integrality, which means providing services to all citizens in all levels of health complexity. Primary Health Care (PHC) has consolidated as strategy to better cope with limited financial resources for the health sector and to tackle the regional inequality. Initially, the family health teams were set to assist poorest regions. As the evidence of its effectiveness stacked, it spread to the whole country.

Figures have been consistent for 2 decades; 32 thousand health family teams are set so far. They assist more than 100 million inhabitants and there is a trend to grow up even more in the future. This model proved to be cost-effective and is delivering good health assistance results (Harris e Haines 2010).

1.1 Human Resources for PHC: A Nationwide Challenge

Nowadays, four million Brazilians work directly in the health sector. Over the last ten years, the employment in health sector has increased 60.5%, probably the highest rate in national economy. In the next four years, there will be nearly a million of new jobs in health sector.

Brazil reproduces in many ways the worldwide scenario for human resources for health. There is regional misdistribution and shortage of general practitioners for PHC. For instance, the concentration of physicians per 10 thousand inhabitants varies bottom to top from less than 10 to 30.

Complex regulation of health professions make health team attribution balance hard to achieve. Each health profession has a specific regulatory law and a corporate professional council with self-regulatory powers. Every council systematically disagrees with the others about each profession privileges and obligations.

Working conditions in the public services often drives good professionals away, and there are complex interactions of financial and non-financial incentives to attract and retain them.

One good example is the Family Health Program. The major impact of the family health program was the establishment of a new labor market in which the traditional trend towards specialization was being replaced by a better orientation to PHC, with an interdisciplinary and multiprofessional approach, close to community through local health councils, following the ideals proposed in Alma-Ata.

Family Health Program main weakness lies in Human Resources Development. So far the education of health professionals and the most prestigious practices rely on specialized and hospital-based care and it is difficult to change this status-quo. Convincing professionals to adhere to a new proposal is a hard task.

Training of health professionals did not change fast enough to keep up with these changes in the health system. Graduates have curricula based on hospital training, and more experienced professionals are focused hospital specialists. This result in Medical Doctors and Nurses not suited for work in PHC.

1.2 Health Professional Undergraduate and Postgraduate Education

It's not an easy task to reform the undergraduate, postgraduate and continuous professional education in the health sector toward PHC. Universities are autonomous entities in Brazil, even the public ones. The influence of professional associations is also very powerful, and the board powers they bear in Brazil make it harder to change professional education without their cooperation.

To make medical and health professional education more adequate to contemporary health needs, a new strategy was put in motion.

Nowadays, medical school graduates he can choose tree paths. The traditional one is to choose to be a medical specialist, by doing residency training and working in the conventional labor market. The other two paths lead to general practice. One is the family medicine residency program and the other is the direct access to labor market, as the family health teams don't require residency training.

Brazilian Ministry of Health (MoH) strategy is divided in two fronts: pre-service, with PRO-SAUDE, and in-service, with UNA-SUS (Campos et al. 2010). PRO-SAUDE is a program that aims to reorient the medical and other health professions undergraduate education. The Open University of the National Health System (UNA-SUS) is a public educational system dedicated to the health workers.

2. WHY AN OPEN UNIVERSITY?

Five years ago, in 2008, it was clear to the decision-makers in the Ministry of Health that only investing on the traditional educational system, based on presential and tutorial education, would be costly and inefficient. A new approach was needed, and a few elements pointed out that investing on elearning and distance learning was the way to go.

Thus, the Brazilian Ministry of Health set an ambitious target regarding post-graduation and continuous medical in 2008: offering fifty thousand places in specialization courses for family doctors, nurses and dentists. Regarding local health system managers, MoH announced the intention of offering managerial training to a hundred thousand of them. It has never been done before, and the numbers on the table were tenfold what was done in the previous decade.

The advance of information and communication technology in the last two decades, and their impact on the society had been systematically ignored in health professional education policy until that moment.

The elements that pointed out to distance learning and elearning were: the huge size of the country and the distribution of family health teams all over it; the concentration of Universities on the rich southern half of the country; the large quantity of material to be offered and produced, which required mass-production of didactic material.

The strategy set in place was based on a revision of many previous experiences, and was entitled Open University of the National Health System.

The expression open university regards different institutions and educational strategies. An obvious reference is the Open University of the United Kingdom, with decades of experience in distance learning and hundreds of thousands of students and graduates. Another relevant experience was the Open University of Brazil, set by the Ministry of Education to double the places in pedagogy courses, to train teachers in the inner country. An unobvious reference was the University of Berlin. In Humboldt's view, the freedom of teaching and learning was a landmark for the creation of the University of Berlin, and played an important role in the unification of the German Republic (Flexner 1994). The reference to this experience is in the conceptual orientation of UNA-SUS, and is essential to deal with adults, experienced professionals who will only put effort to learn something, by itself or with the aid of someone else, after scrupulous evaluation - and on his rhythm and style.

UNA-SUS was preceded in the MoH by the Telehealth Brazil Program, which demonstrated how information technology could lead to impressive results for the health system. The Telehealth Brazil uses the Internet as infrastructure to provide in-site and just-in-time second opinion in medical diagnosis and treatment. It allows young medical doctors working in rural areas to achieve more precise diagnostics and to prescribe evidence-based treatments, as well as a constant exchange of experiences among health professionals. These strategies are also applied to other health professionals, such as dentists and nurses among others, and so far has shown excellent results, improving the quality of care in rural and remote areas and avoiding unnecessary "medical tourism" to the big cities.

An executive plan was published in 2008 and stated the following actions to be done in the following two years:

1. Create a collaborative repository of learning resources in health (ARES).
2. The creation a collaborative network of public universities to offer post-graduation courses and continuous health professional education in large scale, using distance learning and elearning (UNA-SUS Network)
3. Establish specific partnerships to produce high quality material that will be available in collaborative repository.
4. Create a unique story of in Health for each worker. (*Plataforma Arouca*)

The integration of these elements would be the basis of the UNA-SUS System. The Collection enabled the exchange of materials between educational institutions and history would enable the exchange of students and the establishment of institutional arrangements for revalidation of educational credits among institutions.

Learning approach is based on andragogy, student-centered methods and formative assessment, and use of communication and information technologies (ICT).

UNA-SUS Network is comprised by public universities able to offer distance learning post-graduation courses. In order to adhere to UNA-SUS, the university must accept membership terms that include publication of the courses as OER and sharing students curricular information.

This collaborative network feeds a public and open access repository of educational resources. Other institutions may collaborate, as long as they meet the national quality standards set. The OERH Repository is where the collaborative process becomes tangible as a public asset available to everyone. That is only possible because of the public-public relations of UNA-SUS. As UNA-SUS deals with public and nonprofit institutions, it is easier to settle copyleft as a rule.

Plataforma Arouca is a web platform where health workers have integrated access to their professional and continuing educational timeline. This timeline may be published by each health worker as an official curriculum. Data about health professional experience is gathered from health facilities, and information about post-graduation and continuing education is gathered from medical residency programs, universities and other health educational institutions. Data exchange is based on webservices and other automated and secure interfaces. *Plataforma Arouca* allows that, no matter where the health worker learned something relevant to his professional activities, it can be considered as a part of his continuing educational efforts.

UNA-SUS is ruled by a council with participation of Ministry of Health, Ministry of Education, as well as representatives of States and Municipalities, Universities and Pan-American Health Organization. This ensures that the strategic planning covers all the necessary institutional points of view. States and Municipalities participation allow it to be nationwide, understanding differences of regions and rural and urban areas. Both ministers participation allow it to consider health needs that require immediate answer as well as the cautious and long-term planning of required by educational systems. Universities participation allows UNA-SUS to deal better with their autonomy and the eternal struggle within them: innovation versus tradition. PAHO participation allows it to communicate better with similar experiences in other countries and with their own OER initiative, the Virtual Campus of Public Health.

3. STABLISHING UNA-SUS

In 2008 began the implementation of UNA-SUS, initially as a program that aimed to establish a network of public universities that could act in a coordinated way, offering courses for of health workers. The documents that supported this deployment are available on the Ministry of Health Portal (BRAZIL 2009).

It was hoped that this network would articulate its members through the exchange of experiences, cooperation for development of the educational activities they were entitled to, development and validation of interactive learning technologies, sharing of educational resources and by sharing structure for presential students meetings. On June 18, 2008 it was announced that the Ministry of Health (MoH) would receive proposals from public universities accredited for distance learning to adhere to this network. MoH would fund the courses in order to meet its ambitious large scale continuing educational goals.

To guide the writing of projects by candidate universities, a series of documents entitled “reference documents” were published. These documents dealt with the issues related to the offering of courses: presentation of the context of implementation of the UNA-SUS, conceptual and political-pedagogical landmark, recommendations about elearning standards, and copyright negotiations. The reference documents were guided by the UNA-SUS Executive Project (Oliveira, 2008).

UNA-SUS membership consisted in a standardized cooperation agreement signed between the Ministry of Health and the Educational Institution. These agreements were backed up by detailed projects that detailed the methodological and technological options of each participant university.

The project should demonstrate the integration of various areas of knowledge needed to establish a large-scale educational program for family health teams. Teams should be composed of professors of medicine, nursing, dentistry, with the support of experts in planning, producing and offering distance education, involving various areas of knowledge: adult education, graphic arts, communications, engineering, science information, computing.

The evaluation of these projects was conducted by a committee of five experienced consultants in the areas of Health Education, Distance Education and Family Health. The committee approved an evaluation tool for projects that had as main categories: formal aspects of the project submission, the general structure of the project, institutional soundness of the proposal; indicators of teaching-service integration; indicators of supply capacity at a distance; detailed production plan of educational resources, detailed educational supervision and student assessment plan; course content, structure, domains, specific professional and formative/summative evaluation; budget and implementation plan.

The standardization of the negotiation of projects allowed the emergence of the UNA-SUS Network. Even though each university present political-pedagogical distinct proposals, they all were based on a common set of commitments that would serve as the basis for the formation of their identity as a group.

These projects would be monitored by MoH through online monitoring of each student’s progress, using *Plataforma Arouca*. The learning resources should be published for open access in each university institucional repository, and then indexed in the OER repository.

These actions created the basis of the UNA-SUS Network while respecting the autonomy of universities.

4. INFORMATION SYSTEM DESIGN

In order to have this complex institutional arrangement to work as one, an educational information framework was established. This framework is based in three core elements: identity management, open educational resources (OER) and integrated curricula.

For identity management, an Identity Federation was created, using Security Assertion Markup Language (SAML). Obligatory attributes for authentication are: name, e-mail and national registry number. Each participant institution is encouraged to have an Identify Provider (IdP), and most of them are using Shibboleth, a Java-based implementation maintained by Internet2 consortium.

For OER Management, ARES was set and participant universities are being encouraged to set institutional OER repositories. Whereas they are not set yet, the OER are harvested directly from their Virtual Learning Environment (VLE).

Form curricular management Arouca Platform was created as a national health professional education hub resulting in individual integrated curricula. The platform is currently being integrated directly to each university VLE.

Table 1 summarizes how these elements interact at national and at educational institutional levels.

Table 1. Educational Information Framework elements of UNA-SUS

| Element | National Level | University level |
|---------------------|----------------------------------|------------------------------|
| Identity Management | Portal UNA-SUS - SAML Federation | Identity Provider |
| OER | ARES | Institutional OER repository |
| Curricula | Plataforma Arouca | Virtual Learning Environment |

Information is connectable in all UNA-SUS systems using two key descriptors that are used to index educational certificates, courses and OER. The first is the health thematic descriptor, where DeCS is the elected standard. DeCS is an expanded and tri-lingual version – Portuguese, Spanish and English – of the Medical Subject Headings. It is developed by BIREME, a Pan-American Health Organization organism.

The second key is the Brazilian Labour Classification (CBO), maintained by the Ministry of Labour, which provides standardized information about jobs, professions and specialties.

4.1 The Collaborative Repository of Open Educational Resources in Health (ARES)

The Collaborative Repository of Open Educational Resources in Health (ARES) is meant to provide greater savings and a progressive increase of quantity and quality in the provision of learning resources. With the publication of these resources in open access, under copyleft licenses, they can be used for subsequent educational projects. So a gradual reduction in the costs of these projects is expected, due to the reuse of didactic material. Also, because of ARES public and collaborative collection nature, all users of educational resources available test the quality of the material and contribute to its improvement (Oliveira, VA, 2008).

The planning of the ARES took into account movements such as the Open Access, Open Educational Resources and the worldwide popularization of Moodle and SCORM in the past decade. This led to the adoption of standards as IEEE LOM and OAI-PMH.

Each institution member of the UNA-SUS should have its own repository of educational material in open access resources on the Internet, and these would be registered in the ARES, allowing one to find available resources in all of them. Thus, the responsibility for cataloguing, validation and negotiation of copyright is distributed among the partners. This allows the preservation of institutional acknowledgment of the universities, while it ensures that everyone has access to these publicly funded resources.

ARES is available in <http://acervo.unasus.gov.br>, organized into collection Moodle Backups, learning objects in SCORM, and simple objects and assessment items.

The main features of ARES are:

1. Allows viewing of all the educational resources produced in the UNA-SUS, sorting and searching them by characteristics such as: learning objectives, target audience, health topics, media used, among other features;
2. Enables the reutilization of resources while ensuring adequate reference to the authors, thus ensuring their authorship and copyright management,
3. Enforces technological and informational standards that ease their adoption by anyone interested;
4. Provides the MoH a broader vision on all educational resources available, enabling faster and better decision making about educational actions for health workers in calamities such as epidemics.

UNA-SUS set a learning resources metadata for ARES, based mainly in Dublin Core and IEEE Learning Object Metadata (LOM). Main extensions regard the use of DeCS and CBO as key identifiers and a new subset of metadata regarding the validation processes of learning resources.

ARES is built over DSpace, chosen due to its open source license, modularity, active developer community and popularity as institutional repository solution for digital content. Code override was used whenever was possible in order to maintain compatibility with future DSpace updates. Main modifications were due to adoption of UNA-SUS metadata, federative user authentication and customization of submission process.

4.2 Integrated Curricula Solution (*Plataforma Arouca*)

It was anticipated that each university would have hundreds to thousands of students enrolled - how could the MoH effectively monitor project implementation? As autonomous universities, each of them had their own academic information system. Paper checking one by one was not a viable option. Likewise, to receive Excel spreadsheets via e-mail is insecure, void and with great risk of losing or misunderstanding data.

The experience of the Platform for Data Integration of Federal Superior Educational Institutions (PingIFES) by the Ministry of Education pointed a way. PingIFES consisted in an automated and secure massive ETL system linked to all 71 federal universities on the country. This solution is shown as the perfect mechanism to follow the courses of specialization in large-scale family health teams. More than that, this model fits perfectly with the concept of organizing the provision of flexible and modular courses in the UNA-SUS, as it allows the integrated individual record of any learning experience.

Plataforma Arouca (PA) is inspired also in *Plataforma Lattes*, an online database of scientific curricula, from the Ministry of Science and Technology, and in *Plataforma Freire*, an online directory of courses offered by the Ministry of Education for elemental and middle grade teachers, and high school teachers.

Based on PingIFES experience, MoH in cooperation with the Federal University of Minas Gerais (UFMG) developed *Plataforma Arouca* (PA). It's already integrated with the universities of UNA-SUS Network, with the National Registry of Health Facilities (CNES) and National Council for Medical Residence. It provides services useful to everyone involved.

Health workers can have a certificated, digitally signed curriculum with educational certificates and professional experience. It also provides a feedback about availability of courses in their areas of interest.

Health system and health facilities managers can view a dashboard with statistics about their employees' educational certificates and interests, as well as information about course offerings for their profiles.

Educational institutions can register course offerings, detailing course name, bid calendar, classes, locations and curricular structure. They can securely inform about availability of seats, new students and graduates, allowing detailed accountability to funders.

Funders of educational activities can monitor the implementation of the projects they support.

The PA was developed with JEE (Java Enterprise Edition) technology. The software is implemented with open source code available on the market, like Java Server Faces, Facelets and RichFaces for user interface; JPA, Hibernate and Spring for database access; Apache CXF for SOAP access and Jasper Reports for reporting. The Mondrian API is used for DataWarehouse development.

The only dependency of the PA is the JEE web container, so it can run under simple implementations, like Apache Tomcat, and also in complete ones, like JBoss or IBM WebSphere application servers.

The authentication is done as part of UNA-SUS identity federation, with SAML protocol implemented using Shibboleth. The communication between web browsers and application server is protected by SSL and, for SOAP access, client authentication with digital certificate is required.

Webservices are available for complete communications of VLE with PA, including: checking if candidates meet requirements, registering course offerings, informing enrollment lists and uploading course certificates.

UNA-SUS developed modules for Moodle LMS webservice integration with PA. These modules have been successfully tested in a Tuberculosis course offered by UNA-SUS this year. 2,807 applied for the course, 2,130 had their requirements documents dismissed as PA webservice confirmed their fulfillment. So far 1,675 students finished at least one module of the course, and 282 graduated. Their certificates are already available for download at PA.

5. RESULTS

The first result was the expansion of post-graduated education for primary health care professionals in Brazil. The number of seats for specialization in family health increased tenfold in five years, from an average of 770 seats/year at 2002-2005 to 7,823 at 2006-2010 (Campos et al. 2010). Available data suggest that the improvement was not restricted to the number of seats, but also in the quality and impact of the courses.

In a research made with the first 648 graduates of the program in the state of Minas Gerais, 82,4% reported that had used in their practice the planning tools and teamwork strategies learned with the course. (Grillo e Sena 2012). Another study, with 192 graduates from Mato Grosso do Sul state suggest that the course helped the students to critically review their professional practice (De-Carli et al. 2011). In Santa Catarina State, the project interviewed 878 graduates. 80,5% of them reported that the course lead them to knowledge useful in their jobs, and 85,2% reported that their health service improved the relationship with clients (Boing et al. 2011)

We conducted a query with the first 294 graduates of the National Course on Tuberculosis Control offered by UNA-SUS. In a four levels Likert scale (disagree, partially disagree, partially agree, agree), over ninety percent agreed that: they learned a lot with the course, that the course will be useful in their job, the presentation and language were adequate. Lower scores were regarded ease of navigation (62%) and quickness in learning to interact with the VLE (85%). 97% reported that they would recommend the course to a colleague interested in the topic.

With the success of the project, Federal Government decided to make it permanent. An inter-institutional committee for developing the Open University of SUS was established in May 2010, which was responsible for planning the deployment of the Executive Secretariat of the UNA-SUS as part of Fundação Oswaldo Cruz (Fiocruz) in Brasília (MINISTRY OF HEALTH, 2010). On December 2010 a Decree was edited establishing UNA-SUS as an educational system, comprised of three elements: UNA-SUS Network, ARES and *Plataforma Arouca*. The system is coordinated by the National Secretary of Human Resources for Health and by Fiocruz, subordinated to the MoH.

6. CONCLUSION

The potential use of distance education to expand access to learning opportunities where and to whom they were not previously available is widely documented and coverage of educational achieved by the UNA-SUS reiterates this finding.

UNA-SUS is advancing in several aspects such as: incorporation of new educational technologies - which make learning more flexible and therefore more suitable for working professionals; the use flexible cooperative network, adding universities with different political-pedagogical projects, integrating curricular students information and publishing educational resources for open access.

The results achieve so far points that UNA-SUS will result in: (1) greater coverage and better quality of opportunities for health workers; (2) reduction of the waste on poor quality learning resources, addressing redundant themes and using similar methods. Everyone will have access to everything that is produced by the network and open access leads to quality (ARES); (3) economic and faster job and promotions interviews, as curriculum is now digital, not on paper (*Plataforma Arouca*). (4) greater transparency in the use of resources for health education, with identification and follow up of beneficiaries (*Plataforma Arouca*).

We believe that the Open University of SUS is a robust action, relevant and cost-effective. Its full implementation in the coming years will bring numerous benefits to Brazilian citizens who will be able to count on the assistance provided by the health workers more skilled, they will have free access to a large, modern and democratic system of support for their .

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THE ROLE OF ACADEMIC COMMUNITY IN THE NETWORK SOCIETY

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ABSTRACT

Based on critical transdisciplinary research methodology, this paper analyses the role of academic community in the network society and shows that, in this specific context, small evolutionary steps are more efficient than revolution. Based on responsibility of each individual for own actions, it develops the Freirean model of the role of academic community in the network society. The developed model starts from conscientization, and develops into a series of steps that make a never ending circle very similar to Freire's codifications and decodifications. It reminds that the role of academic community in the network society is directly associated with the question what kind of world we would like to live in. Following Freire's idea that all education is political, it calls for active personal development and social engagement for achieving personal ideals. In this way, the paper replaces pessimism contained in contemporary critiques of global education with moderately optimistic academic direct action.

KEYWORDS

Academic community, network society, critical transdisciplinary methodology

1. INTRODUCTION

We live in the age of dialectically intertwined technological, social and other transformations commonly known as globalisation. In the field of education, those changes cause profound commodification which consists of managerialist principles and McDonaldized practices (Beckmann & Cooper, 2004; Giroux & McLaren, 1994; McLaren, 2000, Brighouse, 2004). In order to inform practical action, this paper focuses to the role of academic community in these processes. Educational systems are deeply rooted into the community: speaking about education, therefore, actually means speaking about the whole society.

Based on the parallel between contemporary academics and ancient jesters the first part of the paper analyses the role of academic community in the network society and shows that, in this specific context, evolution is more efficient than revolution. The comparison between academics and jesters has two important advantages. Firstly, it draws parallels between completely different worlds: cross-section between those worlds, such as the need for maintaining a real picture about oneself, has the real potential for universality. Secondly, the allegoric character of this comparison opens space for contemplation which is by and large free from tacit knowledge about the current social reality. On such basis, it allows 'thinking out of the box' which has the potentials for real change. On the flip side of the coin, the comparison between academics and jesters causes important drawbacks regarding scientific validity of the research.

Looking into the past for guidance, the second part of the paper recognises the specific position of academics which lies somewhere between their ideals and the reality of their social position called *in and against the state*. It shows that the oppositional possibilities developed by London Edinburgh Weekend Return Group (Mitchell et al., 1979) are far too general for solving the research question. Following McLaren's argument (2000: 15), it reconceptualises Freire's educational thought starting from the concept of conscientização (1972) in the context of network society. It reminds that the role of academic community in the network society is directly associated with the question what kind of world we would like to live in. Following Freire's idea that all education is political, it calls for active personal development and social engagement for achieving personal ideals.

2. RESEARCH METHODOLOGY

This paper lies on the very borders between positivism, interpretivism and critical theory. Positivist aspects of the paper are mostly hidden in secondary sources: for instance, the assertion that contemporary education is increasingly McDonaldized is predominantly based on statistics (Ritzer, 1993). The interpretivist aspects of the paper arise from using the allegory of jesters in order to inform scientific work, i.e. from individual thinking out of the box rather than direct interpretation of positivist data. Following the great tradition starting from Frankfurt School through Freire to McLaren, the paper is inherently critical: it simultaneously develops knowledge about the current social conditions and directs practical action. In this way, it aims against political, social, economic and other forms of oppression.

This kind of approach is interdisciplinary, because it uses concepts and ideas developed in various research traditions. It is also transdisciplinary, because the “dialogue with other disciplines and theories is a source of theoretical and methodological development” (Fairclough, 2007: 1). There is a small but rapidly growing body of research about theoretical and practical aspects of transdisciplinary research methodologies. Unfortunately, however, deeper analyses of the issues associated with transdisciplinarity exceed the scope of this paper. Based on previous research in the field (Jandric & Boras, 2012), we shall briefly look into two main problems with transdisciplinary research in the context of this paper: the problem of correspondence between various research methodologies and the position of the researcher.

The problem of correspondence between various research methodologies is inherent to all transdisciplinary research. Let us briefly describe its main features using the common example of dichotomy between interpretivism and positivism. Interpretative research is theoretically and practically capable for providing an insight into individual behaviour and consequently incapable to provide wide generalisations. On the opposite side of the spectrum, positivist research is theoretically and practically capable to provide generalisations but incapable to include individual context.

Within the framework of transdisciplinary research methodology one might be tempted to involve a bit of interpretivism into a positivist research, or to involve a bit of positivism in an interpretivist research. According to Howe, however, this cannot be done without applying restrictions arising from both theoretical frameworks to the final result (1988: 12). Alternatively, one might use Nicolescu’s logic of the included middle (2006) and raise the whole research to the abstract level of modelling. In this case, however, the final results will also be models and therefore in need for translation into the reality. This paper uses the second approach and develops a model of the process aimed at defining the role of academic community in the network society. Deeply rooted in praxis, this model equally contains theoretical and practical aspects. Like all models, however, it is fully abstract and requires appropriate translation into specific contexts of its applications.

Despite its transdisciplinary nature this paper is deeply rooted in theoretical framework of critical theory, which gives the researcher a very specific role within the research process. Thorough analysis of the position of critical researcher also lies beyond the scope of this paper. However, its main characteristics are well known. Critical research is inherently political, and critical researcher cannot and should not be neutral. Within the framework of critical theory, research simultaneously develops our knowledge about the world we live in and represents a battle field for the struggle for more just society. Last but not least, critical research is deeply rooted into its context (Carr & Kemmis, 1986). Therefore, this research provides only a model of the process aimed at defining the role of academic community in the network society which is useless without reconceptualisation in the specific context of its application.

In a slightly different context, elements of critical transdisciplinary research methodology used in this paper have been developed in a recent book co-written by the author of this paper (Jandric & Boras, 2012). Using fairly similar theoretical basis, Fairclough develops his transdisciplinary discourse analysis (2007). Shortly before his death, Kincheloe started to develop his research methodology in a similar direction (2009). Various contemporary critical theorists such as McLaren (2000) and Kellner (1989) implicitly use elements of transdisciplinarity in their work. As can be easily seen from the above examples, critical transdisciplinary research methodology slowly but surely enters the arena. As far as the author of this paper is aware, however, it still waits for the complete theoretical and practical elaboration. Without any doubt, critical transdisciplinary research methodology is a very useful tool: however, any interpretation of research results should take into account that we do not fully understand its main features and theoretical and practical consequences of its application.

3. ACADEMIC COMMUNITY IN THE NETWORK SOCIETY

At mediaeval courts, jesters had been the only people who could frankly speak their minds. Jesters understood history, politics, science and mathematics, knew foreign languages, masterfully told stories and skillfully played music. Their sharp comments on social reality had been allowed to hit the nail in the head of the touchiest topics, including matters of daily politics and dirty secrets about royal families. Such liberty came with a high price: jesters had been notorious for having many enemies, including some of the most important people of their times.

Jesters' only protection from revenge was their specific status and humbleness of their position. They had been paying for the freedom of speech by giving up all material possessions. However, it should be admitted that their daily lives had been fairly comfortable. At royal courts food is plentiful, rooms are warm, and clothes are useful albeit somewhat funny. Jesters had been able to afford plenty of time for reading, writing, studies and reflection. Wise monarchs understood that they needed jesters in order to keep the real pictures about themselves. Despite the lack of any political, economical or military power, jesters had often influenced royal decisions stronger than many politicians (Otto, 2001).

Academics had been true jesters of the 20th century. In the massive society characterised by one-way mass media such as television and strong national governments (van Dijk, 1999), academics did not have the power to decide about important political, economic and other matters. Their salaries represented a rough equivalent of the mediaeval warm room, regular meals and clean clothes. During economic crisis academics had been the last people to lose safe government funded tenures; during economic booms they were the last people to profit from the increased income. Academics travelled, taught, talked and published almost anything they wanted. Modern rulers rarely followed their advice in daily matters: at the historic scale, however, scientific achievements did strongly inform political decisions. Up to very recently, the position of academics had been deeply privileged: in the society based on economic principles, they made their living from the quest for knowledge.

Following global trends, however, during the past few decades worldwide academic jesters have been brought to the verge of extinction (Beckmann & Cooper, 2004; Giroux & McLaren, 1994; McLaren, 2000, Brighouse, 2004). This is not the consequence of a new law, or massive holocaust, or any single conscious human activity. Instead, academic jesters are slowly but surely transformed into mercenary work force by the global social structures powered by information and communication technologies often referred to as the network society (van Dijk, 1999; Castells, 2000), which eliminate the need for their existence. Unfortunately, social trends are not reasonable in the same sense as living organisms. For this reason, they seem unable to grasp the obvious: lamb which overestimates its running speed will be quickly eaten by wolves, drivers who overestimate speed of their reactions are the main reason for traffic accidents, and people who underestimate their need for food and water will starve during their trip to the desert. By simple analogy every society needs to keep the realistic view of itself in order to survive, and until very recently a large part of this task had been done within the academia.

The direct consequence of the inability of our society to understand this essential need is the emerging new academia without name, face and attitude married to managerialist principles and McDonaldized practices (Ritzer, 1993; Giroux & McLaren, 1994; McLaren, 2000, Brighouse, 2004). This coxless pair abolishes the whole range of traditional academic practices such as active social critique and blue skies research. Unfortunately, this inevitably brings a whole range of problems described in various critiques of contemporary education from all sides of the political spectrum (*ibid*).

During the past decades academics and non-academics have contemplated possibilities offered by various development scenarios. Facts are clearly visible to everyone; according to ideological preferences, teams are slowly gathering into three main camps. The dominating camp consists of various interest groups which withdraw different kinds of personal benefits from the death of traditional academia. The opposing camp consists of genuine academic jesters devoted to their colourful clothes and academic freedoms. Both camps also include several fools who simply went on with the opinion of the majority at their department, in their families or with the massive hysteric calls for efficiency, accountability and other buzz-words of the network society created by the public media governed by large capital. The largest camp contains the silent majority which does not publicly express its opinion. Some people are silent because they do not have an opinion; others are silent because they do not dare to develop an opinion. Following the fact that many academic

positions had already lost their independence from superstructures, the majority is silenced by the simple fear for survival.

Last but not least, it is a well known fact that digital natives have difficulties with understanding the digital immigrants (Prensky, 2001). Following the same line of reasoning, it can easily be shown that the young academics who never experienced anything but commodified educational systems simply accept the current social conditions as natural. At the moment, the number of such people is perhaps small: within the scope of single human lifetime, however, they might become the majority.

Contemporary struggle for academic freedoms is just a small part of the big war with numerous faces such as the Arab Spring, Occupy Protests etc. In another age, this war would probably step out of the fringes much faster. In the age of globalisation, however, corresponding to the highly differentiated division of labour, there is a general complicity, and the complicity is matched by a general lack of responsibility. Everyone is cause *and* effect, and thus *non*-cause. The causes dribble away into a general amalgam of agents and conditions, reactions and counter-reactions, which brings social certainty and popularity to the concept of the system (Beck, 2005: 33).

Institutions of the network society are simultaneously causes and effects of its problems (van Dijk, 1999; Castells, 2000). If we neglect primitivist theories which seek causes of all problems of the contemporary society in its complexity and advocate return to pre-global society organised in small, organic communities (Zerzan, 2004), any revolution will simply have to develop the new institutions in order to compensate the need for the old ones. Conceived within the ubiquitous global context, however, the new institutions will be prone to the same problems as the old ones. In the current social climate, therefore, there is not much use of revolutions.

4. A FREIREAN MODEL OF DEVELOPMENT

Perils arising from commodification of education powered by managerialism and McDonaldisation are obvious (Beckmann & Cooper, 2004; Giroux & McLaren, 1994; McLaren, 2000, Brighouse, 2004). Working in the current system, however, each and every academic (including the most conscious ones such as the noted academics from the last quotation) personally contributes to increasing social inequality and further social unrest. This brings most academics directly into the struggle between their ideals and forces that govern their daily existence. The more one understands about social consequences of education, the less he or she can avoid this struggle in daily life.

Fortunately, this uncomfortable position has already been fairly well researched. In 1979, London Edinburgh Weekend Return Group issued the famous pamphlet *In and Against the State* (Mitchell et al, 1979) which polemicalizes the contradictory position of teachers, community workers and other professionals who simultaneously receive money from the state and struggle against it. The London Edinburgh Weekend Return Group identified eight oppositional possibilities for critical action from the position in and against the state. The oppositional possibilities are: defining our problem our way, overcoming individualisation, rejecting misleading categories, defining ourselves in class terms, stepping outside the brief, refusing official procedure, rejecting managerial priorities and alternative organisation in struggle. The identified possibilities are independent of social structure and immediate context (ibid). For this reason, they can be adapted to various contexts including the role of academic community in the network society.

The academic community still struggles about the first oppositional possibility: defining our problem our way. Some academics such as McLaren clearly see commodification of education as a problem (2000), while other academics such as the authors of Bologna convention (Schatzman, 2007) see problems in the fact that education is not fully commodified. Unfortunately, it is pointless to move on to more advanced oppositional possibilities without clearly defining the problem. For instance, what is the point in refusing official procedure if there is nothing to replace it with? In order to clear up this problem, the whole paper is dedicated to development of understanding of the role of the academic community in the network society.

In the amalgam of the diverse global academic traditions, where probably the only common element is independence of thought, it is impossible to clearly define the problem in a common way. For this reason, answers should be sought for in a less prescriptive manner. The academic community has always deeply despised top-down approach: in order to keep its nature, therefore, it is necessary to build understanding of the role of the academic community in the network society using bottom-up approach. Probably the only

conclusion that all academics would accept without hesitation is that proper academic work requires freedom. Jesters who are afraid of their masters simply lose the main reason for their existence.

Furthermore, it is an undeniable historic fact that the struggle for freedom is both theoretical and practical discipline. It is impossible to achieve freedom without action, and it is impossible to conceive action for freedom without clear theoretical guidance. "They are to be understood as *mutually constitutive*, as in a process of interaction which is a continual reconstruction of thought and action in the living historical process which evidences itself in every real social situation". The only element which remains intact in this interplay is "the disposition to act truly and rightly" or Aristotle's *phronesis* (Carr & Kemmis, 1986: 34).

If revolutions are really unable to achieve the desired changes, the only remaining direction for development is evolution. True academic jesters, therefore, should continue doing what they know best: they should accumulate discrepancies in the dominating discourse until it breaks under their weight and evolves into a more acceptable form (Foucault, 1972). Guided by *phronesis*, academics should simultaneously develop theory and practice of academic action in the network society. Theoretical background is already here: it should 'just' be adapted to the problem of the role of academics here and now. All education is deeply historic: it is the direct consequence of the past and current social conditions, and an active creator of the future social conditions. In order to develop strategies for academic action, therefore, it is useful to take a look into past experience. However, it is a well-known fact that pre-global forms of struggle are simply inadequate for the context of the network society (Beck, 2005; van Dijk, 1999). In order to keep the best of past and present, McLaren asserts that the globalization of capital, the move toward post-Fordist economic arrangements of flexible specialization, and the consolidation of neoliberal educational policies demand not only a vigorous and ongoing engagement with Freire's work, but also a reinvention of Freire in the context of current debates over information technologies and learning, global economic restructuring, and the effort to develop new modes of revolutionary struggle (McLaren, 2000: 15).

According to Freire, the first step towards achieving the more just social conditions is *conscientização* (1972). This is a broad concept that starts from individual, almost intimate conscientization of one's social conditions and reaches towards the highest conceptual planes such as social justice and freedom. In a very broad interpretation of *conscientização*, the possible way to define the role of academic community in the network society could be as follows.

Firstly, academics should develop genuine interest for social issues associated with own praxis. By definition, this kind of interest is expected from people who work in fields such as education and sociology. However, it is not less important for those academics who work in seemingly unrelated fields such as chemistry or engineering. Regardless the field of professional interest, each academic is involved some kind of education – teaching, mentoring younger colleagues etc. – and this activity is inherently political (Freire, 1972). Nowadays, it is simply irresponsible to say: "I am a scientist who happens to teach few hours per week". All education has profound social impacts. Refusing to accept one's responsibility for those impacts does not annihilate that responsibility: instead, it simply shifts power towards the existing superstructures (Freire, 1972; McLaren, 2000).

Grasping all relevant aspects of professional activities, one should build own attitudes. Those attitudes should evolve together with one's social and personal conditions; by definition, the only element which should remain intact is *phronesis*. It would be personally irresponsible and methodologically wrong to try and predict the kinds of attitudes people might arrive to. In this aspect, it is necessary to follow Freire's faith that all people are able to correctly interpret own social conditions (1972) and accept the general belief that people will put *phronesis* above own petty interest.

Interaction with people is an essential part of the academic job. However, this interaction should not be narrowed exclusively to the field of professional interest: following the above argument, an academic who publishes and talks about chemistry should also say a word or two at least about science education, if not education in general. Hidden attitudes cannot change anything: academics should therefore step out of the closet and loudly speak their minds about all aspects of their professional practice. The obvious first step in this direction is engagement with colleagues and students. However, the academia should not be an ivory tower isolated from the rest of the society. For this reason, it is very important to communicate with people outside of the world of academia who, for the most part, do not have the privilege to discuss such issues at their homes and workplaces.

It cannot be over-emphasised that the society needs to keep the realistic view of itself in order to survive, and that academics play a key role in the process of creating that view. The struggle for academic freedoms therefore represents only a fraction of the great war for power and meaning. This struggle reaches much

further than preserving the historic rights and privileges. It starts with the question what kind of world we would like to live in, and results in the world we co-create on daily basis. For this reason, the role of academic community should not remain confined to the academic community: instead, its scope is the whole society.

Since Heraclitus it is well known that “you could not step twice into the same river; for other waters are ever flowing on to you” (in Hoyt, 2002). In order to keep an eye on the subject, we might add that you could not step twice into the same river also because the second time you would not be the same person as the first time. In order to keep up with the current social reality and personal development, these four steps – individual conscientization, building attitudes, interaction with people and broad approach which encompasses the whole society – should be repeated in reasonable temporal intervals. Each circle brings new factors in the equation, and each circle provides the best solution for problems here and now. To an extent, the developed model resembles Freire’s codifications and decodifications developed in the context of reading of the world vs. reading of the word (1985).

The position of contemporary academics still bears certain resemblance with the position of ancient jesters: the arm of globalisation is much smoother at university halls than within shopping malls. Despite obvious continuity between past and present, however, discourse of the network society is simply incommensurable with the discourse of its pre-global predecessors such as the massive society (van Dijk, 1999; Castells, 2003). There is no need to cry over traditional academic freedoms: in the network society, they make less and less sense anyway. There is no need to cry over traditional concepts of value: as can be easily shown using the concept of copyright (Ayres, 1999; Stallman, 2002), the many traditional concepts are simply obsolete. The struggle for ancient freedoms cannot be won: instead, the role of academic community in the society should be constantly redefined and linked to the general struggle for a more just society.

5. DISCUSSION

This paper is based on four important pillars: parallel between contemporary academics and ancient jesters, the belief that evolution is more efficient than revolution in the context of the network society, the belief that Freire’s ideas can be adapted to the contemporary context, and specific views to human nature. However, neither of those pillars is completely correct.

In mediaeval times the majority of European courts supported jesters. However, their number had always been extremely small (Otto, 2001): for this reason, the position of jester(s) is more similar to the position of presidential advisors or small, high level advisory boards than to the position of contemporary academics. Moreover, the levels of jesters’ influence varied in reach and scope and ranged anywhere from high-level entertainers to real political advisors (ibid). Finally, while the contemporary academia is formally separated from the government, the position of jesters had always been directly linked to monarchs (ibid). For those reasons, the parallel between contemporary academics and ancient jesters should be understood like an informative hyperbola, or like an illustration which should be interpreted in the similar ways as models of atom from high school textbooks. It helps us to grasp depth and extent of the problem, but does not provide solid ground for drawing proper analogies. The parallel between contemporary academics and ancient jesters cannot provide verifiable scientific data: its main purpose is to inform scientific research and provide inspiration.

Using a radically shortened argument, the paper shows that evolution is more efficient than revolution in the context of the network society. The complete argument in favour of this statement, derived from the context of e-learning, can be found in the recent book co-written by one of the authors (Jandric & Boras, 2012). However, equally sound argument that can be found in favour of the opposite idea. The dichotomy between revolution and evolution is a never ending struggle which regularly pops up in many fields of science (Turner & Maryanski, 2008: 4). By far, this discussion exceeds the limits of this paper and the ability of its author. For this reason, conclusions presented in this paper do not represent a definite answer to problems of academia in the network society. Instead, it is much safer to say that they represent fictional development of one of the possible scenarios.

This paper is firmly based on McLaren’s assertion that Freire’s ideas can be adapted to the contemporary context. As already mentioned, discourse of the network society is simply incommensurable with the discourse of its pre-global predecessors such as the massive society (van Dijk, 1999; Castells, 2003).

However, there are some universal truths such as phronesis which can equally be applied to all contexts. Any research which correctly recognises those truths will be able to properly reconceptualize other, temporary conclusions; the key to success of this research lies in making the correct distinction between universal and particular truths in Freire's work. In this paper, universality of Freire's ideas such as conscientization has been interpreted from a wide selection of valid academic sources. For this reason, they should be indeed universal.

Earlier in the paper we noticed that conclusions derived in this paper are directly related to specific views to human nature such as Freire's faith that all people are able to correctly interpret own social conditions (1972) and the general belief that people will put phronesis above own petty interest. As clearly shown in previous research, such attitudes cannot be rationally confirmed or rejected: for this reason, they will forever remain in the sphere of belief (Chomsky, 1996: 107).

6. CONCLUSION

Based on critical transdisciplinary research methodology, this paper analyses the role of academic community in the network society and shows that, in this specific context, small evolutionary steps are more efficient than revolution. Based on responsibility of each individual for own actions, it develops the developmental model of the role of academic community in the network society. The developed model starts from conscientization, and develops into a series of steps that make a never ending circle very similar to Freire's codifications and decodifications (1972).

This research is subject to several important methodological restrictions. Its transdisciplinary nature raises the found conclusions to the abstract level of modelling. All education is praxis, and models are abstract descriptions of the reality. For this reason, they require translation into specific contexts of each application. Furthermore, this research is strongly informed by critical theory and consequently ultimately political and deeply rooted into its context. Its results are therefore far from general: instead, they require constant dialogue with the reality.

The parallel between contemporary academics and ancient jesters is a hyperbola without proper scientific validity. However, it provides excellent illustration and inspires new ideas. The belief that evolution is more efficient than revolution in the context of the network society represents fictional development of one of the possible scenarios for the development of our society. The belief that Freire's ideas can be successfully adapted to the contemporary context is probably the least problematic of the above. Nevertheless, it is hard to be certain whether this reconceptualization correctly interprets Freire and even harder to assess the influence of possible misinterpretations to the derived conclusions. Finally, some questions about human nature cannot be rationally proved and therefore will forever remain in the sphere of belief.

Despite firm restrictions, this paper unmistakably replaces pessimism contained in contemporary critiques of global education with moderately optimistic academic direct action. Firmly based in critical transdisciplinary research framework, it "requires one to maintain a clear balance between the imagined and hoped-for future, and the critical analysis and concrete action that was needed to achieve that future" (Boyd, 2007: 7). In this way, it simultaneously dreams about a better society and provides academics with guidelines for liberatory action for free and just social relationships here and now.

At one hand, the incomplete elements such as the need to theoretically and practically analyse opportunities and restrictions offered by critical transdisciplinary research methodology are important restrictions to validity of this research. At the other hand, however, those elements have a very important purpose to indicate possible directions for future research. In the best critical tradition, this paper does not develop a definite set of recommendations: instead, it invites academics to reconceptualise their own praxis in the context of the network society.

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QUALITY IN E-LEARNING: CONSIDERING INSTRUCTIONAL DESIGN APPROACHES

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ABSTRACT

The theories of Instructional Design and the models built to support this activity are presented in this article with the intention of connecting them to a Didactic-Pedagogical entity created for a Quality Model for the products/services of education that uses Information and Communication Technologies (ICT). A vision of quality regarding to the educational products and the mention of other models that address the quality of these products emphasizes the importance of the proposed model that can be used continuously for the construction of educational products and services.

KEYWORDS

Quality, Instructional Design, E-learning, Distance Education.

1. INTRODUCTION

Barker (2007, p.109) considers that “e-learning is one of the primary new product/services in the global knowledge economy”. She presents current estimates by the Canada industry that there are more than 5,000 companies worldwide engaged in online learning. For Schlemmer et al. (2007) an indicator of the IDC Group estimates a movement of \$ 20 billion dollars per year for the global market for distance education.

Considering these data it is possible to observe a migratory movement in modern society for this form of education based on Information and Communication Technologies (ICT). Thus, some characteristics should be evaluated in these new types of educational services.

Quality is one of these characteristics and has an impact on all aspects of these products/services, whether in teaching/learning process, management activities, mentoring or evaluation. This should be considered at all stages of a generic cycle for the creation of these kind of products, from planning and development phases until operation and maintenance phases.

Many models, guidelines and standards can serve as means of dealing with the quality of education products/services and they are highlighted in section three of this article.

Such models are often applied by its users in order to assess the quality of the product/service in the final phases or when the products are concluded. The activities used for this evaluation, according to Giraffa and Netto (2010), are called: 1) quality audit, where is verified the existence of procedures to ensure quality; 2) quality assessment, which involves the analysis of certain aspects of the product; or 3) accreditation, which refers to a method of external evaluation to verify compliance with certain criteria or predetermined standards.

In this context, the establishment of a model to provide continuous application of quality criteria at the same time that occurs the educational product/service evolution is not only relevant but fundamental as it enables the realization of adjustments over the processes. More details on this subject is in section four of this article which is organized as follows: section two deals with some approaches to Instructional Design that are related to one of the elements of the model in question; section three presents some concepts about quality and relate it to e-learning and distance education; section four which details the structure of the quality model for e-learning and presents the implementation rules pertaining to the model; ending, section five presents the conclusions and suggestions for future research.

2. INSTRUCTIONAL DESIGN APPROACHES

Smith and Ragan (1999) present a brief conceptualization about the Instructional Design and details what is Design and Instruction. The concepts presented below are important to the approaches that are described in this section on Instructional Design and for the model to be presented in later section.

“The term *Instructional Design* refers to the systematic and reflective process of translating principles of learning and instruction into plans for instructional materials, activities, information resources and evaluation” (Smith and Ragan, 1999, p. 2). Because of that, *instruction* was considered by these authors like “the intentional facilitation of learning toward identified learning goals. Terms such as education, training, and teaching are often used interchangeably with instruction” (Smith and Ragan, 1999, p.2). Carey et al. (2005) also consider that the terms education, training and teaching can be used interchangeably.

For Smith and Ragan (1999) the term *education* describes all experiences in with people learn, *training* to refer those instructional experiences that are focused upon individual acquiring very specific skills and *teaching* as learning experiences that are facilitated by a human being. In a complementary way, other relevant term is *design* that “implies a systematic or intensive planning and ideation process prior to the development of something or the execution of some plan in order to solve a problem” (Smith and Ragan, 1999, p. 4).

All of these conceptualizations are relevant to the study and application of Instructional Design, that although it is not applied on a scale that reaches all environments dedicated to some type of education, whether formal or informal, is being increasingly sought after by professionals working with these activities.

The Instructional Design is of fundamental importance in the construction and design of courses. It supports the entire process for construction of distance education products. According to Chao et al. (2010) many educational institutions now have an Instructional Design professional in the center of the group that designs the curriculum and develops programs of activities.

Some advantages of using systematic Instructional Design for Smith and Ragan (1999) are: 1) encourages advocacy of the learner; 2) supports effective, efficient, and appealing instruction; 3) supports coordination among designers, developers, and those who will implement the instruction; 4) facilitates diffusion/dissemination/adoption; 5) supports development for alternate delivery systems; 6) facilitates congruence among objectives, activities, and assessment and 7) provides a systematic framework for dealing with learning problems. With all the features and advantages above, the Instructional Design becomes a key element in the construction of formal or informal courses on any type of educational organization.

Many researchers therefore are conducting researches on the subject and they proposed over the past decades, models, processes, frameworks for the implementation of this practice, considering other relevant points to the activity of Instructional Design. From these viewpoints stand out approaches and theories that will be highlighted below, with a special emphasis to West et al. (1991) which presents Cognitive Theories related to the Instructional Design geared to the learning processes.

Carey et al. (2005) present an approach to treat the properties of the Instructional Design as a Systems Approach Model for Designing Instruction. It is important to consider the defining feature of the system and processes related to this. To Carey et al. (2005, p. 1), “*system* is technically a set of interrelated parts, all of which work together toward a defined goal”. The components of the system are the learners, the instructor, the instructional materials, and the learning environment. These components interact in order to achieve the goal. Carey et al. (2005) consider the result of using the systems view of instruction is to see the important role of all the components in the process.

Carey et al. (2005) present the model that includes ten interconnected boxes and a major line that shows feedback from the next-to-last box to the earlier boxes. The ten boxes represent sets of theories, procedures, and techniques employed by the instructional designer to design, develop, evaluate, and revise instruction. The components of the Systems Approach Model presented by Carey et al. (2005) are: 1) Identify Instructional Goal(s), 2) Conduct Instructional Analysis, 3) Analyse Learners and Context, 4) Write Performance Objectives, 5) Develop Assessment Instruments, 6) Develop Instructional Strategy, 7) Develop and Select Instructional Materials, 8) Design and Conduct Formative Evaluation of Instruction, 9) Revise Instruction, and Design and 10) Conducts Summative Evaluation.

These perspectives call for a reflection on how to choose and to use the approaches mentioned. Regardless of which model is used, this must systematize the activities of the instructional designer and outline the ways by the procedures set forth in these models favoring the creation of instructional systems.

Carey et al. (2005, p. 10) considering that “the individual instructor who has day-to-day instructional responsibilities can use the process to develop only small amounts of written or mediated instruction at any given time. The process can also be used effectively and efficiently to select from among existing materials and to design instruction that is not materials based”.

Gagné et al. (1992) initiated an approach to presenting Instructional Design in detail the five major categories of instructional outcomes – the human capabilities that are learned with the aid of instruction. To design instruction, one must seek a means of identifying the *human capabilities* that lead to the outcomes called *educational goals*. These five categories of learning outcomes are: Intellectual Skill, Cognitive Strategy, Verbal Information, Motor Skill and Attitude. In fact, these authors present three functions relevant to any model of instructional system: “1) identifying the outcomes of the instruction, 2) developing the instruction, and 3) evaluating the effectiveness of the instruction” (Gagné et al., 1992, p.21).

It is possible to check in Instructional Design approach proposed by Gagné et al. (1992) a formatting system design and instructional delivery. For this they consider a Systems Approach Model for Designing Instruction proposed by Dick and Carey in 1990, presenting succinctly the stages of this framework. They propose in details the phases and activities to another Instructional Design System.

This proposal outlines 14 steps, divided into four sections: “*System Level* (1. Analysis of needs, goals and priorities; 2. Analysis of resources, constraints, and alternate delivery systems, and 3. Determination of scope and sequence of curriculum and courses; delivery system design), *Course Level* (4. Determine course structure and sequence; 5. Analysis of course objectives), *Lesson Level* (6. Definition of performance objectives; 7. Preparing lesson plans (or modules); 8. Developing, selecting materials, media; and 9. Assessing student performance (performance measures), and *System Level* (10. Teacher preparation; 11. Formative evaluation; 12. Field testing, revision; 13. Summative evaluation; and 14. Instalation and diffusion)” (Gagné et al., 1992, p.31).

The approach of Smith and Ragan (1999) describes an important feature of the term Instructional Design, and this term covers a more extensive system-wide instructional and considers the process of design, development, implementation, and revision of instruction. In general, the procedural approach by (Smith and Ragan, 1999, p. 5) is the answer to these three questions: “1) *Where are we going?* (What are the goals of the instruction?); 2) *How Will get there?* (What is the instructional strategies and the instructional medium?); and 3) *How will we know when we have arrived?* (What should our tests look like? How will we evaluate and revise the instructional materials?)”.

Smith and Ragan (1999) based on these three questions proposes the answers, considering that these three questions can be stated as major activities that an instructional designer completes during the design and development process: 1) Perform and instructional analysis; 2) Develop and instructional strategy; and 3) Develop and conduct an evaluation. This process model considers three main blocks of activities: 1. Analysis (Learning context, Learners, Learning task); 2. Strategy (Determine: Organizational strategies, Delivery strategies, management strategies); and 3. Evaluation (Conduct formative evaluation). Each block generates a result set for each phase: 1. Analysis (Write test items); 2. Strategy (Write and produce instruction); and 3. Evaluation (Revise instruction). The result of the Analysis phase is crucial to the step of defining strategies, ie to the phase of the Strategy and the result allows the initialization of Evaluation phase. The results obtained in phase three feeds back the model and may be considered as input to the Strategy and Analysis phases.

West et al. (1991) present an approach of Instructional Design totally related to the cognitive strategies. For this, considers five steps in Instructional Design: 1. Setting objectives; 2. Preassessment, that is, determining whether the target students have the prerequisites to benefit from the instruction; 3. Planning instruction; 4. Trial, that is, presenting the instruction for developmental purposes; and 5. Testing and evaluation. From this, they describes the nine cognitive strategies: 1. frames type one; 2. frames type two; 3. chunking; 4. concept mapping; 5. the advance organizer; 6. metaphor; 7. rehearsal; 8. imagery; and 9. mnemonics. “These are the primary contributions of cognitive science to Instructional Design” (West et al., 1991, p. 22).

The cognitive strategies are mental activities performed by persons. To West et al. (1991), in Instructional Design, the designers’ task is to plan the instruction so that the student can use one or more of the cognitive strategies to learn the material, to actively, mentally process the content. As the designer plans the instruction, decisions must be made about what strategy or strategies are most appropriate for the content and for the particular students.

From these topics, it becomes clear the importance of Instructional Design in the education process and the necessity to implement monitoring mechanisms that allow measure the quality of products/services throughout the entire process, from the drafting process as well as the development and implementation processes. The concepts of quality and process will be exposed in the next section.

3. QUALITY: CONCEPTS AND RELATIONS WITH E-LEARNING

The above approaches to Instructional Design greatly collaborate in the creation, design of courses either in conventional educational environments or in environments that use ICT (Information and Communication Technologies), as in the case of e-learning or distance education.

These approaches can influence quality indicators for educational products developed based on theories and practices of Instructional Design and this leads to deeper considerations about the quality e-learning. This issue is better detailed below.

Quality is now an increasing feature observed in many different types of products and services. This treatment is no different in the educational sector, especially those who consider the ICT (Information and Communication Technologies) as the main element in the core, be it a product or a service or even a solution that incorporates both elements.

Rekkedal (2006) mentions that in many areas, contemporary society has recently started to require more emphasis on quality. This is reflected on the quality model for e-learning presented in this work and on models, standards, and guides mentioned below developed for this purpose.

Some generic definitions can be considered by several authors on the concept of what is quality. However, according to Baker et al. (2007), quality is the degree to which an object (process, product, or service) meets a set of attributes or requirements and, to Humphrey (1989) it is related to compliance with requirements.

Quality in e-learning or in distance education for Kanwar (2007) involves the establishment of indicators and devices, well as the infrastructure, resources and practices that consider the current technological paradigm, linking these relevant issues to students (digital generation), teachers and administrators.

For Valentine (2002), when it comes to e-learning or distance education, some problems regarding this type of learning can be mapped: quality of instruction, uncertain costs, misuse of technology and the attitudes of teachers, students and administrators, each of these problems has an effect on the quality of the product.

All these elements that guide the subject of quality lead to a need for quality assurance program so that it can eliminate redundancies, ambiguities and subjectivities that can be demonstrated in the treatment of this superlative feature in the educational environment.

To do so, many documents are founded like models, standards or guidelines that can be used to consider and assess the quality of products/services related to education. Sometimes features are aimed at the evaluation, audit or certification in order to highlight the quality of such products. Shelton (2011), Rekkedal (2006), Chao (2010) and Barker (2007) collaborates with some works that express various types of models, standards and guides that have different goals, whether for use by distance education courses or e-learning. Some of these documents are: 1) IHEP's 24 benchmarks for success in internet-based distance education; 2) CHEA's Accreditation and Quality Assurance Study; 3) EADL/European Association for Distance Learning: Quality Guide; 4) Canadian Recommended E-learning Guidelines; and 5) ISO/International Organization for Standardization: ISO/IEC 19796-1 Standard on Quality for E-learning.

The importance of quality related to educational elements puts the main considerations as: 1) how to plan and develop such elements and 2) what is the way for guarantee the quality of it.

Considering all educational elements in various areas, whether they are learning objects, the designed courses, educational centers, all are capable of measuring quality. Often it is measured in a static way, exclusive of the existing product or service, ie, with mechanisms for audits and certification (or accreditation).

One of the possible goals to present a continuous and qualitative view, would be to consider quality aspects throughout the planning, development and operation (or use) of educational elements mentioned above. With appropriate mechanisms and metrics the qualitative characteristic would be measured at certain times, for example, in the design phase or development or operation.

The above models can greatly assist in these activities although sometimes were not created for continuous use, but ready to be used in the final phases, aiming to determine the quality of the product/service concluded. To establish these standards in order to be used continuously in the life cycle of educational product/services or to be used in a specific time, in either case there are some factors to assess the quality and one of this is the establishment of metrics that can measure the quality of products/services. According to Rossi and Mustaro (2011), considerations of quality can be accomplished in several ways, but above all, numerically they can be observed and compared.

In this sense, the metrics in general enables producers and evaluators of a product or service on determining the qualitative condition of this. The metric has the function of determining value, based on procedures and activities demonstrated in numbers indices related to product quality and related productivity, Koscianski and Soares (2006). According to Humphrey (1989), the set of process metrics is essential for process improvement.

Considering the above, the measurement becomes crucial in the face of qualitative characteristic which seeks to determine, even for products and related educational services.

4. QUALITY MODEL FOR E-LEARNING CONSIDERING INSTRUCTIONAL DESIGN

The quality of product/service in education is important especially by the fact that the inclusion of computational elements are increasingly in education solutions. Taking into account the number of models, standards or guides, as mentioned in the previous section, which emerged in the last decade to validate the quality of educational products.

From this analysis, with a formal vision of continuous improvement, there is another proposal to address the quality for the educational products/services. Presented below, the model considers the qualitative criteria for the development of an e-learning product/service. The structure of the proposed model and the elements that compose it and its form of implementation and use are highlighted below.

The model considers three levels in its structure and a set of rules organized into common entities in each level. The same can be used in conjunction with other quality models for the development of the same educational product/service. Figure 1 presents the simplified structure of the model and then are briefly summarized each of the elements that compose it. This allows to define the concept of each instance of the elements, how they behave and how they interact.

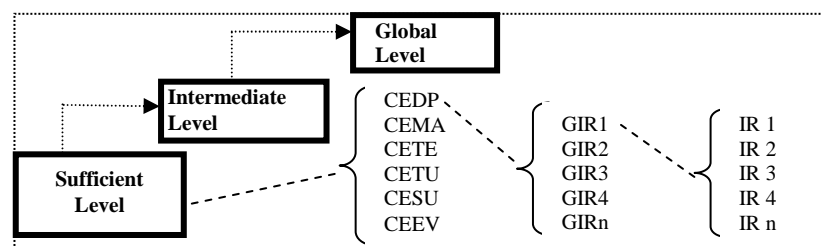


Figure1. Simplified Structure Model (Rossi and Mustaro, 2011, p. 881)

The model was designed so that its implementation is continuous and determines the qualitative criteria of the product/service throughout the development.

The first element of the model is the *Level*, which determines the degree of adherence to the model, the degree of compliance with the rules involved in this implementation. There are three levels and is not possible to reach the third level without going through the second, or the second without going through first. According to the default settings of the model is guaranteed to all who are in a certain level, have a minimum of necessary rules implemented. The model' levels are: 1. *Sufficient Level*; 2. *Intermediate Level*; and 3. *Global Level*.

The second element is the *Common Entity (CE)* that generally corresponds to the main parts of an e-learning department. They are defined for each *Level* and it has the rules to be implemented. All levels have the six *Common Entities* defined for the model.

The model's *Common Entities* are presented as follows: 1. *Didactic-pedagogical*: meet the cognitive processes aimed at learning step and also the elements involved in the Instructional Design; 2. *Management*: considering the management and operation of the product; 3. *Technology*: involves the entire technology apparatus; 4. *Tutorial*: deals with issues involved in mentoring courses; 5. *Support*: covers the relevant support to students; and 6. *Evaluation*: covers topics relevant.

Another element of the model is the *Group of Implementation Rules (GIR)*. This is under the *CEs*.

Finally, the element that actually describes what should be implemented is the *Implementation Rule (IR)*, i.e. the rule that must be satisfied to meet the model. This element should describe in detail what should be implemented and represents the minimum granularity of the model. Each rule must always be associated with a *Group of Implementation Rules* and is not repeated throughout the model.

In this model the *Didactic-Pedagogical Common Entity* has common characteristics derived from Instructional Design approaches and cognitive processes aimed at learning, presented in section two. It was based in the theories of Instructional Design and the implications of cognitive processes in Instructional Design activities, according to West et al. (1991), Gagné et al. (1992), Dick et al. (2005) and Briggs (1977).

Table 1, 2 and 3 show which *Group of Implementation Rules* and the actual *Implementation Rules* that were defined for the *Didactic-Pedagogical Common Entity* for the three levels defined for the model, accordingly to (Rossi and Mustaro, 2011, p. 882). The same descriptions are included in the five other common entities to establishing as a quality model as whole for e-learning products.

Table 1. Implementation Rules for CEDP Common Entity Didactic Pedagogical (Sufficient Level)

| Group of Implementation Rules | Code | Implementation Rule |
|--|------------------|---|
| CEDP 1 – Specific objectives | IRDP 1.1 | Specific objectives should be defined and documented. |
| | IRDP 1.2 | The specific objectives should indicate the described effects on the learning process. |
| CEDP 2 – Specific objectives – topic | IRDP 2.1 | Topics should be defined and documented. |
| | IRDP 2.2 | The limits for each topic should be defined and documented. |
| | IRDP 2.3 | Must be registered examples referred to each topic. |
| CEDP 3 – Specific objectives – types of learners | IRDP 3.1 | The main occupation / grade of the learner must be defined and documented. |
| CEDP 4 – Specific objectives – types of learning | IRDP 4.1 | The types of learning (eg conceptual, procedural, and attitudinal) must be defined and documented. |
| CEDP 5 – Specific objectives – function | IRDP 5.1 | The functions of the instructions, i.e. the need for this matter to the learner should be defined and documented. |
| CEDP 6 – Content – instructional domains | IRDP 6.1 | The percentage that referred whether the instruction is intended to bring about changes in thinking, attitudes and/or skilled performance considering cognitive ability, affective and psychomotor. |
| CEDP 7 – Content – instructional content | IRDP 7.1 | The different types of guidance that will affect student should be defined and documented. |
| CEDP 8 – Content – uses of knowledge | IRDP 8.1 | Should be defined as the explicit and tacit knowledge will be used. |
| CEDP 9 – Means of instruction | IRDP 9.1 | Must be defined from the perspective of the learner, how will be defined the problems to be used during the instructional process. |
| | IRDP 9.2 | Should be defined the possible courses of methods to be used during the learning stage, by the instructor and by the learner. |
| CEDP 10 – Testing and evaluation | IRDP 10.1 | Tests should be relevant to the nature of what is being learned. The types of tests and evaluation should be defined and documented. |
| | IRDP 10.2 | The degree of formality of the tests or evaluations should be recorded for each test or evaluation set. |

Table 2. Implementation Rules for CEDP Common Entity Didatic Pedagogical (Intermediate Level)

| Group of Implementation Rules | Code | Implementation Rule |
|--|-------------------|---|
| CEDP 100 – Specific objectives | IRDP 100.1 | What the learner will be able to perform after learning should be defined and documented. |
| | IRDP 100.2 | The conditions under which the learner must achieve these experiences should be recorded. |
| CEDP 101 – Content – uses of knowledge | IRDP 101.1 | Should be defined the ways in which the learner will use the knowledge. (e.g. replicative, associative, interpretation, application). |
| | IRDP 101.2 | The limits for each topic should be defined and documented. |
| CEDP 102 – Means of instruction | IRDP 102.1 | Media that can be used to support the learning process should be recorded (video, podcasts, texts, learning objects, serious games, etc.). |
| CEDP 103 – Testing and evaluation | IRDP 103.1 | Formative and summative evaluation, for example, should be defined. Considerations for testing or evaluation of education improves the acquisition by the learner should be defined and documented. |

Table 3. Implementation Rules for CEDP Common Entity Didatic Pedagogical (Global Level)

| Group of Implementation Rules | Code | Implementation Rule |
|-----------------------------------|-------------------|---|
| CEDP 200 – Specific objectives | IRDP 200.1 | Pre-tests to provide evidence of the level of learning achieved must be defined and documented. |
| CEDP 201 – Means of instruction | IRDP 201.1 | The types of experience that can be used in the preliminary inquiry must be defined and documented. |
| CEDP 202 – Testing and evaluation | IRDP 202.1 | Internal or external evaluations can be considered and documented. |

The descriptions of Instructional Design approaches, as well the Implementation Rules proposed, allow summarize some common elements that imply in operationalization variables:

- Establishment of mechanisms to make the learning process effective and efficient;
- Concern about the cohesion of the proposal, specifically the objectives, materials, activities and assessments;
- Structuring strategies/devices to overcome learning problems;
- Definition of roles and organization of team work for the development of the proposal;
- Recognising the special (context, students, media, and modes of delivery).

The operationalization of these requirements might consider the following variables:

- Consider the function of the proposal (which will be used for an instructional design approach and what is right or what should be combined);
- Establish steps that allow not only the proposal as the phases involved in its development;
- Define the team involved, as well as forms of communication between professionals;
- Adapt strategies for monitoring and measuring results at different keypoints, in addition to establishing an overall evaluation process.

5. CONCLUSION

The theories and practices of Instructional Design have long collaborated in various sectors of formal education, either presencial or at a distance, to structuring, development and maintenance of the courses. These theories have been studied in detail and three of them were highlighted in this article considering its relevance and use in different educational environments.

The theories presented helped in some depth in the characterization of the model described in the previous section, focusing on the approach proposed by West et al. (1991) that also includes the concepts of

cognitive theories for Instructional Design. These elements collaborated to the foundation of one of the entities that integrate the model proposed. This refers to the didactic-pedagogical entity that belongs to an educational product as e-learning, or distance education centers.

The proposed model will be able to support their users in the planning and development of education products/services, according to the levels proposed it should be used continuously to implement the common rules of the various entities.

Another relevant work to be considered as part of this research is to develop mechanisms that support quality measurement, and beyond this, an automation tool that allows for customization of the model. With this kind of system, chief education officer, or even a consultant of e-learning or distance education centers can simulate different scenarios to define the most appropriate path from the concept of proposal to its continuous implementation.

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USING WIKIS FOR COLLABORATIVE LEARNING: CRITICAL EVALUATION AND RECOMMENDATIONS

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ABSTRACT

Wikis are potentially considered as tools that foster collaborative learning and writing. Yet, there still are critical elements that need to be addressed to promote genuine collaborative writing, such as student resistance against wikis, limited student contribution to collaborative writing with wiki, or that students are reluctant to use wikis for online course work. Using MediaWiki as a platform, this work reports on the evaluation of students' collaborative writing activities by means of survey questionnaires with open-ended questions, and data logs that are automatically generated by wikis as students perform collaborative writing projects. The results are critically discussed and some recommendations are suggested for collaborative writing with wikis in teacher education.

KEYWORDS

Collaboration, collaborative learning, collaborative writing, cooperation, MediaWiki, wiki

1. INTRODUCTION

A number of studies report on critical elements of collaborative learning, such as student resistance against wikis, limited student contribution to collaborative writing with wiki, or that students are reluctant to use wikis for online course work (Cole, 2009; Elgort, Smith, and Toland, 2008). Most of these studies are based on participants' subjective perceptions by means of survey questionnaires, interviews, and other qualitative methods. Recently, a growing number of studies have drawn on the log data generated by wikis (Hadjerrouit, 2011; Judd, Kennedy, and Cropper, 2010; Leung and Chu, 2009; Santos, Sabates, Hernández-Leo, and Blat, 2010). The data log tracks all actions performed by students and stores all previous versions of the wiki. The data log is of considerable interest to collect statistical data associated with collaborative writing activities. This paper reports on an initial attempt to evaluate students' collaborative writing activities using MediaWiki as a platform. MediaWiki provides functionality to carry out collaborative writing activities and assessment, e.g. editing content, tracking students' contributions, comparing the differences between two versions of a document in the history page of the wiki. The features facilitate a statistical analysis of students' collaborative writing activities on the wiki. MediaWiki has also a discussion page that supports interaction and dialogue between students. The work uses both survey questionnaires with open-ended questions and the data logs of the wikis to evaluate students' emerging activities associated with collaborative writing. The main goal is to assess: (a) The work distribution and level of contribution among students; (b) The types of activities that students carried out; (c) The work intervals and the timing of contribution; and (d) The students' perceptions of collaborative writing. The results are then critically discussed and some recommendations are suggested for collaborative writing with wikis in teacher education.

2. COLLABORATIVE LEARNING AND WRITING

Collaborative learning describes a learning process generated by groups of students working as a team to solve a problem. Collaborative writing is a specific form of collaborative learning. It is an activity that transforms a text into a collective document by multiple students (Bradley et al, 2010; Chao and Lo, 2009;

Tal-Elhasid and Meishar-Tal, 2007; Trentin, 2009). Genuine collaborative writing is primarily a matter of modifying and transforming a text into a collective document. Students need to co-ordinate their efforts to produce the document collectively. Beyond the modification of others' contributions, collaborative writing also involves providing feedback and suggestions (Bradley et al, 2010). Of particular interest for the quality of collaborative writing with wikis is peer-assessment (Tal-Elhasid and Meishar-Tal, 2007). The benefits of collaborative writing are viewed as very positive for the learning process. According to McConnell (2005; cited in Bradley et al, 2010), collaborative writing fosters critical thinking. It enables the sharing of information and the acquisition of communication and discussion skills. It also offers opportunities to practice literature review, academic reading, and writing (Kim et al, 2009; Trentin, 2008). Likewise, Yarrow and Topping (2001) claim that students working collaboratively improved significantly more than those who wrote alone. The writing of a collective document can be accomplished cooperatively or collaboratively. Cooperation is seen as work where students split a task into subtasks among themselves, and work independently from each other (Ta-Elhasid and Meishar-Tal, 2007). In contrast, students collaborate when they work together and co-ordinate their efforts to accomplish a task collectively (Resta and Laferrière, 2007; Ta-Elhasid and Meishar-Tal, 2007). With other words, cooperation is defined by the division of work between students who are faced with a joint activity, while collaboration involves the "mutual engagement of participants in a coordinated effort to solve the problem" (Dillenbourg, Baker, Blaye, and Malley, 1996, pp. 190, cited in Judd, Kennedy and Cropper (2010)). More specifically, cooperation "implies either splitting up the work or solving subtasks individually and combining the results into a final product". In contrast, collaboration "means a coordinated attempt to solve and monitor a problem together, with perhaps some division of labour on aspects of the problem" (Scanlon, 2000, pp. 464-465, cited in Judd, Kennedy and Cropper, 2010).

3. RESEARCH METHODOLOGY

3.1 Participants

Participants were 10 students enrolled in wiki projects associated with a teacher education course in Web 2.0 technologies offered by the faculty of Technology and Science over a span of 8 weeks. All participating students were using wiki for the first time. None of them were involved in wiki projects or had pre-requisite knowledge in collaborative writing. The teacher divided the students into three groups based on their choice of the wiki subject. The groups were then involved in three wikis associated with collaborative writing projects.

3.2 Wiki Projects

The wikis were developed by three teams of students in collaboration with the university teacher as supervisor, on the one hand, and fellow students as peer reviewers, on the other hand. Supervision and peer review occurred by means of e-mail, wiki discussion forum, and during meetings with the teacher. The students' contributions to the wiki projects were not assessed individually, but as a group work. The projects need to be performed in accordance with guidelines for writing good articles, editing, style, and use of references. Students should acquire basic knowledge about wiki functions such as editing and developing content collaboratively, as well as discussing technical and pedagogical issues related to the wiki topics chosen by the students, that is predators, planets, and nutrition and diet. The purpose of the projects was to present information about the wiki topics in a straightforward manner, without having to spend much time to find relevant information. The users of the wikis are pupils in lower secondary schools.

3.3 Data Collection and Analysis Methods

Both qualitative and quantitative methods were used to investigate students' collaborative writing activities with wikis. Qualitative data collection involved students' perceptions of collaborative writing by filling a survey questionnaire with the following open-ended questions:

- a) I like to comment and edit fellow students' contributions to the wiki. Yes/No. Explain.
- b) I like that my contribution to the wiki be edit and commented by other students. Yes/No. Explain.
- c) The quality of collaboration increased with the use of MediaWiki. Yes/No. Explain
- d) Describe briefly what you think about the quality and degree of collaboration
- e) Do you think that MediaWiki promotes collaboration? Yes /No. Explain

Central element for quantitative data collection and analysis was the data logs generated by the wikis. The logs provided all interactions with the wikis, chronologically listed, displayed date, authors and changes made in the text by means of color coding. The data logs were particularly useful to support data collection because they kept track of the contributions to the wikis made by each member of the groups. Data analysis consisted in classifying the information provided by the data logs in three categories:

- Distribution of work and number of contributions (or percentage of edits) made by each student
- Type of activities (or contributions) performed by each student
- Work intervals associated with each group

Once the data were structured according to the three categories, statistics was created to assess students' collaborative activities. A crucial category in data analysis is the type of activities the students carried out. Taxonomies for analyzing students' activities have been reported in the research literature (Leung and Chu, 2009; Meishar-Tal and Gorsky, 2010; Pfeil et al, 2006). The following categories were used:

- Modify content
- Add content
- Delete content
- Fix link
- Delete link
- Add link
- Grammar, style, and spelling
- Formatting

These categories are not equivalent in type and importance in wiki research. Since this work is oriented towards collaborative writing, it follows that "modify content" and "delete content", "add content", as well as "fix link", "delete link", and "add link" need to be prioritized, followed by grammar/style/spelling and formatting. In asserting this, it does not mean that formatting, grammar, style, and spelling are not important regarding the quality of collaborative writing. It only states that collaborative writing is first of all a transformation of an initial text into a collective document by modifying, followed by deleting, and adding content. In this regard, "modifying content" means rephrasing one's sentences, and not just changing the structure of the document by adding a subsection.

4. RESULTS

4.1 Distribution of Work and Level of Contribution

Table 1 presents the distribution of work and the number of contributions made by each member of the groups. For group one the percentage of contributions ranged from 37.23% to 30.70%, which means the workload is evenly distributed. Furthermore, one student in group 2 contributed to 46.48%, which is almost the half of all contributions, and the rest is evenly distributed between the other students. In group 3, student 1 contributed to 46.12% and student 2 to 36.41%. The rest (17.43%) was performed by two students. As for group 2, the results indicate that the workload of group 3 was not evenly distributed when compared with group 1, since most of the activities on the wiki were done by one or two students.

Table 1. Distribution of work and number of contributions made by each member of the groups

| | Group 1 | Group 2 | Group 3 |
|------------------|-------------------|-------------------|-------------------|
| Student 1 | 137 (37.23%) | 119 (46.48%) | 95 (46.12%) |
| Student 2 | 118 (32.07%) | 74 (28.91%) | 75 (36.41%) |
| Student 3 | 113 (30.70%) | 63 (24.61%) | 27 (13.10%) |
| Student 4 | | | 9 (4.37%) |
| Total | 368 (100%) | 256 (100%) | 206 (100%) |

This data helps to check who contributed to the wiki, but it does not consider the quality and type of the contribution. Hence, to analyze the degree of collaborative writing, it is important to look at the type of activities done on the wikis.

4.2 Types of Activities

The analysis of the wiki activities shows that the students carried out all editing activities described in the taxonomy for collaborative writing (add, modify, and delete content; add, fix, and delete link; format, and grammar/style/spelling) to a certain extent. Table 2 shows all editing activities for the three groups. The number of total entries in Table 2 is slightly higher than in Table 1, because a single student contribution may consist of one or more activities.

Table 2. Types and number of activities carried out by the students

| | Group 1 | Group 2 | Group 3 | Average |
|-------------------------------|-------------------|-------------------|-------------------|-------------------|
| Modify content | 55 (11.68%) | 31 (8.81%) | 5 (1.99%) | 7.49% |
| Delete content | 66 (14.01%) | 9 (2.56%) | 21 (8.33%) | 8.30% |
| Add content | 147 (31.21%) | 95 (26.99%) | 67 (26.59%) | 28.27% |
| Fix link | 1 (0.21%) | 13 (3.69%) | 19 (7.54%) | 3.81% |
| Delete link | 15 (3.18%) | 5 (1.42%) | 1 (0.40%) | 1.67% |
| Add link | 36 (7.64%) | 96 (27.27%) | 46 (18.25%) | 17.72% |
| Grammar/style/spelling | 29 (6.16%) | 50 (14.20%) | 40 (15.87%) | 12.08% |
| Format | 122 (25.90%) | 53 (15.06%) | 53 (21.03%) | 20.66% |
| Total | 471 (100%) | 352 (100%) | 252 (100%) | 358 (100%) |

Looking at the types of activities that the students performed mostly, the following categories can be distinguished: add content, delete content, format content, and modify content that other students created. The most frequent activity in group 1 was adding content (31.21%), followed by formatting (25.90%), deleting content (14.01%), and modifying content (11.68%). Otherwise, the other activities were more or less insignificant. In group 2, the most frequent activity was adding link (27.27%), followed by adding content (26.99%), formatting (15.06%), and grammar/style/spelling (14.20%). In group 3, the most frequent activity was adding content (26.59%), followed by formatting (21.03%), and adding link (18.25%).

The distribution of the activities among the groups may be explained by the nature of the wiki topics in terms of number of links, images, and figures. However, from the perspective of collaborative writing, the modification of existing content is an activity that the students did not carry out much as the results clearly reveal when compared with the number of all activities (11.68% in group 1, 8.81% in group 2, and 1.99% in group 3; average score 7.49%). From the perspective of adding information to existing content, the number of students' activities was much higher (average score 28.27%), almost four times higher than the one registered for modifying content. Likewise, formatting was three times higher (20.66%). Also adding link achieved a higher average score (17.72%) than modifying content. Even though activities associated with grammar/style/spelling (average score 12.08%) are important for the quality of the document, they cannot directly be considered as genuine collaborative activities, since these are more related to language issues. Clearly, it appears that group members mostly worked on individual sections of the wikis.

Even though the workload in group 1 is evenly distributed, the data logs provide clear evidence that the students tended to focus more on separate parts of the writing task rather than seeing the whole wiki. As a result, it appears that students were more apt to engage in cooperation rather than collaboration. Group members mostly worked on individual sections of the wiki. This reduced their ability to produce shared knowledge and collective documents of the wiki topics. There were few occasions when the groups worked on the same section by revising substantially each other's work. Clearly, this cannot be considered as true collaborative writing, since students rarely revised or modified others' content. Instead, students were more concerned with adding content, formatting the text, and adding links.

4.3 Timing of Contribution and Work Intervals

The wiki projects were carried out using a rapid prototyping approach to speed up the process of developing the wikis (Shih, Tseng and Yang, 2008). During the development process, the student groups were supposed

to create a number of prototypes associated with collective texts that need to be gradually improved collaboratively. The student groups had four deadlines, one for each important prototype during the development process. Figure 3 shows the timing of the contributions and work intervals. It appears that two groups, particularly group 3 and group 2 in lesser degree, worked much as the last deadline approached, and did not follow the schedule assigned throughout the project period as the increased number of activities during the last month clearly shows. This reduced the possibility of collaboration further.

Table 3. Timing of contribution and work intervals

| | Group 1 | Group 2 | Group 3 |
|-----------------|-------------------|-------------------|-------------------|
| March | 87 (23.84%) | 129 (50.39%) | 140 (67.96%) |
| February | 187 (51.83%) | 97 (37.89%) | 62 (30.10%) |
| January | 91 (24.93%) | 30 (11.72%) | 4 (1.94%) |
| Total | 365 (100%) | 256 (100%) | 206 (100%) |

4.4 Students' Perceptions of Collaborative Writing

More details about the students' collaborative activities were obtained by survey questionnaires with open-ended questions. Looking at the responses, it appears that the majority of the students liked to edit each others' contributions. In stark contrast, students indicated that collaboration did not increase substantially, and that collaboration was rather of average quality. The majority of the students also pointed out that MediaWiki did not automatically promote collaboration. There are many reasons that may explain these results. First, the students indicated that oral discussions and other communication channels were equally important for collaborative work. There were several responses of which the following are representative:

... I think the whole discussion tool was unnecessary. (...). Oral discussions are better alternatives to online discussion (...). It is also very redundant to engage and comment on the wiki when we more or less always sit together and work.

... We have not taken advantage of the discussion page. The reason is that we as a group have largely worked together. It is easier to talk to the person sitting next to you than to write down a message using MediaWiki.

... How much time is spent online does not need to reflect how the group work has been. I feel that my group had a very good collaboration, but it does not look like when you look at the discussion page.

Second, the limited capacity of MediaWiki does not facilitate multiple-editing, because the tool was unable to cope with simultaneous editing. Students reported their disappointment:

... It happened to me several times when someone else in the group did something at the same time, edited and printed the "Save" before me, then I lost everything I had edited, and none of my changes were saved. (...) The problem is that it does not happen in real time as Google Docs, (...).

Third, students mentioned technical, pedagogical, and social reasons to explain why MediaWiki did not substantially increase collaboration, or even hindered collaboration:

... I cannot see that the discussion forum of the wiki raises the level of collaboration. It would be the same quality without.

... MediaWiki has nothing to do with collaboration when we all sit together to work and talk face to face continuously.

... MediaWiki made us very frustrated, and this forced us to work even more closely than we already did.

... I think that MediaWiki promotes collaboration, but because of the unstable server, we worked together in ways other than the discussion forum. We used email and Google Talk.

Also lack of familiarity with MediaWiki was an obstacle for increased collaboration:

... It took some time to become familiar with special wiki tags such as tables, links, etc. When this was put in place, MediaWiki becomes a good tool for collaboration.

Fourth, besides oral discussions, students indicated that they used other online forums:

... It is easy to communicate over other types of channels, e.g. IM (Instant Message) and Skype.

... Because there was a lot of down time on the wiki, we were forced to use other forums to collaborate and edit the material so that we would achieve better consistency.

... Such tasks were more or less accomplished through other forums than online discussions.

Another reason was that collaboration did not happen in real time, and because of connection problems. Other mentioned the superiority of Google Docs regarding concurrent writing.

... Because it is not effective, and things do not happen in real time, as in Google Docs.

5. DISCUSSION

The main result of this work is that using MediaWiki to carry out collaborative writing does not guarantee that students will work together in a coordinated way to achieve a common goal. Rather, cooperation, by splitting up the task in subtasks and writing individually to complete the work, still remain the main approach to writing. A piece of evidence is provided by the data logs, which show that collaborative writing activities were carried out in a relatively simple and uncritical way. Adding content was the most frequent activity in group 1 (48.98%), followed by formatting (25.90%), and deleting content (14.01%). The most frequent activity in group 2 was adding link (27.27%), followed by adding content (26.99%), and formatting (15.06%). The most frequent activities in group 3 are similar to those observed in group 1 and 2. Even though the selected activities are a necessary part of any writing process, they can not be seen as genuine collaborative writing. If collaborative writing is considered as an activity that deeply and substantially transforms an existing text into a collective document, the results reveal that the students did not really engage in collaborative writing, since modifying, rephrasing, and altering others' contributions, and critically reflecting on others' writings were not the most frequent activities. The distribution of work among group 2 and 3 and their level of contribution also confirmed that wiki development was mostly done by one or two students, except for group 1, where the workload was evenly distributed among the students. With the exception of group 1, the timing and work intervals in group 2 and 3 also show that the most part of the work was done the month before the delivery of the projects, which is not surprising given the students' tendency to postpone completing their work until the last minute (Leung and Chu, 2009). The postponement of work may have undermined collaboration and the students' opportunities to interact with their peers and members of other groups. Another piece of evidence is provided by the students' perceptions of collaborative writing activities, which indicate that collaboration did not increase substantially, and that collaboration was rather of average quality. Many reasons may explain low collaboration: technical problems, use of other communication channels, oral discussions, and lack of familiarity with wikis. While most technical problems could easily be solved, pedagogical problems still remain the main factor that may hamper collaborative writing.

Karasavvidis (2010) suggests that poor collaboration is to a large extent determined by the dominant learning paradigm in higher education - the behaviorist learning epistemology. This paradigm is incompatible with the socio-constructivist epistemology of wikis, which presupposes that collaboration and active participation are indispensable for learning. As collaboration, critical reflection and discussion are necessary conditions for using wikis, collaborative writing cannot develop fully, unless the existing paradigm changes radically. With other words, wikis' potential capabilities to support collaboration cannot be realized without a shift from behaviorist to socio-constructivist learning. Clearly, collaborative writing will not work fully unless students are accustomed to collaborative learning and practices. It follows that students should be given more time to experiment and familiarize with those practices and receive support throughout the course. A socio-constructivist learning paradigm that fosters collaboration would increase the likelihood of successful student involvement in collaborative writing with wikis.

6. RECOMMENDATIONS

Some recommendations can be drawn for a successful implementation of wikis as collaborative writing tools in teacher education. Most of the recommendations rely on a socio-constructivist approach to learning:

1. The first step towards a collaborative approach to wikis is to the acquisition of collaborative skills. These must be addressed before taking advantage of wikis. Such skills become necessary to foster collaborative learning, which is a prerequisite for collaborative writing. Collaborative learning should not be restricted to wikis alone but should be possible using any means found useful: allow students come together to discuss a topic, especially when the participants have different backgrounds and can add to each other's knowledge; reflection through co-author summaries of what they have learned (Tetard, Patorporpi, and Packalen, 2009).

2. Besides the acquisition of collaborative skills, critical factors of success may be the students' preparation, support in collaborative writing, and familiarization activities with wikis (Minocha and Thomas, 2007). Also the close integration between the learning tasks and goals, whether and how these will be

assessed individually or in groups, and which assessment items are taken into consideration, may motivate students to effectively engage in meaningful collaborative writing (Nokelainen, 2006).

3. Motivation is an essential component of collaborative writing with wikis. The results reveal that motivated students edited more content and used more wiki features. Motivation can be achieved in many ways. First of all, motivation must be seen in relation to the wiki topic itself, whether it is intrinsically interesting, highly relevant and meaningful to the student. Motivation can be achieved through wikis that allow students to take control over their own learning that provides opportunities for high level of activities. High motivational value can also be achieved through performance or learning goals, such as passing the course (Nokelainen, 2006).

4. Furthermore, the development of wikis needs to be structured so that the students are motivated to take part in the process of collaborative writing. An approach similar to the one developed by Trentin (2009) could be used. The approach needs to incorporate some structured stages (Hadjerrouit, 2011). It is centered on a group of collaborating students, because active participation of group members is given high priority. Then, the approach uses rapid prototyping to produce a number of prototypes that can be quickly revised through feedback. Finally, the approach is incremental throughout the whole process, because a number of revisions are necessary to improve the quality of the wikis through a continuous cycle of gradual refinement.

5. Assessment of the wikis plays an important role in evaluating the students' contributions. Both quantitative and qualitative assessment may be used. Quantitative assessment may enhance the students' motivation to pass the course. This method is dependent on the assessment of students' contributions by means of the data log that is generated by wikis, and the way the data are compiled statistically. Quantitative assessment is not the only way to evaluate students' contributions. There is a need for other assessment forms, since statistical data alone do not provide a full picture of students' contributions. Qualitative assessment forms may be self-assessment or/and peer assessment, on an individual basis or in groups, in line with the philosophy of collaborative learning (Tal-Elhasid and Meisjar-Tal, 2007).

6. Collaborative writing also needs to benefit from peer review (Rieber, 2006). During peer review, students evaluate other students' wikis to find out if they followed the wiki requirements. Peer review gives students a possibility to look at the requirements once again, because they are assessing whether other students followed them. As a result, they may be especially careful to reassess their own understanding of the requirements. In turn, a careful understanding of the requirements may help the students revise their writings and improve their wiki after the peer review process.

7. Finally, the role of the teacher cannot be underestimated in collaborative writing by guiding the students and providing appropriate feedback. A facilitator of collaborative writing, the teacher is not supposed to restrictively control the learning materials and the writing methods the students prefer to adopt. Instead, students should feel confident with methods that suit their personal learning style.

7. CONCLUSIONS AND FUTURE WORK

Although the results are limited to the small sample of students in the particular context described in this article, the results are in line with research work indicating that wikis alone cannot foster collaborative writing, unless pedagogical factors are taken into account (Carr, Morrison, Cox, and Deacon, 2007; Cole, 2009; Elgort, Smith, and Toiland, 2008; Lund and Smørdal, 2006). Based on this conclusion, some implications are drawn for successful collaborative writing with wikis in teacher education. Future research work will take into consideration these implications to improve collaborative writing with wikis. Future work will also be undertaken with larger student groups to ensure more reliability and validity of the results.

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EVALUATING EGROUPS FOR COLLABORATIVE MARKETING PLANNING BY FIRST-YEAR BUSINESS STUDENTS

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ABSTRACT

Academics are charged with continuous curriculum improvement in a move toward more learning-centredness and authentic assessment. Changes to curriculum are to be informed, in part, by student feedback on assessment, as well as insights into student learning processes. With delivery of courses to domestic and international cohorts in internal and external modes, this task is challenging, particularly for large first-year units. This paper presents a curriculum innovation and renewal involving the group design for a major new collaborative marketing plan assessment in a compulsory first-year Marketing unit within a Bachelor of Business course. The efficacy of the design is evaluated for 105 external students in Session 2 in 2011. Three main sets of improvements to eGroup design are identified and implemented in Session 3 2011 (for 43 external students). The impact of these improvements is also reported. The findings can be used to inform curriculum renewal toward more experiential learning within external and converged learning contexts.

KEYWORDS

Curriculum design, eGroups, marketing planning, assessment, eLearning environment.

1. INTRODUCTION

The assessment reform underway in higher education is increasingly concerned with those features of the curriculum and teaching that have the most direct impact on learning (Boud D. and Associates, 2010). It calls for 'sustainable' assessment, that is fostering learning throughout life (Boud & Falchikov, 2006) and meeting the needs of the present without compromising the ability of students to meet their own future learning needs (Boud, 2000). Sustainable assessment goes hand-in-hand with learner-centredness, which places the learner and his or her learning at the centre of all instructional practices (in contrast to the traditional teacher-centred paradigm with its emphasis on transmission of subject content.) Students in a learning-centred paradigm construct knowledge through gathering and synthesizing information and integrating it with the general skills of inquiry, communication, critical thinking, problem solving and so on (Huba & Freed, 2000). The learning theory most consistent with sustainable assessment (or learning-centredness) is constructivism. Constructivist theory is where the learner constructs knowledge through their own activities building on what they already know. It is an active process. As new understandings, experiences and information are gained, learning occurs (Hanson & Sinclair, 2008). A type of constructivism is experiential learning (Dewey, 1938; Kolb, 1984). Experiential learning is consistent with a deep approach to learning, as opposed to surface or strategic learning approaches (Munn, 2003). As students engage in this deep approach, they begin to relate their learning to previous learning as well as their own personal experiences, thus continuously building and strengthening the scaffolding (Biggs, 1994).

Experiential learning projects can foster the development of interpersonal skills through group work (Burdett, 2003; Kennedy, Lawton, & Walker, 2001; Lang & Dittrich, 1982). Teaching students how to work collaboratively at undergraduate level is recognised as the single most important factor in ensuring the development of other, associated graduate skills and abilities, not only at university but also during work placement and employment (Crebert, Bates, Bell, Patrick, & Cragolini, 2004). Students develop the understanding, sensitivity and critical interpersonal skills needed in modern workplaces (Hunter, Vickery, & Smyth, 2011). While group work is commonly used in teaching, it tends to be underused in sustainable assessment. This is problematic because assessment occupies such a central position in learning systems. Described as the de-facto curriculum (Rowntree, 1977), effective assessments provide stimulus for learning

(Dean & Cowley, 2009; Lizzio & Wilson, 2004) and a means to ensure achievement of intended learning outcomes (Houghton, 2004). Both are important in the contemporary higher education (HE) sector with its growing focus on accountability, quality assurance and enhancement (Biggs, Kember, & Leung, 2001). The need for as well as benefits and drawbacks of collaborative assessment, in particular, at university level have been widely cited (e.g. Devlin, 2002; Hunter et al., 2011). Less developed are the practical frameworks for facilitating group work assessment (Brandt, 2011). Two exceptions are the comprehensive online resources on student assessment provided by University of Technology Sydney (UTS) (2010) and a guide by Devlin (2002) to assessing group work, though these both focus on the face-to-face, not virtual environment.

Despite the general merits of group work, the call for more group work in marketing education (Fontczak, 1998) and the significance of assessing group work, only half of first-year marketing subjects offered at Australian universities assess student learning in collaborations (von der Heide, 2010). Further, even though the take-up of virtual learning environments at universities (e.g. Learning Management Systems (LMS), such as Blackboard) is growing, most collaborative learning occurs face-to-face between on-campus students. Students studying by distance, who rely almost exclusively on information technologies, such as Blackboard, Elluminate Live (EL), a virtual classroom, and Wikis to facilitate interpersonal communication, are rarely given the opportunity to work together on major assessable projects through virtual teams or eGroups. A virtual team –whether comprised of students or employees – is defined as a group of geographically and/or organisationally dispersed coworkers assembled using a combination of information and communications technologies for accomplishing an organisational task (Malhotra, Majchrzak, & Rosen, 2007; Townsend, DeMarie, & Hendrickson, 1996). The drawbacks faced by a virtual team, such as ineffective communication, difficulty in supervision and monitoring and the need for virtual work skills (Kurupparachchi, 2009) may limit the take-up of eGroups for assessment purposes in marketing education.

This paper presents a new curriculum design for eGroups in first-year external business students' marketing studies. Selected outcomes from implementing the design during the first offering in Session 2 2011 are described and provide the foundation for evaluating the effectiveness of the initiative. Some suggested improvements to the assessment design for the next offering (in Session 3) are outlined and interim results provided. Procedures to facilitate group work in the online environment are highlighted.

2. DESIGNING THE EGROUPE ASSESSMENT

As the study of marketing is important for all business students, Marketing Principles is a designated first-year core subject within the Bachelor of Business at SCU. The learners are diverse: Every year around 450 students from Australia and internationally (China and Papua New Guinea) complete this unit. Approximately 150 of these students are enrolled in distance mode (in Australia), with a high proportion working full-time. External students do not receive any face-to-face instruction and rely fully on technology to facilitate their learning. The assessment to which group work relates is a project in the form of a two-part collaborative marketing plan (Assignment 2) introduced in Session 2 2011 and weighted at 50%. Experiential learning is facilitated as students integrate learning from all 12 topics covered during the 14-week session. The project contains choice, moderate risk and high levels of collaboration to promote learning and as a means to achieve more employable graduates. The assignment is carefully scaffolded to anticipate needs of students struggling with the new approaches (major assessable group work and real-life marketing planning).

2.1 EGroup Design

The introduction of Assignment 2 to students in the Unit Information Guide (UIG) explains each aspect of group work pertaining to the assignment as per Devlin's (2002) and UTS' (2010) guidelines. This includes rationale for group work, group size, group tasks, group formation, getting started and managing the group, monitoring group work, managing risks of group work, collecting and writing-up group data, submitting group reports, assessment of group work and access to group work resources. Some highlights of the group instructions for external students are provided below.

2.1.1 Group Formation

Groups of three to four students are formed early in the teaching session using a technique called 'selective appointment', one of four techniques described by in the UTS (2010) guidelines. Homogenous groups are

formed on the assumption that groups work better when the members have more in common. The *primary* shared criterion is each student's grade expectation (High Distinction/Distinction, Credit or Pass) for the unit. This serves as an indicator of the amount of effort students are likely to invest in this assignment. According to UTS (2010), there are many advantages associated with this mark aspiration appointment system: (1) Students have some choice in the formation process, (2) high achieving students do not feel as though their marks will be dragged down by students aiming for a pass, (3) students with lower mark aspirations do not feel the pressure to have to perform and (4) it is relatively easy to administer. The *secondary* shared criteria used for eGroup formation is residential location of student. This gives students in an eGroup the opportunity to meet if in proximity. While for internal students the groups are formed in-class, external students provide their responses to the group forming questions in a special quiz set-up on the Blackboard. This data is downloadable to a spreadsheet and can be used to appropriately assign students to groups.

2.1.2 Getting started and managing the Group

Effective groups generally have regular and productive meetings, that is members get together *synchronously* – whether face-to-face or virtual (phone, skype, wiki, Elluminate Live). The initial start-up (or kick-off) meeting is particularly important, as it sets the ground rules and goals - a team charter - for the group. Once this is accomplished, *asynchronous* (non-timebound) communication within the group works sufficiently well, especially for external students. Once the groups are finalised (just after census date in Week 3; final date for withdrawal without fail), students are asked to make contact with group members through their group wiki (or in-class) to establish a start-up meeting. At the first-meeting (by Week 4) students are recommended to undertake the following two exercises in their group - both available on the unit Blackboard Group work resources: ‘*Getting to know you*’ group exercise’ (an easy way to learn more about fellow group members) and ‘*Team charter exercise*’ (seek agreement on name of group, meeting methods and times, procedures for poor contribution from other students, decision making processes and, importantly, goals). Further, to ensure that equal status of group members is maintained, students are urged to adopt a rotating role structure. The means that the common team roles are randomly assigned in the first meeting and then rotated on a regular basis: *Facilitator* (chairs the meeting), *Time keeper* (keeps the meeting to time), *Recorder/note taker* (takes the minutes of the meeting), *Devil advocate* (critically examines the ideas of the group members and tries to avoid ‘group think’ emerging within the group), *Team players* (support the other roles through active promotion). As the group gets underway, other useful tools are available on the unit Blackboard Group work resources: ‘*Team meeting report*’ – a basic action plan (What to be done? By whom? By when?). This helps the group stay on track. It can easily be placed on the group wiki and ‘*Team review exercise*’ – a tool to rate a group's strengths and weaknesses.

2.1.3 Monitoring the eGroup

Each group is essentially self-regulating. This means that the group is responsible for managing its own meetings and achieving its goals. To help monitor progress, a different member from each group is asked to give a verbal progress report at an Elluminate Live sessions on a weekly or fortnightly basis. Regular verbal reporting is beneficial because it holds members accountable, allows each member to gain experience with making presentations, keeps communication channels open in the group (between members) and helps groups compare their progress to other groups.

2.1.4 Managing risks of eGroup Problems

Students may face a number of risks by working in a group, e.g. social loafing, dominating members and conflict. This is a true reflection of a workplace environment where people must work together. The instructions and resources provided are designed to help students take responsibility for making their group work. Students who feel their group is not managing these risks sufficiently well by itself, may contact their tutor for assistance. They are requested to provide the tutor with completed copies of the above-mentioned forms to demonstrate that the group has already taken all possible steps to address the issue(s): Students are reminded that if their group chooses to separate, the team work component of the mark is deducted.

2.1.5 Collecting and writing-up eGroup Data

To facilitate the collection and writing-up of data within each group, a wiki for each group is established once group membership has been finalised. Individual students can make own contributions and edit other

group members' work on the group wiki. The wiki page can be used to draft the content of Parts A and B and to post the various team exercises mentioned above to your group wiki. Use of the group wiki is *optional*. Parts A and B of Assignment 2 are submitted online by one member of the group to the Blackboard site using the text matching software 'Turnitin'.

2.1.6 Assessment of eGroup Work

Group members receive the group mark for assessment purposes, whereby peer assessment is used to moderate the mark. Students are asked to indicate – for each group member – whether the contribution to group work was more than, less than or equal to 'fair share'. To do this, students individually complete a confidential "Peer assessment of group contribution" form for Assignment 2 Parts A and B and submit online. If no forms are submitted, a 'fair share' contribution by all students is assumed.

3. EVALUATING THE EGROUP ASSESSMENT – FINDINGS SESSION 2

Because it is a major assessment innovation in the curriculum, the effectiveness of the group-worked project needs to be monitored and evaluated, as suggested in the higher education literature (Biggs et al., 2001; Dunn, Morgan, O'Reilly, & Parry, 2004). A first evaluation of the group work procedures was undertaken after completion of Session 2 2011 to inform improvements to be undertaken in Session 3 2011. Three main data sources were used for assessment evaluation: (1) The new curriculum (as per the UIG) was previewed and critiqued by peers from teaching and learning and within the marketing discipline prior to implementation. Input from the five academics on the teaching team was sought throughout the teaching period regarding what worked, what did not work and how to improve. (2) Formal and informal student feedback was evaluated to inform the new curriculum (e.g. von der Heide & Ponir, 2011) and has been used to determine further curriculum improvements. (3) Throughout Session 2, the effectiveness with which the new curriculum was implemented was carefully observed. For instance, all assessments for each Session 2 student cohort were moderated (sampled) to identify, where possible, and correct issues.

The quantitative results for Session 2 are presented in Table 1. In brief, of the 105 post-census date students, 81 (77%) passed the subject, achieving an average of 35.91 (credit grade) in the 50% eGroup assignment. To assess the extent to which eGroup helped with learning, students were asked to rate group work in terms of challenging them to do their best work. On a 5-point scale (1 = not at all; 5 = extremely so), the mean score for 36 Session 2 external students (43% response rate) was 3.39 (67.8%). This compares favourably with the impact of online quizzes on learning, which scored 3.22 (64.4%), but less so with the impact of the marketing plan tasks on learning (3.91; 78.3%). These results indicate that the majority of students are satisfied with the eGroup design. Some typical external student comments in a reflective exercise on the eGroup experience in Session 2 were:

"One member of our group initially appeared shy and unmotivated in our live online chats through Elluminate Live. I tried to motivate her through encouragement, asking 'do you have any questions?'. This didn't work as she would answer 'No'. So I changed my tactic and started asking open-ended questions. This encouraged her to talk and motivated her to participate more. This was a skill I learned by doing this task, and I feel it will benefit me in my professional career." (member of eGroup 17)

"Having never really worked in a group situation such as this, I feel my ability to work with others and contribute to the assignment equally was something that was enhanced by this process. Having the support and diversity of a group is something I felt really worked and enhanced the all round appeal of this assignment." (member of eGroup 21)

"I find watching the self worth and esteem grow in a group that receives acknowledgement and gratitude for their efforts from the group very personally gratifying." (member of eGroup 24)

"We had a really good mix of group members with different skills that we all contributed evenly and on time." (member of eGroup 25)

However, discussions with tutors at team debrief sessions and student feedback obtained through surveys in Session 2 2011 indicated that the group work aspect of Assignment 2A and B also had some problematic aspects: (1) For Students, time commitments for higher grade aspirations used to determine group membership were not always fully understood. Attrition of group members meant that some groups had fewer than three members. Approximately one-third of eGroups were affected by students withdrawing from the unit. Further, the relative contributions by students were not always properly indicated on peer

assessment form. (2) For markers, coordination between external student markers was not always smooth. The group work criterion on the rubric was sometimes interpreted differently. Finally, peer assessment feedback form was not always accounted for.

4. CHANGES FOR SESSION 3

Session 3 2011, which follows immediately from Session 2 2011, presented the first opportunity to address the group work issues identified in Session 2. As only external students are permitted to study in Session 3, collaboration was by way of eGroups only. This section discusses each of the three main changes to eGroups undertaken in Session 3 based on the feedback from Session 2.

4.1 Improve Group Formation and Stability

Three interventions were designed to address the major Session 2 issue with group work – appropriate forming of groups and maintaining group membership. This was particularly problematic for the eGroups, i.e. for collaborating external students.

4.1.1 Increase Number of Students with Appropriate Grade Aspiration

This change relates to the formation of groups using the selective appointment technique. To help students determine a more realistic grade aspiration, explicit guidelines were added on the appropriate amount of time to spend on the group assessment task per week for each of the five grade levels. The question students had to answer (using the ‘test’ function in Blackboard) was worded as follows: *Which grade will you work toward achieving in this unit? Please be realistic, i.e. keep in mind your other work, study and family commitments and your need for R&R. As a guide, to achieve: a HD, you will need to spend 4+ hours per week on Ass2 and group work; a D, 3-4 hours per week; a C, 2-3 hours per week; a P, 1-2 hours per week; Fail, 0-1 hours per week.*

Further, to increase the response rate to the two group formation questions, more email reminders were sent to students. These two initiatives resulted in a 15% increase in the response rate to group formation questions: S3: 75% (42 of 56 enrolled at the time); S2: 65% (85 of 130 enrolled at the time). This permitted a more informed allocation of students to groups, i.e. grouping of students with similar task commitment for group list based on data from the group formation questions. This, in turn, led to more stable groups: Based on S2 data, groups in which students indicated grade aspiration, the attrition rates were lower and performance was higher.

4.1.2 Reduce Student Attrition in the Group

To address the problem of student attrition within Assignment 2 groups, students were regularly reminded (in EL lectures, per Blackboard announcement and per emails) to carefully consider their commitment to the unit by census date (date before which withdrawal is without penalty). Unlike Session 2, groups were finalised *after* census date to ensure maximum stability of group membership. To encourage fast and committed group work, all groups were advised immediately after census date to make contact with their fellow group members. A detailed “Welcome to your Assignment 2 group” email was sent to all students advising on how to get started in their group, how to work online in their group and providing the Assignment 2 due dates. In addition to the group wikis set-up in Session 2, another Session 3 initiative and related project activity was to also set-up student group pages, which enable file exchange, discussion boards and emails between members within a group. As evident in Table 1, these measures have helped to reduce attrition and fail rates in S3.

4.2 Improve Student Compliance with intended use of the Peer Evaluation Form

To help ensure that students properly complete the peer assessment form, the form was revised to address the problems, such as over-rating themselves. Also, the term ‘peer assessment’ led some students to confuse this piece with the actual Assignment 2A&B assessment, causing mix-ups with the assignment upload. Hence, the following changes were undertaken: (1) An ideal rating column was inserted showing that, ideally, each

group member should be rated as a '3' = fair share contribution; (2) The name of the form (as well as Assignment content area and Grade Centre columns) was changed to 'Peer rating'. Initial feedback from tutors suggests that these changes help clarify the use of the forms to students and, hence, achieve higher levels of compliance.

4.3 Improve Quality, Consistency and Speed of Marking Group-Worked Assignments

In addition to the interventions to improve student group performance, the managing and marking of the eGroups required attention. Accordingly, three initiatives were introduced in Session 3.

4.3.1 Increase Uptake by Markers in Rubric re Peer Ratings of Group Work

To ensure that markers view and take into account the group members' peer ratings in the analytic rubric (Excel file) for each part of Assignment 2 (A&B), a reminder note was added to the 'Assessor's comments'. Before clearing the cell and adding their comments, the markers are prompted to ensure that they have checked one of the three possible ratings for the criterion 'Professionalism: Individual peer rating of group contribution' in the rubric:

(a) Peer ratings not received → no moderation of marks required unless others' peer ratings show otherwise

(b) Peer ratings received; all group members contributed fairly → no moderation

(c) Peer ratings received; NOT all group members contributing fairly → moderation required (25% increments).

To ensure markers' consistency in applying adjustments in case (c), the value of increments to be added or deducted for each greater or lesser level in share of contribution was specified on the rubric. (For instance, if two group members rated a third member as contributing *less* than fair share to the assignment, 25% of the group mark would be deducted from that member's mark. If two group members agreed that a third member contributed *more* than fair share, that member would received 25% on top of the group mark.) This procedure had previously been discussed with markers in a meeting, but was not consistency followed. In line with ALTC research fellow, Beverly Oliver (2011), each rubric's standard descriptors was adapted to better indicate to student the standard achieved for each assessment criteria, e.g. "acceptable-developing" instead of "Pass" and "proficient" instead of "Credit"..

4.3.2 Consistent Evaluation of the Team Criterion in Rubric

A further improvement to the analytic rubric for Assignment 2 (A&B) was to clarify the expected standards of teamwork performance. Previously, some markers were unsure as to what qualified as evidence of teamwork and whether to apply the teamwork mark to the group or to individuals. The rubric now specifies that evidence of organised teamwork may be presented in the assignment (e.g. group charter, minutes of group meetings), in-class, in group wikis or group pages. The UIG and the rubric indicate that the mark awarded is for the group, unless moderated on the basis of peer assessment. The S3 markers were reminded that individual marks for teamwork defeat the purpose of fostering teamwork and should be not awarded.

4.3.3 Accelerated and Error-Free marking through Advanced Group Management

In addition to setting-up group wikis and group pages in Blackboard, in S3 – for the first time – each group was linked to the Grade Centre using 'Smart Views'. Markers and tutors can now readily identify, manage and mark students within a given group. This speeds up marking significantly and allows markers to readily cross-reference students marks' and peer ratings, thus reducing errors. Feedback from both tutors on this initiative has been very positive.

As shown in Table 1, the changes to eGroup procedures in Session 3 appear to have had an impact in terms of reduced student attrition and failure and more favourable student attitudes toward the value of collaborative learning, whereby the average performance of completed projects has remained stable (ca. 36 out of 50%).

Table 1. Comparison of Session 2 and 3 data

| | | Session 2 | Session 3 |
|---|----------------------------------|-----------|-----------|
| Students | Passed | 81 (77%) | 36 (84%) |
| | Failed | 24 (23%) | 7 (16%) |
| Number of groups | Passed students | 30 | 15 |
| | Failed/withdrawn post census | 16 | 5 |
| eGroup average score (out of 50%) for passed students | | 35.91 | 35.87 |
| eGroup score standard deviation | | 6.05 | 5.92 |
| Average no. of students per group | | 2.7 | 2.4 |
| Group work challenged me to do my best work | (1=not at all; 5 – extremely so) | 3.39 | 4.71 |
| More able to motivate and manage groups | | 3.31 | 4.43 |
| Better able to manage projects | | 3.26 | 4.43 |

5. DISCUSSION AND CONCLUSION

This paper outlined a scholarly approach for evaluating and further improving a curriculum innovation in sustainable assessment, namely the eGroup aspects of a major collaborative marketing plan assessment. It is in line with calls for us to become better teachers by endeavouring to become more critically and more deeply reflective (Brookfield, 1995). Through a process of ‘reasoned confrontation’ (Reynolds, 1998), the group work component of this learning and assessment task was systematically and iteratively scrutinized. The process for doing so was outlined here in an attempt to model an evidence-based approach to our teaching. Feedback from expert teaching and learning instructors, as well as peers and students was canvassed and is accounted for. The result of such an exercise is that we are in a better position to understand our assessment rationale and to devise appropriate procedures to ensure assessment works as intended.

The findings presented in this paper show that assessable eGroups play an important role in the curriculum. Students who genuinely engage with the group tasks can perform well. Learning management systems, such as Blackboard, and applications, such as wikis and Elluminate Live, can be used to facilitate group formation, management and assessment. This means that external students do not need to be excluded from collaborative assessment, and an aligned curriculum can really be achieved in a converged or blended learning context. While group work adds complexity to the task for both staff and students, it can be effectively designed and implemented, as was detailed in this paper. The pay-off in terms of developing professional collaborative skills critical to success in business (Australian Business Deans Council, 2011) is indisputable.

In the case of Marketing Principles, clearly, the impact of group work improvements implemented during the course of S3 2011 needs to be further monitored. Maintaining the momentum with regard to continuous improvement is important, so that the educational experience is as effective, authentic and contemporary as possible. 2012 will still be about consolidating and refining the new assessment regime introduced in S2 2011 to smooth out any problems. For instance, monitoring and reporting using existing LMS features is cumbersome, especially for large, diverse cohorts and multiple markers, and ‘workarounds’ still need to be developed. As the academic team becomes more comfortable with the collaborative experiential Assignment 2, further innovation to build graduate capabilities (Oliver, 2011) may be considered in 2013. Possibilities might include more collaborative teaching, incorporating an e-portfolio approach, self-assessment, more peer assessment and, possibly, some cross-unit assessment (e.g. group work in first-year Management and first-year Marketing). Ideally, group work skills should be developed throughout a course or program to give students ample opportunity and time to practice.

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AN ANALYSIS OF SOCIAL PRESENCE AWARENESS IN E-COLLABORATION OF POSTGRADUATE STUDENTS

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ABSTRACT

The reformation of the higher education system in South Africa resulted in the merging of several universities with a large number of students at the postgraduate level. Tshwane University of Technology, like other South African universities has varied learning sites in different geographical locations. Interaction between postgraduate students and their supervisors or subject instructors is often limited and confined to formal spaces and time. This then means that students tend not to have the necessary platform to address their on-demand learning problems or challenges, as they move away from university formal spaces. The limited and inconsistent learning support hinders a smooth learning experience, often leading to delayed or incomplete learning tasks, including research works. The alternative for students is then to seek support from knowledgeable peers, who are often dispersed in varied geographical locations. This paper argued that an e-Collaboration environment may provide the just-in-time learning support needed by postgraduate students. The educational challenges faced by students may be alleviated if a correct platform is provided for them to be able to consult with each other or their instructors. To this point, the paper sought to analyse how awareness of social presence may help address the challenges by facilitating e-Collaboration.

KEYWORDS

Awareness, Context, Social presence, e-Collaboration, Postgraduate students

1. INTRODUCTION

Students use the awareness of social presence, while in different contexts, for learning and knowledge transformation (Kekwaletswe, 2007). With relevance to this paper, majority of postgraduate students do not reside on campus while others are situated in other countries and continents. Currently, learning activities at the postgraduate level are often confined to particular places resulting into challenges regarding accessing knowledgeable peers and choosing the right time to collaborate with each other. Therefore, it is important for students to be aware of the affective, interactive and cohesive indicators as they use web-based tools for effective e-Collaboration among them. Additionally, the fact that students are not aware of knowledgeable peers calls for social presence and context awareness in their collaboration activities. Thus, their sense of belonging and communities should be created; focusing on similar or relevant interests and inquiries among the students (Seaba and Kekwaletswe, 2011).

Student-to-student interaction and collaboration are afforded by social presence since these activities involve group work, group discussions, brainstorming, group assignments, group projects, and online group debates. In collaborative learning activities, social presence eliminates the students' full dependence on the instructors (Whiteman, 2002) by allowing continued mediated social interaction among students; coupled with the expression of emotions and cohesiveness expressed in a number of ways, including the use of emoticons, humor, and self-disclosure. Kuehn (1993) noted that text-based, asynchronous interactions use unconventional symbolic representations such as emoticons to facilitate the way people express themselves when interacting online.

This paper reports on a study conducted to analyse social presence in e-Collaboration of postgraduate students. The objective of the paper is to determine how awareness of social presence affects e-Collaboration of postgraduate students; and subsequently conceptualise a social presence based e-Collaboration framework. The following research questions drove the study: *1. how does social presence awareness affect e-*

Collaboration of postgraduate students? 2. how can a social presence based framework be conceptualised to facilitate e-Collaboration? E-collaboration activities at the postgraduate level were studied and analysed using social presence indicators with the focus on how students collaborate using web-based tools; and how aware they are about each other's presence. Majority of research studies on e-Collaboration focus on the elements of e-Collaboration, factors that influence e-Collaboration while other studies are concerned with the development of e-Collaboration frameworks. This paper extended the existing body of knowledge by providing insight into the link between e-Collaboration and social presence. Social presence has in previous studies been associated with Web-based learning. In this paper, awareness of social presence was the premise for e-Collaboration among postgraduate students.

2. SURVEY OF LITERATURE AND THE THEORETICAL FRAMEWORK

2.1 E-collaboration in Higher Education

The term e-Collaboration is increasingly being used to refer to collaboration activities made possible by the use of information and communication technology (Weiseith et al., 2006).. E-collaboration is the purposeful application of collaboration technologies to support groups in the creation of shared knowledge toward collaborative effects (Munkvold, 2005). As emphasised by Anaya and Boticario (2011), new information and communication technologies have strengthened the application of collaboration as a learning strategy. Therefore, e-Collaboration is applicable in the different contexts, including the higher education context.

According to Kock and Nosek (2005), the earliest articles on e-Collaboration dated back to the 1990s. However, research on e-Collaboration has a long history, possibly started in the late 1970s. Among multifarious related research studies is that of Computer Supported Collaborative Work (CSCW), which was also conducted in the 1970s, followed by a conference in the early 1980s considered as the foremost meeting point for CSCW researchers. CSCW research brought technological solutions to e-Collaboration problems to the forefront.

Another e-Collaboration research (Kock and Nosek, 2005) targeted a group of technologies namely Griup Decision Support Systems (GDSSs) which has grown over the years to become the main area of research in information systems. The advent of the Internet brought in researchers from different disciplines and areas of investigation into the realm of e-Collaboration research. Among those disciplines are human resources management, accounting, marketing, clinical psychology, economics and education. This has led to the development of many communities such as communities of inquiry dedicated to addressing issues in connection with e-Collaboration research. Another trend is the integration of communities with the intention of bringing together scholars through the identification of diverse issues required for e-Collaboration research to occur (*ibid*,2005). E-collaboration is not limited to supported cooperative work or computer mediated communication, because in addition to computers, other existing electronic technologies support collaboration among individuals who work together towards a common goal.

Collaboration in the learning context is carried out by small interactive groups; thus, effective learning is made possible when students work in groups, express their thoughts and collaborate to establish group-based solutions to different problems. Furthermore, student-to-student collaboration helps students to achieve higher levels of academic objectives (Andreas et al., 2010).

2.2 Computer-supported Collaborative Learning (CSCL)

CSCL research has three categories namely: distance education, information retrieval and information sharing (Andreas et al., 2010). Therefore, collaboration of students in geographically dispersed locations is supported by cCSCL.

CSCL has been recognized as a major research field over the years. Most importantly, participants do not work in isolation using digitized materials and technologies; rather, they embark on social interactions, knowledge co-construction and communication. Another activity involved is the posting of ideas and comments while working within the CSCL environment for the generation of questions and revision of ideas

to advance knowledge within the community Chan and Chan (2011). Specifically, the collaboration element distinguishes CSCL from the broad e-Learning practices (Stahl et al., 2006).

2.3 Learning Concepts that Support e-Collaboration

2.3.1 E-research

E-research is applied in many different disciplines and uses tools for improving human interaction and support collaborative activities (Maeder, 2008). E-Research allows for wider participation in cutting-edge research projects (Voss et al., 2009). A study conducted by Lariviere (2006) showed that academic practices, specifically research practices, have become more collaborative over time. Melin (2000) emphasized that collaboration in research results into more collaborative work, higher level of knowledge, expertise and quality of research. Other advantages of collaboration in research include “higher motivation, potentially higher efficiency and effectiveness, greater productivity, a higher quality of output due to peer reviewing of co-authored work” (Duque et al., 2005).

Research collaborations are based on sharing of resources. Furthermore, in other situations, it is impossible to accomplish the objective without collaboration when the required knowledge spans multiple fields. In the higher education field, the importance of collaboration is recognized in a number of publications when researchers or postgraduate students write research papers together. Their research findings show that collaboration improves learning, and that it is a main factor in academic achievement (Borgman, 2006).

E-research is another form of collaboration (also referred to as e-Collaboration) and facilitates collaboration through the access to content, tools, and services in distributed locations. Borgman (2006)'s research findings pointed out that “research specialties that are more collaborative and make more use of instrumentation are more likely to use e-Research technologies”. Additionally, researchers who collaborate tend to have the same disciplinary knowledge and skills due to the fact that research is more collaborative and not a solo activity (*ibid*, 2006).

2.3.2 Social Constructivism

According to Lou and Macgregor (2004) social constructivist viewpoints have contributed to the reshaping of social aspects of learning enhanced by technology (Koschmann, 1996). Instruction can be improved by making a shift from lecturer-centered to student-centered social-constructivist paradigm where students are encouraged to work collaboratively with their peers in both face-to-face and online environments (Institute for Higher Education Policy, 2000).

Student-centered pedagogical approaches are gaining momentum in higher education. An essential principle is the establishment of a problem and the opportunities given to students to progressively analyse the problem from different perspectives collaboratively as a group (Poell, 1998).

Collaborative learning is highly essential in cases where students have to work on academic activities in the form of groups. In this context, from a social constructivist perspective, students with varying levels of knowledge collaborate and work together in small groups towards a shared goal (Salomon, 1993), motivating students to direct their learning activities (Harrison & Stephen, 1996). Several meta-analyses of small-group collaborative learning research indicate that students who form part of collaborative groups possess the necessary collaboration skills including interpersonal, group management and inquiry skills (Lou et al., 2001).

2.4 Theoretical Framework

2.4.1 Social Presence

Presence can be grouped into two broad types: social and physical presence. The physical type of presence refers to interactions in a physical location in which the medium of interaction seems to be invisible. On the other hand, the social type refers to communicating with someone, coupled with the implication that the medium seems to be transformed into a social entity. These types of presence are not established based on the same experiences and the same characteristics of communication. One can possibly experience physical presence without any level of social presence, and on the contrary one can experience social presence without physical presence. This can be referred to as virtual social presence Rogers and Lea, 2005).

It is argued that distinguishing the physical from the social presence enables “a reconceptualization of social presence that has significant consequences for the representation of groups in computer mediated or virtual environments” (Short et al., 1976). One of the most effective theories revolving around presence was the social presence model established by the Communication Studies Group at University College in London (*ibid.*, 1976) which is defined as the degree at which the medium allows interpersonal contact and is closely linked to intimacy and immediacy. In this paper, social presence is defined differently as: “the sense of being with others” (Heeter, 1992), “level of awareness of the co-presence of another human”, the “feeling that one has some level of access or insight into the other’s intentional, cognitive, or affective states” (Biocca & Nowak, 2001).

Social presence consists of and is dependent on certain indicators including, cohesive, affective and interactive; these indicators afford the social presence needed among people who are embarking on collaborative projects (Boston et al., 2009). Eggins and Slade (1997) noted that responses are advantageous in a conversation: they establish sense of community, express the willingness to interact, help and increase interactions. In addition, responses indicate acceptance of the initiator; they build and sustain relationships, express willingness to mutual and interpersonal support and also serves as an encouragement to interact with peers. Interpersonal needs such as affiliation and self-esteem can be satisfied only through interaction with peers. However, reinforcement facilitates the establishment of interpersonal interaction. In turn, reinforcement in a text-based interaction is communicated through compliments, acknowledgements and expressing appreciation (Rourke, 2001).

The cohesive social presence indicator is concerned with building and maintaining commitment in a group. It is defined by: *phatics*-communication used to share feelings instead of communicating information or ideas. Bussman (1998) mentioned that *phatics* include informal conversations or “communicative acts such as formal inquiries about one’s health, remarks about the weather, or comments about trivial matters”. Vocatives: addressing peers by names; is an important expression of group cohesion. In support of this, Eggins and Slade (1997) noted that the use of vocatives ensure that social presence exists; vocatives indicate an establishment of closer relationships among peers. Inclusive pronouns indicate a feeling of togetherness (Sanders and Wiseman, 1990).

2.4.2 Social Presence in a Collaborative Setting

The main goal for establishing social presence in the e-learning environment is to create a level of comfort in which people feel relaxed and free around their peers (Whiteman, 2002). In other words, the absence of social presence decreases the amount of knowledge that could be shared as well as the personal relationship among group members. In support of (*ibid.*, 2002), social presence is enhanced when groups of students work in an online environment (Yoon, 2003). Additionally, Short et al., (1976) stated that interactions are socially meaningful when there is evidence of the other person’s presence; this indicates the importance of virtual social presence in an e-Collaboration environment.

Stacey (2002) mentioned that online collaborative learning of students highlighted the importance of interactive online group discussions for the understanding and interpretation of different concepts. Through collaborative group interactions, students communicate different perspectives, discuss ideas and receive responses from peers. The mutual understandings are developed through verbal interactions. When students are able to project themselves into an online textual environment with little visual contact, online learning is effectively facilitated (*ibid.*, 2002). According to Aragon (2003), recent research acknowledges the fact that social presence is an element, among others, that contributes to establishing a sense of community among students in dispersed geographical areas.

Social presence in the education context leads to the need for students to establish identity with others (Whiteman, 2002). High levels of social presence create an approachable and friendly learning environment (Rourke et al., 2001). This shows that social presence supports affective learning objectives by ensuring that group interactions are engaging and rewarding. It is therefore important for students to know exactly how to create this social connection within the learning contexts. In this paper, social presence was used to determine how its awareness affects e-Collaboration of postgraduate students.

3. RESEARCH METHODOLOGY

The interpretive paradigm was followed in the study where Tshwane University of Technology, located in the city of Pretoria, South Africa, was used in the qualitative case study. Selective sampling, specifically purposive sampling was then used to select participants; according to Harry (2005), this kind of sampling is suitable for qualitative case studies and focuses on sample selection based on relevance to the context and problem.

In South African universities, including Tshwane University of Technology, masters degrees are categorised into two: masters by full research only and masters by coursework and research. On the other hand, doctoral degrees are all by research only, therefore students who enrolled for masters by research and coursework need to collaborate as they work on collaborative assignments or projects. Those enrolled for degrees by research only need to collaborate for knowledge sharing and transformation as well as collaborative paper writing and publication. Moreover, students have to accomplish their learning objectives while situated in different geographical locations. Therefore selected students were requested to use both synchronous and asynchronous web-based systems for embarking on their projects and sharing knowledge.

In the study, *blogs* were utilised, because they are one of the fastest growing online media inventions which are written chronologically through the use of entries or posts. Most blogs include links, text, video, images, and a mixture of other features and opinions. They are easily accessible and create a platform through which students can connect, interact and collaborate online. New online communities of people who share similar interests or opinions can be established through blogs. In other words, blogs are forums that connect students with different types of issues, problems and tasks; irrespective of their levels of study (Hamill, 2009). Postgraduate students were requested to join the created *E-collaboration Times* blog for synchronous interactions. *WebCT*, a university learning management system, was also used since students are reasonably familiar with it, and know how to use discussion boards and communication tools. It was used to gather long text responses to open questions, and enabled the analysis of textual interactions without the need for additional data entry where students had to complete forms.

Electronic mail was also used for textual interactions because it is the primary medium currently used by the students. The mails helped in the understanding of how asynchronous e-Collaboration could take place among the students. In addition to web-based systems, the understanding, exploration and description of e-Collaboration were made possible through interpretations of the data collected from contextual interviews with students.

Shank (2002) as cited by Goethals et al., (2004) defines qualitative research as “a form of systematic empirical inquiry into meaning”. Therefore, qualitative research is an interpretive approach (Denzin and Lincoln, 2000) because it is concerned with seeking deeper insights into a phenomenon. Hence, the study took the qualitative nature due to the fact that data were based on the actual understanding, inner feelings and perceptions of students which could not be measured and analysed statistically or quantitatively. The social presence indicators were used to analyse the collect data with the focus on how social presence awareness affects e-Collaboration of postgraduate students (research question 1). Findings presented in the succeeding section are based on the analysed and interpreted data with the aim of presenting the social presence-based e-Collaboration conceptual framework (research question 2).

4. SOCIAL PRESENCE AWARENESS IN E-COLLABORATION OF POSTGRADUATE STUDENTS

In synchronous e-Collaboration, two out of three of the affective indicators did not exist but students disclosed themselves and quoted each other's statements while collaborating on the blog. Cohesive indicators were identified and this indicates that despite the absence of most of the affective elements, self-disclosure via the blog profiles contributed to the sense of togetherness and belonging in the group leading to the possibility of working on their assignment.

On the other hand, in asynchronous e-Collaboration, all the affective indicators were not expressed: emotions, humour and self-disclosure. It was also drawn that interactive indicators were also absent and this demonstrates lack of interactions, which might possibly lead to poor collaboration. All the cohesive elements were identified and based on this; the interpretation is that sense of cohesion or togetherness or unity alone

affects e-Collaboration negatively as questions pertaining to the projects were not asked and group members' statements were not referred to.

Gorham and Christophel (1990) noted that humour serves as an invitation to initiate a conversation; additionally, it reduces social distance, and it conveys the willingness to share learning experiences. Therefore, humour may help maintain social presence and could be used as a strategy for eliminating challenges concerned with similarity among group members. The absence of the affective and interactive indicators indicates lack of understanding and cooperation. Thus, cooperation among the collaborative group can be referred to as another additional social presence awareness action, in addition to the interactive, affective and cohesive indicators.

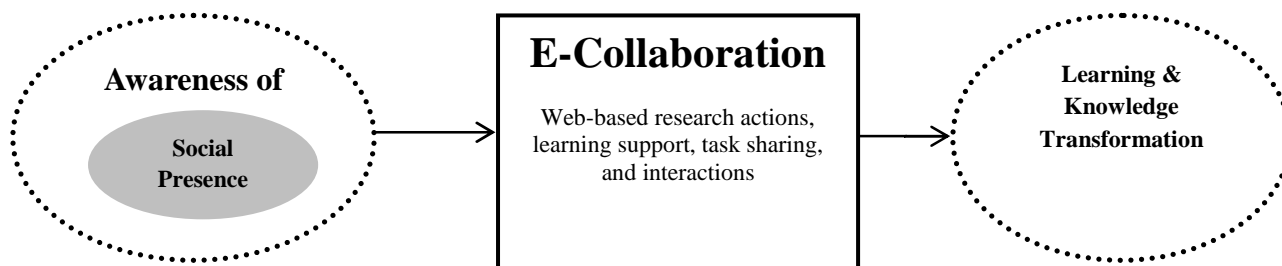


Figure 1. A conceptual social presence awareness framework for e-Collaboration amongst postgraduate students

The influence of social presence awareness on collaboration is highlighted when students are aware of each other's feelings through the use of emoticons leading to frequent or decreased interactions and an establishment of sense of community; further resulting into the completion of knowledge transformation. The interactions, task sharing and experience sharing activities create an e-Collaboration environment in which knowledge transformation is made possible. This is in support of a suggestion made by Kekwaletswe (2007) that transformation of knowledge is dependent on social presence indicators. This means that if the affective, interactive and cohesive indicators exist in an e-Collaboration environment, learning activities are completed and students' level of knowledge is somehow shared and refined.

The influence of context awareness indicates that in addition to the social presence indicators, students should be aware of the context in which e-Collaboration should occur. This includes the awareness of availability of peers who are knowledgeable enough to share their skills and expertise; thus ensuring that an effective e-Collaboration environment is created. Context awareness also covers the awareness of time, the location of self and that of others, awareness of the appropriate web-based tools as well that awareness of the social and academic background. This is to ensure that students collaborate with the same objectives, common interests and focus.

The analysis of social presence indicators and their influence on e-Collaboration showed that they sway interactions and collaboration very differently – negatively and positively. This is due to the fact that when students use asynchronous web-based systems (emails), they do not have the platform to express their emotions explicitly; thus creating an unfriendly e-collaboration environment in which knowledge transformation is not made possible. On the other hand, in asynchronous e-collaboration, affective and interactive indicators are minimal.

5. CONCLUSION

The limited and inconsistent learning support hinders a smooth learning experience, often leading to delayed or incomplete learning tasks, including research works. The alternative for students is then to seek support from knowledgeable peers, who are often dispersed in varied geographical locations. This paper argued that an e-Collaboration environment may provide the just-in-time learning support needed by postgraduate students. The educational challenges faced by students may be alleviated if a correct platform is provided for them to be able to consult with each other or their instructors. To this point, it is important that the framework for e-Collaboration amongst postgraduate students be developed cognizant of the social presence awareness

indicators that would help students to establish sense of togetherness during e-Collaboration. However togetherness alone, without the correct platform or environment, does not help students to address their challenges as they work on their individual research projects, assignments and other collaborative tasks. Thus, it is paramount that the e-systems such as learning management systems (e.g., WebCT) used by students be re-designed sensitive to the social presence indicators and the context in which students often find themselves.

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EXPLORING CONSUMER CORE THEORY TO PREDICT YOUTH ADOPTION OF TECHNOLOGY BASED HIV/AIDS PREVENTIVE ACTIONS

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ABSTRACT

The consumer core theory is explored in this study to predict youth adoption of technology based HIV/AIDS preventive actions. The objective is to validate goal desire, goal intention, action desire and action intention elements of the consumer core model. Goal desire is assessed by anticipated emotions, goal intention is assessed by goal desire and action desire is assessed by attitude, social norms, perceived behavioral control and goal intention. Action intention that determines technology adoption is assessed by perceived behavioral control and action desire. This technology adoption model was tested using a paper-based survey distributed to youth aged 15-24 years. Data analysis was performed using an analytic modeling technique of partial least square. The three most important elements of the consumer core model that influence youth intention towards adopting technology based HIV/AIDS preventive actions were found to be perceived behavioral control, action desire and goal desire.

KEYWORDS

Technology Adoption, Health Behavior, Consumer Core Theory, HIV/AIDS Prevention

1. INTRODUCTION

The prevention of the spread of HIV/AIDS in the society remains an important issue to governments, interest groups, parents and individuals. In particular, reducing the spread of HIV/AIDS among youth aged 10-24 years is a millennium development goal (Kaplan, 2006). The prevalence rate of HIV/AIDS is reportedly high among youth aged 10-24 years and to date, health related studies have not found 100% cure for HIV/AIDS. Technology based preventive actions such as the use of condom to prevent sexual infection and mobile information technology to access and distribute relevant health information can help to minimize the spread of deadly diseases such as HIV/AIDS and to improve health outcomes. The technology based preventive approach is metaphorically premised on the analogies that prevention is better than cure and ignorance is worse than diseases. For example, having relevant information readily available at all places, at all times and to the right people can help to increase awareness and reduce decision making errors. It is our belief that by making relevant health information services available to youth, it is possible to reduce the spread of HIV/AIDS in the society.

There are several theoretical frameworks for identifying factors that impact on behavioral or action intentions of people to adopt new technologies. However, there seems to be insufficient studies on youth adoption of technology, especially in the contexts of healthcare (Aggelidis and Chatzoglou, 2009) and mobile technology (Khoumbati and Themistocleous, 2006). In addition, many existing studies focus on professionals, adults and studies on factors influencing technology adoption among youth have been limited (Umrani and Ghadially, 2008). Moreover, the state-of-the-art studies on youth are mainly focus on their positive development (Khalili and Olugbara, 2011; Catalano et al, 2010; Beals and Bers, 2009; Tebes et al, 2007; Gallagher et al., 2005). The understanding of factors influencing youth adoption of technology based HIV/AIDS preventive actions will help healthcare practitioners to design innovative strategies and provide ubiquitous services. This will also help developers to design specific technologies that are suitable for the needs of youth who have personal, social and cognitive differences from adults (Beals and Bers, 2009). The

technologies that are specifically developed for adults or general use may not easily adapt to the specific context of youth. As a result, there is an essential need to study technology adoption among youth so as to improve our understanding of technology requirements.

In this study, we explore consumer core (given the acronym CCore) theory (Bagozzi, 2007; Bagozzi, 2006) to predict youth adoption of technology based HIV/AIDS preventive actions. CCore is a latest individual-level consumer behavior theory that can be used to represent the decision making process behind technology adoption. The CCore model presents five central elements that constitute the heart of consumer decision making with regard to goal striving (Bagozzi, 2006). These elements are identified to be goal desire, goal intention, action desire, action intention and self-regulation. A goal desire is the result of deliberative or spontaneous goal setting processes. A goal intention is a self-commitment to strive towards attaining a desired end state and is stimulated by a goal desire. An action desire, which is also known as instrumental or behavior desire moderates the effects of a goal desire on a goal intention and the effects of an action desire on an action intention. An action intention, which is also known as implementation or behavior intention is a self-commitment to perform a particular action that leads to the realization of an end goal. A self-regulation is an active imposition of personal moral or self-evaluative standards to decide on ones desires. The decision may involve cancelling, overriding, modifying or postponing further consideration or implementation of the desire to act.

2. OVERVIEW

The concept of technology adoption generally refers to the acceptance and use of new technologies by people. Extant studies have revealed that people are often unwilling to adopt a certain technology even if the usage will result in an improved performance (Wu, 2009). Theories of technology adoption have been extensively applied to several application areas, including electronic business adoption by small and medium enterprises (Ifinedo, 2011; Ramayah, et al. 2009), diffusion of different information technologies within organizations (Tanoglu, et al, 2010), user adoption of mobile banking (Zhou et al., 2010), health information technology adoption (Kijisanayotin et al, 2009), instructor adoption of web-based learning systems (Wang and Wang, 2009), intention of public health nurses towards web-based learning (Chen et al., 2008), internet adoption (Porter and Donthu, 2006) and adoption of mobile communication standards (Tan, 2002).

The adoption of technology at an individual level is traditionally modeled within the theoretical framework of Technology Acceptance Model (TAM) (Davis, 1989). TAM postulates that technology adoption is determined by behavior intention (Liao et al, 2009), which is determined by a combination of perceived usefulness and perceived ease of use of a technology (Wu, 2009). Theory of Reasoned Action (TRA) (Fishbein and Ajzen, 1975), Theory of Planned Behavior (TPB) (Ajzen, 1991), theory of Diffusion Of Innovation (DOI) (Rogers, 1995), Social Cognitive Theory (SCT) (Bandura, 1986), Trans Theoretical Model (TTM) (Prochaska et al., 1998) and Precaution Adoption Process Model (PAPM) (Weinstein and Sandman, 2002) have also received increasing attention. The Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh et al., 2003) was developed to consolidate factors of eight older technology adoption theories towards improving prediction power through social factors. The Health Belief Model (HBM) (Rosenstock et al., 1988) is one of the most commonly used individual-level theories of health behaviors and behavioral change (Noar et al., 2008). HBM is a psychological tool that explains and predicts health behaviors based on attitude and belief of an individual (Wu, 2009; Airhihenbuwa and Obregon, 2000). Due to its flexibility, the model is widely used in health-related studies to predict behavioral change (Wu, 2009; Phuanukoonnon et al., 2006; Nejad et al., 2005; Rosenstock et al., 1988).

Some researchers (Chuttur 2009; Benbasat and Barki 2007; Bagozzi 2007) have pointed out several deficiencies of extant technology adoption theories. These deficiencies include naivety of extant theories, lack of any practical value and falsifiability, questionable heuristic value, limited explanatory and predictive powers, creation of an illusion of progress in knowledge accumulation and theoretically chaotic. The CCore model (Bagozzi, 2007; Bagozzi, 2006) was proposed to address these deficiencies and it has been successful in modeling consumer behavior and marketing-based decision process (Bagozzi, 2007; Bagozzi, 2006, Bagozzi et al., 2003). This individual level model has been extended to an organization level technology adoption framework by formalizing the likelihood that there is a portfolio of focal goals arising from super-ordinate goals of differing levels of perceived importance to be considered during a decision process

(Brandyberry, 2011). The CCore model has enabled us to unify technology adoption and health behavior through its goal and action components and it demonstrates an acceptable predictive power.

3. METHODOLOGY

The methodology of this study consists of a sequence of actions that must be completed to realize the objective. First, a conceptual model based on CCore theory was developed to predict youth adoption of technology based HIV/AIDS preventive actions. Second, the developed model was tested on data elicited by a survey method. Third, Partial Least Square (PLS) analytic modeling technique was used to analyze data and to determine the predictive power of the developed model. Moreover, crosstabulation and Pearson Chi-square were used to study the goal and action preferences of youth. In addition, k-related sample Friedman test was used to select the three most important factors that influence action intention of youth towards adopting technology based HIV/AIDS preventive actions.

3.1 Respondents

The data for this study was elicited by a survey that was administered to undergraduate students aged 15-24 years. These respondents were selected from Durban University of Technology (KwaZulu-Natal province) and Tshwane University of Technology (Gauteng province) in South Africa. KwaZulu-Natal province is the largest and mostly affected by HIV/AIDS among the 9 provinces in South Africa. The population of this province is about 11 million out of 50 million population of South Africa. Tshwane University of Technology is the largest Campus University in South Africa with over 65,000 students. Lecturers from the participating universities assisted the researchers to administer the survey and this yield a high response rate of about 89%. The targeted age group of respondents was 10 to 24 years to contribute to achieving health millennium goal. Moreover, because of the high affinity of youth aged 10-24 years for sex, they are susceptible to HIV/AIDS infection. This was revealed in a study conducted on African-American in 2006, which reported that 15% of all new HIV/AIDS infections occurred among the age group of 13 to 24 years (Cornelius et al., 2011). The number of new HIV/AIDS infection in South Africa is reported to be at 34% for youth (Rehle et al., 2007; Sonenstein et al., 1989).

A total of 200 surveys were distributed to the sampled Universities (100 per university), out of which 177 were returned. Among the returned surveys, 27 were unusable because 8 had cases of missing data, 9 had cases of respondents not having HIV/AIDS related goals and 10 had cases of overage respondents. As a result, 150 responses were used for data analysis. Results of data analysis reflect that no respondents in the age group of 10-14 years, 14% of respondents were in the age group of 15-19 years and 86% respondents were in the age group of 20 to 24 years. It is important to note that the majority of respondents were above 19 years of age, therefore they can make a better judgment on their HIV/AIDS related goals and actions. There were 59.3% male respondents as compared to 40.7% females. About 93.3% of respondents had more than 2 years of experience using mobile phones. Only 1 respondent did not own a mobile phone. Respondents were asked to select the type of human settlement they reside. In all, 50% respondents were from urban areas, 29.3% were from township areas and 20.7% were from rural areas. There were therefore enough representations from different human settlements.

Table 1. Profile of respondents (N=150)

| Characteristic | Content | Frequency | Frequency (%) |
|------------------------------|-------------------------|-----------|---------------|
| Age | 10 – 14 years | 0 | 00.0 |
| | 15 - 19 years | 21 | 14.0 |
| | 20 - 24 years | 129 | 86.0 |
| Gender | Male | 89 | 59.3 |
| | Female | 61 | 40.7 |
| Experience with mobile phone | Less than 6 months | 4 | 02.7 |
| | 6 months to less a year | 2 | 01.3 |
| | 1 year to 2 years | 4 | 02.7 |
| | Greater than 2 years | 140 | 93.3 |
| Own a mobile phone | Yes | 149 | 99.3 |
| | No | 1 | 00.7 |
| Place of stay | Township | 44 | 29.3 |
| | Urban | 75 | 50.0 |
| | Rural | 31 | 20.7 |

3.2 Measures

The survey instrument used to elicit data for this study had 15 items to measure the model factors. There were two sections A and B designed to reflect demography of respondents and model conceptual measures respectively. In Section A, respondents were asked to provide their demographic information and select their HIV/AIDS related goals and actions they would need to perform in order to achieve these goals. In Section B, respondents were asked to answer simple objective questions in relation to the selected HIV/AIDS goals and actions.

Respondents were allowed to select more than one goal and action. Goals were introduced with the statement “which of the following best describe your health related goals?” Response alternatives were (G1) to avoid being HIV/AIDS infected throughout my life time, (G2) to avoid being killed by HIV/AIDS in my life time, (G3) to avoid being a transmitter of HIV/AIDS throughout my life time, (G4) to contribute towards building an HIV/AIDS free society and (G5) I have no health goals related to HIV/AIDS. Depending on the goals that respondents had chosen, they were asked to select the actions necessary to achieve the chosen goals. Actions were introduced with the statement ‘which of the following actions will you undertake to achieve your health related goals?’ Response alternatives were (A1) I will abstain from casual sex in order to achieve my health related goals, (A2) I will use condom during sexual intercourse in order to achieve my health related goals, (A3) I will not share toothbrush and haircuts in order to achieve my health related goals, (A4) I will use mobile technology to access HIV/AIDS information in order to keep me informed on how to achieve my health related goals, (A5) I will promote the use of HIV/AIDS mobile technology to provide preventive guidelines to achieve my health related goals and (A6) I will share relevant information about HIV/AIDS using a mobile technology to achieve my health related goals.

3.2.1 Goal Desire

Three items were used to measure goal desire. The first item sought response to the statement, ‘My desire to reach my health related goals can best be described as’ and we use a seven-point scale with the response alternatives ‘no desire at all’, ‘very weak desire’, ‘weak desire’, ‘moderate desire’, ‘strong desire’, ‘very strong desire’, ‘very very strong desire’. The second item was worded as ‘I feel an urge or need to attain my health goals I have chosen’. A seven-point scale was used, anchored by ‘does not describe me at all’, ‘does not describe me very well’, ‘does not describe me’, ‘describe me moderately well’, ‘describe me’, ‘describe me well’ and ‘describe me very well’. The third item read, ‘My overall wish to attain the goal I have chosen can be summarized as follows:’ and provided response alternatives, ‘no wish at all’, ‘slight wish’, ‘moderate wish’, ‘strong wish’, and ‘very strong wish’.

In addition to the three items, anticipated emotions were also used to measure goal desire. Anticipated emotions refer to prefactual processes whereby a consumer considers how they would feel if they were to achieve a goal (anticipated positive emotion) and how they would feel if they failed to achieve a goal (anticipated negative emotion) (Bagozzi, et al. 1998). Anticipated emotions were measured with two items of positive and negative anticipated emotions. The scales for positive anticipated emotions were introduced

with 'Please take a moment to consider how you would feel if you were to succeed to achieve your health related goals.' Respondents were asked to express the felt intensity of each emotion presented using the subjunctive condition, 'If I succeed to achieve my health related goals, I will feel', seven positive emotions were excited, delighted, happy, glad, satisfied, proud, and self-assured. Negative anticipated emotions were introduced with the statement 'Please take a moment to consider how you would feel if you were not to achieve your health related goals. The subjunctive conditional for the negative emotions read 'If I do not succeed to achieve my health related goals, I will feel', ten negative emotions measured were angry, frustrated, guilty, ashamed, sad, disappointed, depressed, worried, uncomfortable, and anxious.

3.2.2 Goal Intention

Goal intention was measured using a single item, seeking response to the statement 'I feel certain that I will be able to attain my health related goals'. A seven-point scale anchored at 'does not describe me at all', 'does not describe me very well', 'does not describe me', 'describe me moderately well', 'describe me', 'describe me well' and 'describe me very well' was used to measure goal intention.

3.2.3 Action Desire

Two items were used to measure action desire and were introduced with the directive 'please express the overall strength of your desire to perform the actions necessary to achieve your chosen health related goals'. The first item sought agreement with 'I want to perform the actions necessary to achieve my goals' on a seven-point anchored 'strongly disagree', 'moderately disagree', 'slightly disagree', 'neither disagree nor agree', 'moderately agree', 'slightly agree' and 'strongly agree' was used to measure action desire. The second item sought response to 'My overall wish to perform the actions necessary to achieved my goals can be summarized as follows' the response alternatives available were 'no wish at all', 'slight wish', 'moderate wish', 'strong wish', and 'very strong wish'.

In addition to measuring action desire with two items, attitude, social norms and perceived behavioral control factors were also used. These factors have been found to be strong determinants of behavior (Armitage and Conner, 2001; Ajzen, 1991). Attitude is defined as positive or negative feelings of an individual about performing a behavior. It is determined through the assessment of individual beliefs regarding the consequences arising from a behavior and an evaluation of the desirability of these consequences (Ajzen, 1991). Subjective norm refers to the perceived social pressure to perform or not to perform the behavior (Ajzen, 1991). Perceived behavioral control refers to the perceived ease or difficulty of performing the behavior and it is assumed to reflect past experience as well as anticipated impediments and obstacles (Ajzen, 1991).

Attitudes were assessed by asking the respondent to react to the statement 'on the following scales, please express your attitude towards performing the actions necessary to achieve your health related goals', one seven-point semantic differential bad-good item was used to measure attitude. Two seven-point items were used to measure subjective norms and were introduced with the directive 'Please express how strongly most people who are important to you feel you should or should not perform the actions necessary to achieve your health related goals.' The first item stated 'Most people who are important in my life think I should perform the actions necessary to achieve my health related goals'. Seven-point scale anchored at 'extremely unlikely', 'strongly unlikely', 'slightly unlikely', 'likely', 'most likely', 'strongly likely', 'Extremely likely' was used to measure subjective norms. The second item was phrased, 'most people who are important to me would approve me performing the actions necessary to achieve my health related goals.' These items are frequently used to measure subjective norms (Bagozzi et al, 2003; Ajzen, 1991). Perceived behavioral control was measured with a single item asking "how much of control do you have over performing the actions necessary to achieve your goals?" The scale was anchored with 'no control', moderate control and total control.

3.2.4 Action Intention

In this study action intention or behavior intention determines technology adoption. Many previous studies have indicated that behavioral intention and usage of technology share a significant casual relationship and can be used to predict actual usage (Huang, 2010; Cheng et al., 2006; Venkatesh and Morris, 2000). For this reason, we did not measure the actual usage of technology based HIV/AIDS preventive actions, instead behavioral intention of youth towards adopting the technology based preventive actions was predicted.

Action intention was measured using three items. The first stated, 'the strength of my actual intention to perform the chosen actions necessary to achieve my health related goals can best be described as: 'a six-point scale was used with response alternatives labeled, 'no intention', 'very weak intention', 'weak intention', 'moderately strong intention', 'strong intention' and 'very strong intention'. The second item stated, 'In order to achieve my health related goals I have performed the actions selected:' and had five response alternatives labeled 'never', 'always', 'sometimes', 'regular' and 'often'. The third item sought response to 'I will expand efforts to perform the actions necessary to achieve my health related goals', the response alternatives available were similar to the first item of action desire. In addition to the three items used to measure behavior intention, perceived behavioral was also used. Figure 1 shows the research model depicting the relationships between the described measures.

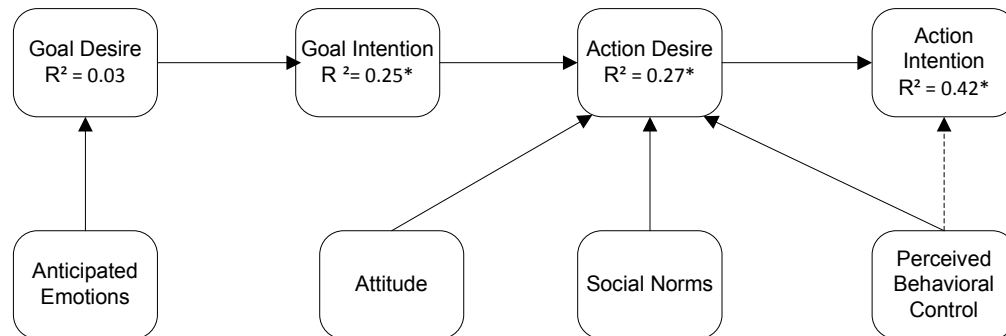


Figure 1. Research model

3.3 Data Analysis

All responses were coded for data analysis using Statistics Package for Social Science (SPSS) version 19.0 and SmartPLS software version 2.0 installed on Intel (R) processor personal computer running under Windows 7. The SmartPLS software version 2.0 facilitates the design of Structural Equation Modeling (SEM) that can be measured with PLS analysis method on a Graphical User Interface (GUI) (Hansmann and Ringle, 2004). The PLS (Ringle et al., 2005) analytic modeling technique was used to test the adequacy of measurements, verify factor validity and item reliability.

4. RESULTS AND DISCUSSION

The preventive actions that youth respondents selected to accomplish their health related goals were analyzed to determine the influences of goal on action. Table 2 shows the crosstabulation of this result, which indicates that out of 66 respondents who selected one action, 84.3% of them selected this action to realize exactly one goal. In addition, out of 74 respondents with one goal, 75.7% of them selected exactly one action to realize this goal (cell with column 1, row 1). According to this result, the realization of just one focus goal by one preventive action appears to be more important to the majority of respondents (37.3%) than having multiple goals or actions. Moreover, youth respondents would prefer to adopt a technology based preventive action that better helps towards their goal attainment. This result supports previous studies that users might be unwilling to adopt a certain technology (Wu, 2009), the user perception of a technology (Jung et al., 2009; Kuo and Yen 2009; Ha et al., 2007) and the criticality of what the technology provided can be key determinants of adoption (Zhou, et al., 2010). Finally, to determine a relationship between action and goal, the Pearson Chi-square is calculated. The error probability obtained for the Chi-square analysis is 0.000, which is less than 0.05 showing that there is a statistically significant relationship between action and goal.

Table 2. Goal and action crosstabulation analysis

| | | | GOAL | | | | TOTAL |
|--------|---|-----------------|--------|--------|--------|--------|--------|
| | | | 1 | 2 | 3 | 4 | |
| ACTION | 1 | Count | 56 | 7 | 2 | 1 | 66 |
| | | % within Action | 84.8% | 10.6% | 3.0% | 1.5% | 100.0% |
| | | % within Goal | 75.7% | 15.6% | 16.7% | 5.3% | 44.0% |
| | | % of Total | 37.3% | 4.7% | 1.3% | 0.7% | 44.0% |
| | 2 | Count | 9 | 15 | 4 | 5 | 33 |
| | | % within Action | 27.3% | 45.5% | 12.1% | 15.2% | 100.0% |
| | | % within Goal | 12.2% | 33.3% | 33.3% | 26.3% | 22.0% |
| | | % of Total | 6.0% | 10.0% | 2.7% | 3.3% | 22.0% |
| | 3 | Count | 6 | 14 | 2 | 5 | 27 |
| | | % within Action | 22.2% | 51.9% | 7.4% | 18.5% | 100.0% |
| | | % within Goal | 8.1% | 31.1% | 16.7% | 26.3% | 18.0% |
| | | % of Total | 4.0% | 9.3% | 1.3% | 3.3% | 18.0% |
| | 4 | Count | 2 | 2 | 4 | 2 | 10 |
| | | % within Action | 20.0% | 20.0% | 40.0% | 20.0% | 100.0% |
| | | % within Goal | 2.7% | 4.4% | 33.3% | 10.5% | 6.7% |
| | | % of Total | 1.3% | 1.3% | 2.7% | 1.3% | 6.7% |
| | 5 | Count | 1 | 5 | 0 | 3 | 9 |
| | | % within Action | 11.1% | 55.6% | 0.0% | 33.3% | 100.0% |
| | | % within Goal | 1.4% | 11.1% | 0.0% | 15.8% | 6.0% |
| | | % of Total | 0.7% | 3.3% | 0.0% | 2.0% | 6.0% |
| | 6 | Count | 0 | 2 | 0 | 3 | 5 |
| | | % within Action | 0.0% | 40.0% | 0.0% | 60.0% | 100.0% |
| | | % within Goal | 0.0% | 4.4% | 0.0% | 15.8% | 3.3% |
| | | % of Total | 0.0% | 1.3% | 0.0% | 2.0% | 3.3% |
| TOTAL | | Count | 74 | 45 | 12 | 19 | 150 |
| | | % within Action | 49.3% | 30.0% | 8.0% | 12.7% | 100.0% |
| | | % within Goal | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |
| | | % of Total | 49.3% | 30.0% | 8.0% | 12.7% | 100.0% |

The reliability and validity of items were estimated. Reliability is the assessment of the correlation between items and latent factors that they measure. Reliability analysis was performed by evaluating factor loadings to identify low reliability items. Many researchers have accepted items with a loading of 0.7 and above when adapted from other setting, but loading of 0.5 is accepted for a new item (Chin, 1998). In this study, measurement items were customized to suite our purpose and to enhance youth comprehension of the survey. Items with a factor loading greater or equal to a threshold of 0.5 were retained. Table 3 summarizes the mean, standard deviation, factor loading, minimum and maximum values for items. All factors show acceptable range of loadings showing that they have acceptable estimate of reliability.

Table 3. Means, standard deviation, factor loadings, minimum and maximum values

| Items | Mean | Standard Deviation | Factor loading | Minimum | Maximum |
|-------|------|--------------------|----------------|---------|---------|
| AD1 | 2.01 | 1.64 | 0.77 | 1 | 7 |
| AD2 | 2.03 | 0.79 | 0.88 | 1 | 5 |
| AI1 | 2.13 | 0.87 | 0.88 | 1 | 6 |
| AI3 | 1.94 | 1.54 | 0.70 | 1 | 7 |
| AT1 | 5.96 | 1.06 | 1.00 | 2 | 7 |
| BC1 | 1.51 | 0.52 | 1.00 | 1 | 3 |
| GD1 | 2.35 | 1.24 | 0.76 | 1 | 7 |
| GD2 | 2.82 | 1.43 | 0.76 | 1 | 7 |
| GD3 | 1.90 | 0.84 | 0.76 | 1 | 5 |
| GI1 | 2.87 | 1.26 | 1.00 | 1 | 6 |
| NA1 | 5.19 | 2.36 | 0.55 | 1 | 10 |
| PA1 | 2.88 | 1.99 | 0.86 | 1 | 7 |
| SN1 | 2.52 | 1.43 | 0.96 | 1 | 6 |
| SN2 | 2.19 | 1.33 | 0.79 | 1 | 7 |

The validity of factors was assessed by examining convergent validity and discriminant validity. Convergent validity is the extent to which items are related to each other and is used to ensure that items measure their respective latent factors and not another latent factors (Aibinu and Al-Lawati, 2010). Composite Reliability (CR) and Average Variance Extracted (AVE) are two metrics in PLS to determine convergent validity. CR is used to assess the reliability of scales and it is suggested to be greater than 0.7 (Aibinu and Al-Lawati, 2010). AVE is computed to determine the amount of variance that a latent factor captures from its measurement items and it should be greater than 0.5 (Fornell and Larcker, 1981). Table 4 shows the result of convergent validity, wherein all factors except emotions are seen to be valid because their CRs are greater than 0.7 and AVE greater than 0.5

Table 4. Composite reliability (CR) and average variance extracted (AVE)

| Factors | CR | AVE |
|------------------------------|------|------|
| Action Desire | 0.81 | 0.68 |
| Action Intention | 0.78 | 0.64 |
| Attitude | 1.00 | 1.00 |
| Emotions | 0.68 | 0.52 |
| Goal Desire | 0.80 | 0.58 |
| Goal Intention | 1.00 | 1.00 |
| Perceived Behavioral Control | 1.00 | 1.00 |
| Subjective Norms | 0.87 | 0.77 |

The discriminant validity was examined as part of validity test to determine if the measuring instrument can discriminate the factor being studied from other similar factors (Leedy, 1997). In doing this, an analysis of cross-loading of items was performed using SmartPLS path weighting scheme to estimate cross loadings of items. Table 5 shows this result where it can be seen that all items measuring a particular factor loaded high in their respective factor as compared to other factors in the model and are therefore discriminately valid.

Table 5. Estimate of items cross loading

| Item | Action Desire | Action Intention | Attitude | Emotions | Goal Desire | Goal Intention | Perceived Behavioral Control | Subjective Norms |
|------|------------------|---------------------|-------------|-------------|----------------|-------------------|------------------------------------|---------------------|
| AD1 | 0.77 | 0.46 | -0.24 | 0.16 | 0.31 | 0.20 | 0.25 | 0.12 |
| AD2 | 0.88 | 0.55 | -0.31 | 0.14 | 0.54 | 0.42 | 0.32 | 0.22 |
| AI1 | 0.56 | 0.88 | -0.40 | 0.13 | 0.47 | 0.35 | 0.39 | 0.26 |
| AI3 | 0.41 | 0.70 | -0.18 | 0.14 | 0.36 | 0.26 | 0.13 | 0.15 |
| AT1 | -0.34 | -0.38 | 1.00 | -0.06 | -0.39 | -0.25 | -0.23 | -0.16 |
| NA1 | 0.06 | 0.10 | -0.05 | 0.55 | 0.10 | 0.01 | 0.02 | 0.04 |
| PA1 | 0.18 | 0.14 | -0.04 | 0.86 | 0.16 | 0.03 | 0.08 | 0.14 |
| GD1 | 0.39 | 0.40 | -0.34 | 0.14 | 0.76 | 0.33 | 0.27 | 0.23 |
| GD2 | 0.30 | 0.33 | -0.18 | 0.09 | 0.76 | 0.41 | 0.24 | 0.08 |
| GD3 | 0.51 | 0.46 | -0.37 | 0.19 | 0.76 | 0.40 | 0.32 | 0.24 |
| GI1 | 0.39 | 0.39 | -0.25 | 0.03 | 0.50 | 1.00 | 0.30 | 0.13 |
| BC1 | 0.35 | 0.35 | -0.23 | 0.08 | 0.36 | 0.30 | 1.00 | 0.14 |
| SN1 | 0.23 | 0.26 | -0.14 | 0.12 | 0.24 | 0.13 | 0.14 | 0.96 |
| SN2 | 0.11 | 0.20 | -0.15 | 0.14 | 0.18 | 0.10 | 0.09 | 0.79 |

The completion of reliability and validity assessments allows for an evaluation of structural model, which presents information on path coefficients that indicate the strength of relationship (Ifinedo, 2011). Unlike other data analysis methods where there is a single goodness of fit metric for the entire model, the SmartPLS structural model is assessed by looking at the explanatory power and the path coefficients (Aibinu and Al-Lawati, 2010). Models with single goodness of fit may still be considered poor based on other measures such as R-squares and factor loadings (Aibinu and Al-Lawati, 2010; Chin, 1998). The explanatory power of a model can be evaluated by examining the variance in dependent factor explained by the model (Aibinu and Al-Lawati, 2010). A criterion used to assess the explanatory power of a structural model is the coefficient of determination (R^2) of latent factors (Henseler et al., 2009). R^2 values of 0.67, 0.33 and 0.19 in a path model are respectively considered to be substantial, moderate and weak (Chin, 1998). The number of latent factors

and their associated items posed a limitation, hence we estimate items that have a positive effect on the R^2 value of behavior intention (Venkatesh et al., 2003).

The R^2 value of 42% that was obtained for action intention is at moderate level. This result suggests that our model fit to data is of acceptable level for action intention. A significance test of the R^2 value was performed using F test for R^2 to determine whether the value is statistically significant from zero. This result indicates that the R^2 value for action intention is statistically significant from zero ($F=51.08$ and $p=0.0001$). As a result, it can be inferred that about 42% of the changes in action intention of youth to adopt technology based HIV/AIDS preventive actions is because of all the factors in the model. In addition, the R^2 value (3%) of goal desire is below the weakest level, goal intention resulted in a weak R^2 value of 25% and action desire is 27%. The low R^2 values for goal desire, goal intention and action desire might be as a result of fewer items used for measurement and low item scores obtained from respondents. This is not considered a critical issue in this study because we aim to predict behavior intention, which influences technology adoption. Consequently, our objective is accomplished using a CCore based model.

Finally, k-related sample Friedman test was applied according to mean ranks to select 3 most important factors that decision makers should considered while making decision in the future HIV/AIDS solution design. These factors are perceived behavioral control ($BC1 = 3.66$), action desire ($AD2 = 4.50$) and goal desire ($GD3 = 4.80$).

5. CONCLUSION

In this study, we explore CCore theory to predict youth adoption of technology based HIV/AIDS preventive actions. The elements of CCore were validated with a survey administered to youth aged 15-24 years from two universities in South Africa. The analytical modeling technique of PLS was used to discover how well data fit the CCore based model. Results of this study reflect that the predictive power of the model ($R^2 = 0.42$) is greater than the moderate level of 0.33 showing that our model well represented the survey data. This further suggests that factors included in the model sufficiently explain the variance of action intention of the youth in adopting technology based HIV/AIDS preventive actions. We hope that government, policy makers and individuals concerned about HIV/AIDS can benefits from the results of this study. Individuals and organizations willing to provide HIV/AIDS technology solutions can use the identified factors (perceived behavioral control, action desire and goal desire) in this study as a baseline to understand behavior of youth towards adopting such technology.

This study obviously has some inherent limitations. First, data were elicited from 150 respondents from two universities in South Africa, but a large sample size might be desirable to detect other significant effects. However, the use of a robust PLS analysis technique was able to alleviate the inherent problems with small sample size. Second, this study did not considered the effect of gender in youth adoption of technology based HIV/AIDS preventive actions. Lastly, casual relationships between model factors were also not considered to determine the robustness of the model. These three limitations will be addressed in the future study.

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PRINCIPLES OF A CIRM LOGIC FOR THE ARCHITECTONIC DIFFERENTIATION OF A FRONT OFFICE IN E-GOVERNMENT

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ABSTRACT

This article presents the architectonic principles of a CiRM- or Citizen Relationship Management logic, as is to be used in the front offices that have been under discussion for some years. Its intended application is aimed at facilitating a comprehensive and integrated citizen and corporate relationship management. Thus a necessary clarification of terms for the front office area is followed by a clear definition of vertical and horizontal integrations between various components of the front office, and facilitation of the traceability and coordination of transactions between front and back office organizations and their applications. Due to its diverse and multidimensional nature, the definition and structuring of the appropriate logic proves to be a highly complex task, for which it may also be useful to take a look at the private sector.

KEYWORDS

Citizen Relationship Management (CiRM), Front Office, Back Office, CiRM Logic, enterprise architecture, e-Government.

1. INTRODUCTION

1.1 Problem Definition

In the private sector the use of new media, including the internet and mobile communication, is a well-established communication channel with customers. In public administration however, the digital age is slow in coming. The variety of new and existing facilities for exchange of information between a government and its people offer many new possibilities for organizing. The administration currently focuses primarily on the web for customer communication, although counter service is still actively used as well. Surprisingly, other channels are painstakingly slow to take hold. A primary obstacle to the expansion of comprehensive multi-channel management (MCM) in front office (FO) organizational units of the administration, for example, is the lack of electronic customer ID. Within Citizen Relationship Management, Schellong (2010) illustrates (organizational) characteristics and task types of the telephone channel in service centres in counties and cities (311 numbers) in the USA. There is a need to differentiate between back office (BO) and FO in terms of transactions, interactions and business processes or tasks.

1.2 Objectives

This article pursues the following objectives: presentation of the requirements for integrated electronic communication with an administration's customers (purely operational/procedural); clear definition of the aforementioned term "CiRM logic" (linking of operational and technical concepts); presentation of the principles of CiRM logic, technical requirements, and specifications.

1.3 Methodical Approach

The following methodical and conceptual approach is used: The main terms used (some of which are unclear) are explained in the first instance. Conceptual and application-oriented aspects of technical support of the newly created front office in administration are also explained. Furthermore, interaction and transaction requirements are generically derived on the basis of generic transactions and processes, for example as specified by Behjat (2003).

2. PRELIMINARY CONCEPTUAL REMARKS ON THE CONCEPTUAL ASPECTS OF THE FRONT OFFICE

It is necessary to define the administration's various communication interfaces with customers, whether these are citizens, companies or other administrations. Interactions initiate processes which are in turn perceived as transactions. In the electronic case it is the administrative boundaries that lead from one information system to another. On the electronic level, systems must be "identified" in order to interact with one another. The FO may be regarded as the organizational pooling of communication units or channels which are responsible for media operation and for corresponding support activities. FO are typically organizational contact points of a virtual or physical nature, functioning as a one-stop-shop. Contact channels, i.e. manifestations of organizational units based on the operation of contact media at contact points, may be contact centre organisations, web communication organizational units, or counter teams. Inbound, these enable concerns communicated by customers to be "pooled" and handled via dedicated platforms; outbound, they are used for contacting customers. They advise, inform, support and receive complaints and, where necessary, coordinate the interactive handling of customers' concerns. A precise definition of the term "contact channel" is offered by Walser (2006), p. 39 with reference to Johnston and Marshall (2006): "A contact channel consists of the configuration of the following corporate elements: employee or customer roles, possible activities or processes to be carried out in the FO, and direct contact media. Contact channels must therefore be configured from the organizational perspective and in information and communication systems." FO are therefore used as an interface for communicating with customers and possibly for transforming these interactively presented concerns into interactions or transactions. A term already mentioned is the "one-stop shop". This concept has different definitions (cf. Von Lucke et al. (2008), p. 19.): single point of contact ("One Shop"; "One Center", "Single Window"), in which "single" means virtual and media-independent. It is also a communication concept for the pooling of administration services at one physical or virtual location and in one process, regardless of the location at which the services are provided and the numbers of producers of the service (cf. Kaftan (2006), p. 68; Von Lucke et al. (2008), p. 19. cf. with regard to One Stop: Franz (2003), p. 36; Kubicek and Hagen (2000), p. 8 f.; Lenk and Wimmer (2002), p. 17; Von Lucke et al. (2008), p. 19; Wimmer (2001), p. 6.). According to Schellong (2010), the term Citizen Relationship Management (CiRM) has to be understood as "[...] a strategy and set of management practices, enabled by technology with a broad citizen focus, to maintain and optimize relationships and encourage new forms of citizen participation". The CiRM logic mentioned above can additionally be defined as the organizational, application-oriented and technical logic for coordinating the multidimensional communication with customers in FO units and with the BO (cf. Walser (2006), Walser and Riedl (2010)). The separation of FO and BO may be regarded as division of (communicational and transactional) labour, with increasing efficiency and effectiveness in both areas.

3. FRONT OFFICE

3.1 Basic Considerations

The FO may be defined as an organizational unit, which (irrespective of the medium and contact channel used, and whether it is locatable or virtual), is the administration's single point of contact for its customers. The FO handles information and communication matters with customers, mostly involving transactions.

Transactions themselves are handled in the BO. The BO corresponds to existing departments of the administration. The task of the BO is to fulfil the transactions and the associated groundwork on behalf of the FO. However, the separation is also a means by which the administration can react more flexible in case of resources and staff shortages. Both FO and BO organizations may have different levels of centralization, decentralization and virtualization (for empirical results, see Schenk and Schwabe (2010)). Information provision, communication and advice are of central importance if direct contact with various departments is no longer necessary for customers to interact with the administration. The simplification is effected by a central and/or virtual contact point for interaction, which takes over coordination of the transactions with the various BO involved. Within the meaning of Schmid (1993) and the authors who reference it (cf. Lenk et al. (2010)), the advice cycle structure with all its dependencies as shown in Figure 1 and the phases visible in it may be differentiated as arrangement and structuring principles.

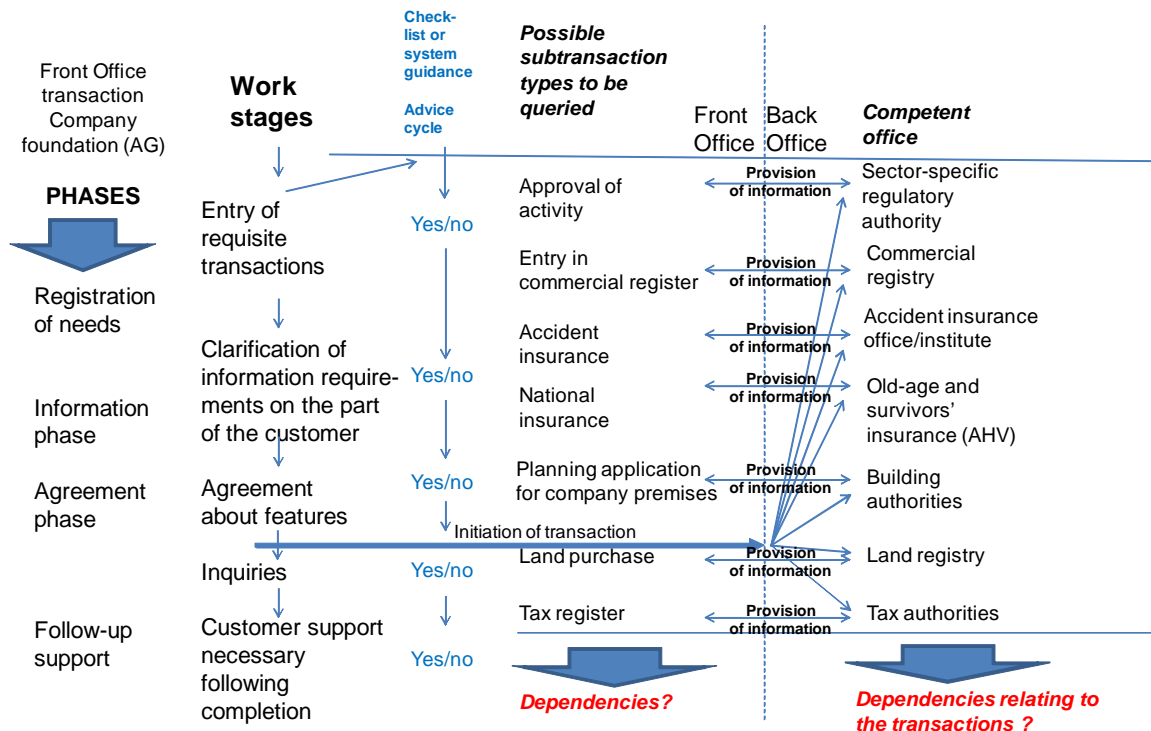


Figure 1. Structure of the advice cycle and relationships between front office and back office.

The aim is consistent multimedia management or multichannel interaction. A further objective is to clarify the division (distribution) of labour: which communication duties are handled, and by whom? How are customer inquiries and concerns to be dealt with? It may be useful if BO do indeed make information available, but this information must be released through the appropriate channel in a workflow. Changes in information also entail changes in communication. Central to the differentiation of communication activities in the FO is the linking of life-situation-specific transactions (with a view to linking with the BO) of advice cycles. These advice cycles may be life situation-specific checklists of back-office departments to be addressed and transaction-specific contents which may be implemented in information systems. Checklists enable customer-specific submissions, based on transaction or ticket numbers. These systems, with transaction or ticket numbers, enable customer's access at any time, even when channels are switched or simultaneously used. In addition, contact histories create an important record of the relationship, which are a fundamental resource for identifying specific customer concerns. The advice support is necessary not only for the staff in the FO, but also for customers because it is impossible to know all transactions in specialist departments for different customer types. It should also be possible, during all non face-to-face transactions, to request a phone call, a home visit or a website with additional details relating to the transaction. In follow-up to interactions, and also wherever simple information requests or even transactions may take place without

direct support from administration staff, self-service facilities may be launched (cf. inter alia Schedler and Proeller (2006) on self service in E-government). The FO should be designed entirely from the customer's perspective which then requires the BO also to be coordinated via the FO, since the customer is the subject towards which reorganization is directed. This also requires a paradigm shift in the administration's attitude about its customers.

3.2 Possible Localization of the Front Office in E-government

In addition to remarks about decentralized and virtual centralized FO, E-government FO can be localized and characterized at the following levels: state district or regional and federal as private FO, FO run by public private partnerships, international FO, FO across several federal levels or across several units within one federal level. By analogy with the single points of contact, based on the EU Services Directive, combinations of the versions mentioned are also possible. Municipalities, states or even countries, for example, can join forces to provide a FO service. A FO may be provided by intermediaries (e.g. chambers of commerce, notaries, lawyers). The legal conditions and characteristics vary according to the principle of federalism and autonomy in different states or communes.

3.3 Customers of the E-government Front Office

The definition of the customer is always dependent on the consideration perspective. The various customer perspectives are examined in somewhat greater detail below:

- Front-office perspective: the customers are the citizen or the company. From the perspective of the front office, the citizens as customers are also differentiated into claimants for state benefits, and voters and citizens (as determinants of the political system; sovereign). Citizen customers may be further differentiated, for example according to nationality, gender, circumstances, life situation, status, etc. Corporate customers may also be further differentiated, for example according to company size, industry, sectors, etc. Business situations may also be differentiated here as the counterpart to the life situation of citizen customers.
- Back-office perspective: the front office is the customer.
- Perspective of the intermediary between customer and front office or between customer and back office company: for the intermediary, the customer is the company or the citizen. For the front office, the customer is the intermediary.
- In process chains in the administration: administrative units may be customers or suppliers of one another, in this case of the same or another unit or level: for example, at commune level, state level, or national level.

The clarification of the corresponding customer perspectives simplify the definition of advice transactions and interactions and the definition of interfaces, for example the internal front and back-office interface, which should be as automated as possible so that – from the perspective of the end customer – the transaction savings resulting from the construction of front offices do not lead to increased coordination costs within the administration.

3.4 Aims of the Front Office from the Administration and Customer Perspective

From an efficiency-oriented perspective, the aim of administration in the front office must be to achieve communication, advice and follow-up logic that is as standardized as possible. The more standardized this can be made, the greater the potential for automation. The standardization is effected on the basis of defined transactions. The standardization can be taken to such an extent that the citizens or companies are guided so far through the process (possibly online via self-service environments or over the telephone via IVR and ACD1), that operators or human support are no longer necessary (aforementioned self service and

¹ IVR stands for Interactive Voice Response and ACD stands for Automatic Call Distribution. These are two typical functionalities as used in call centres or contact centres. The third functionality is CTI. CTI stands for Computer Telephony Integration. CTI enables the

aforementioned customer integration in the administration). There are still some hurdles to overcome in order to handle transactions online and by telephone. For example, registration services are to be introduced for personal identification, which can be initialized e.g. via cards and PIN codes or access codes, or it must be possible to facilitate security certificate-based official traffic without great complications. The aim must be to achieve communication that is as integrated as is necessary or possible e.g. via verbal communication over the web or telephone. A face-to-face communication should only still be used (possibly for an additional charge) where this is explicitly requested by the customer where necessary in exceptional cases, or where disability prevents the use of the appropriate media. From the customer perspective, the implementation of front offices serves to offer the population a round-the-clock² government service from under one roof. Depending on the way in which the service is formulated, the front office should ensure that calls are handled in the most favourable manner (i.e. the most efficient and effective way) and, where necessary, should keep customers informed as to what status their case/transaction has reached with possibly many different parties involved.

4. CIRM LOGIC AND COMPONENT DETAILS

4.1 Components in Detail

The CiRM logic may be defined as a combination of organizational and technological instruments, resources and methods, through which the coordination function of the FO between customers, stakeholders, BO, etc. can be simplified and designed more efficiently and effectively. The range of instruments, resources and methods is defined in detail below (cf. also Figure 2 for possible positionings). Integration of cross-section services such as registration, authentication, access control, authorization, document safe services, etc.: IDs of customers and administrative staff (that are already or not yet involved) are required for transaction handling, so that (digitally) transactions can be reconstructed and the statutory requirements observed and verified, even when transactions are handled virtually. Multichannel communication, media integration (demand aggregation) and management of consistent information provision with the useable channel: it must be possible, regardless of the selected communication channel, for the necessary documents to be accessed (by the customer in document safes). In addition, customer communication templates and advice methodologies should be implemented with templates, through which the information, advice and follow-up support of customers are automated, accelerated and more efficiently designed. This is particularly applicable if there are varying skill levels among employees in the FO. Examples of possible templates are communication campaigns, or advice methodologies for specific life or business situations to take into account all relevant parameters for handling the transaction, dealing with complaints, etc. Functionality for differentiated provision of electronic case data, customer files, cases³, etc.: with the provision of case data and tickets, the transactions can be reconstructed in detail, which may be a legal requirement... Depending on the specific department, various types of data relating to customer cases must be provided in electronic and non-electronic form. Access should be possible from the FO and BO perspective. Ticketing enables cases, including any orders, to be forwarded in a formalized or non-formalized way. “Destruction” of IT-architectonic silo integrations (communication channels vs. host systems) for ensuring consistency of interactions and transactions: the parts of the CiRM logic illustrated above are based on the principle that historically evolved silos are broken down or destroyed, whether these are silos from a web application to a BO system or silos within departments or organizational units which must be broken open so that they are available to all participants to the same degree in the interests of service orchestration. Customer data integration in the FO, between FO and BO, in and between BO is important for various reasons. Only when all necessary customer data for communication and transactions is available, can a comprehensive handling

functioning of computer and telephone to be integrated with one another. Call agents telephone via computers and use headsets to leave their hands free for processing transactions on the computer keyboard.

² Possibly not only with regard to FO, but also where necessary in the BO or even at night (for reasons of quantity or where the official services are urgently required, e.g. for issuing replacement passports or similar).

³ Cases are the form for processing and document preservation in the welfare and healthcare services. These are also known generically as (customer or patient) files. Cases should be able to be viewed by front and back offices where necessary. In this way, for example, the back office can be protected or shielded against unnecessary calls as far as is desirable and necessary.

of the customer's concerns be guaranteed. Customer data integration may be transaction-specific, life situations or business situation-specific. It can be facilitated, via the aforementioned cases, customer files or via tickets. Here it is possible to differentiate between generic or case-specific data integration. Relationship history and customer data integration: where data protection permits, automatic popups showing address data or civilian status which simplify communication in specific transactions can be used to identify the customer and to increase the efficiency of customer communication.. As part of this architecture, the presence of an electronic or non-electronic identification enables offices in communication with the customer to be presented with land registry plans of a property as well. Also within the administration, for example in street maintenance, land registry plans or geodata may be necessary to simplify the communication phase and the retrieval of paper-based land registry plans, and to design more efficient and effective customer communication. Clear definition of sequences and templates for interactions and transactions: the more generic the corresponding communication business processes are and the more frequently they are used, the easier it is to reuse them within a template, which ideally is as generic as possible for reuse in many departments with only minimal adaptation to individual requirements. Furthermore, using standard communication templates is beneficial for corresponding process automations. This is typically done via technical solutions such as workflow implementations and underlying interoperability templates for technical service or application integration. Clear definition of communication templates for use by customers: for BO staff, these are central to the proactively correct customer support strategy. They could be oriented on the basis of life situation or business situation. It is understood these templates are potential development trees for communication, through which the set of transactions-relevant trees for communication for FO or BO are always in view. Multiple inclusions of back-office applications (process chains): the integration between FO and BO is of central importance. If multiple connections of business processes are linked to form process chains or networks, status reporting must be made possible for the FO where necessary and desirable. These reports are also received by customers themselves or made accessible via FO. This facilitates tracking and tracing of the status of customer cases and transactions. In addition, the implementation of appropriate interoperability platforms is crucial for process chain integration (in order to reduce the administration's coordination and transaction costs). Clear definition of the connection between communication and transaction: this point has already been addressed.. An efficient integration platform is central for this purpose. In fact, it is central in defining the communication path from supply of information, through advice, to post-transaction follow-up. Management of process-specific and technology-specific patterns and pattern types: this may include communication, transaction and interoperability patterns, etc. Recognizing patterns enables existing operational and electronic solutions to be reused. Integration templates as such are implementations of the integration by means of the systems and/or mediator platforms (busses, hubs, brokers, etc.). Depending on the distribution of the administration's information systems, close, loose or mass data integrations are to be made possible for specific transactions. Official communication structuring: this is the pooling of facilities for specific target groups. In this process it is necessary to consider whether, depending on the scale and quantity of interactions and business of the target group, it is possible (for example) for separate and specialized FO units – or the corresponding groups therein, differentiated via various customer processes – to be addressed. Examples of this may be differentiated for the healthcare service or certain groups of foreign nationals, etc. The underlying objective must always be to communicate with citizens, companies and customers more effectively. Temporary data provision without transaction/ticketing and corresponding calls, on-demand services and mechanisms: these are communication templates in which no transaction occurs. Interactions that do not lead to a transaction may constitute a large number of cases, depending on the customer group or circumstances. Self-service aspects: self-service facilities may also be differentiated as a special instance of a web contact point. The simplest of these are Frequently Asked Questions (FAQs), they can significantly reduce the load on the FO provided the incentives to use them are in place. Continuing availability of data without transaction/files, cases, etc. and corresponding retrievals as well as on-demand services and mechanisms: this may be necessary if a new transaction is logged in, the person logging in is distracted, or certain additional tasks must be carried out in order to log in – such as obtaining documents, records etc. It must/should be possible for data entered temporarily to be kept available in this case without the entire procedure needing to be repeated up to the appropriate point. Knowledge management services with documentation and process derivations for the procedure in the FO and for specific details (necessary input parameters, execution parameters for the administrative procedure, necessary clarifications for enabling transactions to be initiated, etc.) of the great variety of administrative processes which may occur in the BO: depending on the departmental area, it must be necessary for the customer to be

integrated as far as possible into the fulfilment of the official service (customer integration) or of dealing with the matter as comprehensively as possible, so that it is possible for additional episodes, for example as a result of queries or problems, to be route-optimized.

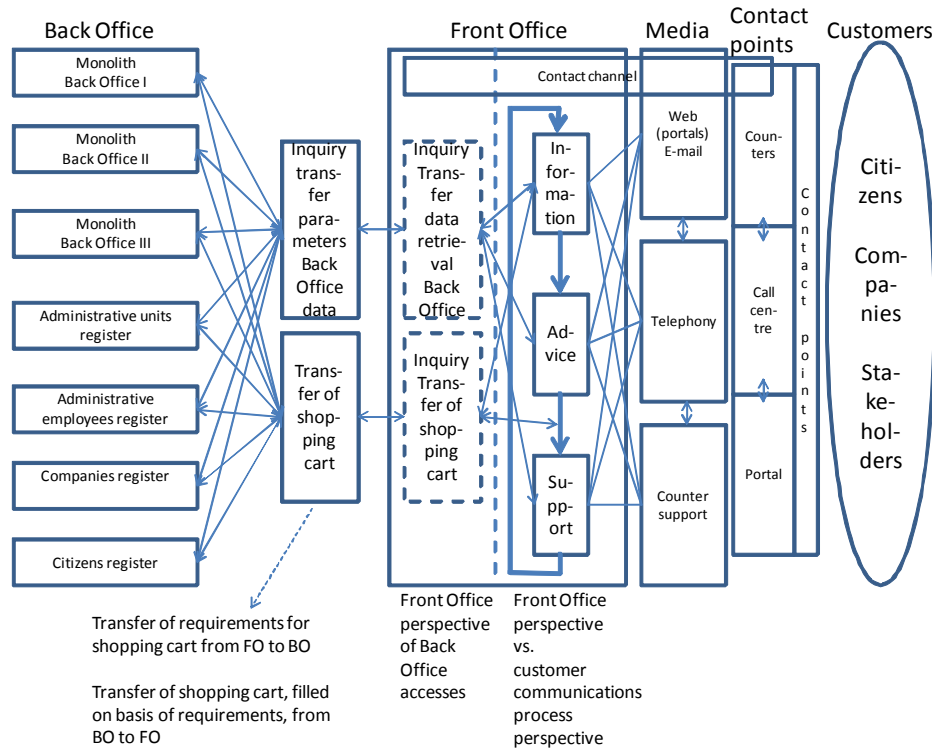


Figure 2. Illustration of the implementation locations and options for CiRM logic.

Stochastic transactions (FO) versus deterministic transactions (BO): the communication cycle is run through fully or partially within a transaction. For every communication episode, another run-through becomes due. Since this communication cycle is based on reciprocity, it may also be called a “zipper of interactions”. The communication that takes place therein does not simply lead to a definite end. The outcome of the communication may therefore be described as stochastic, in contrast to the back-office transaction which is deterministic in character, e.g. the issuing of a tax assessment. Figure 2 shows a map in which some of the front-office principles and aspects of the CiRM logic as defined in this section may be localized and put into practice.

4.2 Benefits of CiRM Logic for Administration and Front Office

The following benefit categories of IT investments in the FO area and in the CiRM logic may be considered as the generic framework of benefits from IT investments according to Nagel (1990), (p. 31): competitive advantages, productivity improvements and cost savings. The following are just some examples of resulting advantages: competitive advantages for location; settlement of high net worth citizens, etc. depending on how the municipality/commune, district/canton, or state is positioned in national competition. The following are examples of productivity: transaction cost savings (reduction in bureaucracy) for the customer, risk of new, higher transaction-related coordination costs created within the administration; elimination of any increased coordination costs through systematic and comprehensive technical integration and interoperability internally; integration of process chains and value-creation chains with potential for productivity improvement. The following savings in transaction, coordination and bureaucracy costs may result from the implementation of FO: reduction in distributed, decentralized personnel with FO tasks in the individual

departments through centralization of personnel with communication-based tasks in the FO; integration across the various media leads to reduced transaction and coordination costs; management of historical and communication records to avoid constant follow-up inquiries about cases; management of cases – by electronically collating all relevant documents, references, signatures, identifications, address data, communication histories, etc. – which is open and available for everyone involved, results in savings in time and costs. It is necessary to take an even more differentiated view of benefit. It is possible that the benefit to the customer is a more integrated FO while administration will be differentiated by integrated FO with simultaneous integration of the BO. This aspect is not examined in greater detail here.

4.3 Special CiRM Logic Area: Communications Processes between Administration and Customer

A special case of CiRM logic is represented by the cross-channel and multi-institutional handling of communication processes as a stringing together of communication episodes (“zipper of interactions”) and, where possible, the anticipation of this “zipper of interactions”. Authorities communicate with customers according to law. Communication processes may be continuous or suspended midway and resumed later. In certain cases it would be helpful to know the content of previous communication. The communication processes between administrations and customers is diverse and complex, as well as ultimately dependent on the departmental area with which the communication occurs. Simultaneous communication happens in companies where several departments are in communication with authorities at the same time, or if a customer uses several media simultaneously. However, it is also possible to differentiate between synchronous and asynchronous communication. A medium is used for communication which permits a more or less rich communication (Media Richness Model and Theory of Media Synchronicity Dennis and Valacich (1999), Gronover et al. (2004), Senger et al. (2002)). It is possible for episode-oriented, phase-specific communication models to be differentiated for life situations, implying differentiated communication between authorities. Lifecycle-oriented communication models, or even target-group-specific models, are also conceivable. For the life situation concept, it is crucial that the mix of media used in the course of the various life phases can be changed, and that the use of the various communication channels by the FO also change accordingly. Furthermore, it is necessary to differentiate proactive communication (outbound, from the perspective of the administration) from reactive communication (inbound, from the perspective of the administration awaiting communication from the customer).

5. INTEGRATION OF FRONT AND BACK OFFICES

5.1 Abstract Front and Back Office Dependency and Interaction Templates

The following generic and not empirically tested templates relating to FO and BO dependencies and interactions may be considered for illustrative purposes (cf. Figure 3): Case 1 – A possible interaction template between FO and BO, starting with a customer communication, appears as follows: Contact with FO initiated by customer; first sub-process in the BO; return to FO; forward to next BO for sub-process handling; return to FO; forward to next three BO; return to FO; FO to customer. Case 2 – However, another possible interaction template between FO and BO, starting with a customer communication, may appear as follows: contact with FO initiated by customer; FO contacts first BO (with or without transaction⁴); first BO contacts second BO (with or without transaction); second BO contacts third BO (with or without transaction); third BO contacts fourth BO (with or without transaction); fourth BO feeds back with new status to FO; FO contacts customer with feedback on status or transaction results. Case 3 – Another possible interaction template between FO and BO, starting with a communication from the BO, may appear as follows: contact initiated by BO to FO (with regard to customer communication; e.g. in order to clarify address data following

⁴ It is possible that only clarifications are needed, or retrievals of (more complex) information by the administration, which customers may require as part of a decision process and which do not necessarily result in back office data transformations and therefore transactions.

a divorce); FO contacts customer; customer obtains clarification; customer contacts FO; FO contacts one or more BO to hand over the necessary information or documents; update data in further locations, registry database, etc.; feedback to the FO; FO updates the customer and transfers the results of the transaction. Not shown above is the case of a straightforward retrieval of information from the FO without the BO being contacted.

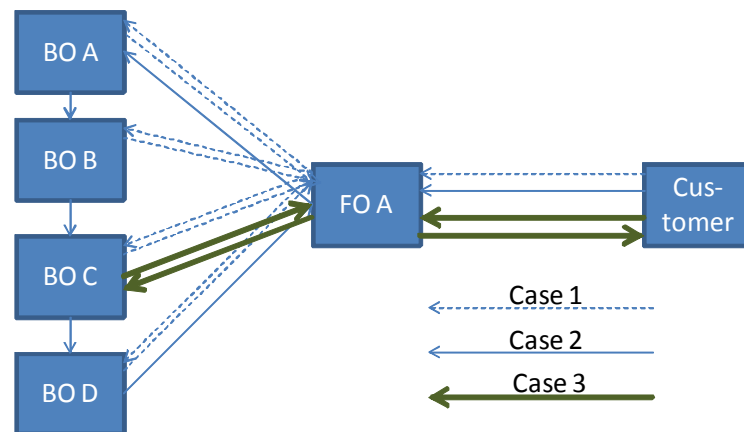


Figure 3. Communication processes between customer, front office, and back offices (inbound/outbound).

This may be necessary, for example, for inquiries about the administration's hours of operation and office locations, or even to inquire about the status of a transaction, where the status notifications from the BO(s) are still reported to the FO and can be called up under a tracking and tracing procedure, etc. It is also possible – for example when clarifying the establishment details of a service company – simply to request advice, which the FO can provide itself depending on its competence and area of responsibility, without needing to make contact with the BO. In this instance the advice concept and the corresponding technical support for BO staff in turn plays an important role, so that even employees who have little knowledge of the transactions are also able to provide the appropriate advice. Intelligent FO advice tools and CiRM logic are required accordingly.

5.2 Support or Cross-Section Services required in the Front Office

The following cross-section- or support services are required in the FO. They must be incorporated into CiRM or FO logic as and when required: integration of a great variety of transaction services from many different BO; integration of virtual mailbox services (document boxes or safes); integration of collaboration services, e.g. for implementation of common electronic form completion; integration of identification and authentication services; integration of card services of many different types, e.g. for identification, payment or other services, e.g. door opening or access to document safes; integration of register services connected with card, identification and authentication services; services for security tunnelling for synchronized processing of official (electronic) documents by FO employees and customers. In the E-health context, this typically involves patient records. In the E-government context it typically involves decisions and documents to be signed. Further, additional/support services may be incorporated into CiRM or FO logic: integration of invoicing services in connection with payment services and card services and their integration. Since BO information systems – if not broken open for service-oriented architectures – are usually monolithic, encapsulations of these systems via service-oriented architectures are required of the type that enables their functionality as services to be addressed. Thus communication interactions can be supported in the FO by the appropriate functionality; back-end services – i.e. encapsulated services from the BO systems – are orchestrated via bus and intermediary “constructions” as required. This does however demand a certain maturity in the business architecture management (in the BO). It also requires standardization of necessary services, starting with a consistent and channel-specific catalogue of services by the FO and BO. This includes the necessary linking of FO and BO services.

6. CONCLUSIONS

This article defines various terms, starting with what a FO is, how it can be delimited from the BO and what kind of features an E-government FO should have. This is followed by a detailed description of what is meant by the term CiRM logic in this article. This is a core element of that which characterizes a FO. The CiRM logic is defined as the organizational and technical methodology and the corresponding instrument housing, by means of which the handling of communication in the FO becomes possible in relation to the BO. This includes, for example, the destruction of the silo integrations, the continuous understanding of the communication and relationship processes which (may) precede and follow a transaction, the features of these communication processes and the specific definition and implementation of various interoperability requirements. Further to this, the article also shows which support services are required from the perspective of the FO and which FO and BO integration variants exist. Much remains to be done in the specific definition of the CiRM logic. First of all the conceptualization must be standardized and consolidated, further refined and specified. Further, it is necessary to investigate in detail what variety of the communication processes that are currently largely denied in the administrative environment and their mapping can and must be addressed in the FO. By studying the communication templates and the communication structures, it is possible to make further steps towards increasing efficiency and effectiveness in communication with customers of the administration. However, to this end the administration must understand and accept communication in its environment as an independent and value-adding factor. Another area to be handled is the further development of interoperability as discussed in the context of the CiRM logic.

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A COMPARISON STUDY OF E-GOVERNMENT ONTOLOGIES

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ABSTRACT

Since e-Government has an increasing influence on how government business processes evolve and change, this paper applies the method of systematic review for identifying, extracting and analyzing the principal proposals for e-Government ontologies. The most mature proposals have been selected and compared by using a formal framework, extracting the key requirements that an integrated and unified e-Government ontology should have, and providing the first steps towards its definition. Ten e-Government ontology models were identified from a systematic review of literature. A ten point comparison framework was developed to consider the underlying concepts as well as application of the ontology models. The comparison results were then synthesised into six gaps to inform future e-Government ontology research. This work is a rigorous and systematic attempt to identify and synthesise the research in public administration ontology.

KEYWORDS

Ontology, e-Government, Public Administration.

1. INTRODUCTION

In order to exploit all the benefits associated with government integration, public sector has to shift its practice from information hoarding to information sharing. Ontology has been suggested as the means for solving this problem.

The principal objective of ontologies is to establish ontological agreements that will serve as a basis for communication between either human or software agents, thus the decreasing language ambiguity and knowledge differences between these agents which may lead to errors, a lack of understanding and unproductive efforts (Angele, 1981), (Bateman, 1995).

This paper aims to review and analyse existing public administration ontology models in order to inform future e-Government ontology research. The next section outlines the method employed for the review of literature. The third section introduces the identified public administration ontology models and analyses them by applying a comparison framework while the analysis results are presented in the fourth section. Finally the paper concludes with final thoughts and possible future research challenges.

2. REVIEW METHOD

A systematic literature review approach proposed by Tranfield et al. (2003) have been used to identify the current e-Government ontology models. It consists of three sequential stages: (1) review planning; (2) review execution; and (3) results analysis.

2.1 Review Planning

The selection criteria used to evaluate the study sources was based on the research experience of the authors of this work, and these sources were selected by considering certain constraints: studies included in the

selected sources had to be written in English and these sources had to be web available and possess search engines that would allow us to execute advanced search queries. The following list of sources was considered: Proquest, ScienceDirect, EBSCO, Compendex, INSPEC, Emerald, ACM digital library, IEEE digital library, SCOPUS, Scholar Google and DBLP.

The research question that was addressed by our review is as follows: What initiatives have been carried out to develop e-Government ontologies in the field of ontological engineering? Table 1 shows the keywords and related concepts that were used to formulate this question and which were used during the review.

Table 1. Keywords

| Area | Keyword | Related Concept |
|--------------|-----------------------|-----------------|
| Ontologies | Ontology | Ontological |
| | Ontology Model | Engineering |
| | Information Model | |
| | Semantic Model | |
| e-Government | Taxonomy | |
| | e-Government | Government |
| | Government | Public |
| | Public Administration | Administration |
| | Public Sector | |
| | e-Participation | |
| | e-Democracy | |
| | e-Procurement | |
| | e-Inclusion | |

As is shown in Table 2, we combined the selected keywords with AND and OR connectors to obtain our search chain.

Table 2. Search Chain

| |
|---|
| (Ontology OR Taxonomy) AND (Government OR (Public AND Administration) OR (Public AND Sector)) |
|---|

The abstracts and titles of papers returned from the keyword search were evaluated by the type of studies (mainly conference papers, working papers and journal papers) and time frame. The papers that satisfied these criteria then had the full paper read to evaluate for inclusion.

2.2 Review Execution

During this stage, the search has been executed in the defined sources and the obtained studies have been evaluated according to the established criteria. After executing the search chain on the selected sources we obtained a set of about 100 results which were filtered with the inclusion criteria to give a set of about 50 relevant studies. This set of relevant studies was again filtered with the exclusion criteria to give a set of studies consisting of 10 primary proposals (Table 3).

Table 3. e-Government Ontology Study Group

| Ontology | Project | Source | Countries Involved | Year |
|--------------------|---|------------------------|----------------------------|------|
| Access-eGov | Access-eGov | Schillinger et al. | DE, PL, SK | 2009 |
| BRITE | BRITE | Goens | BE, DE, ES, IE, IT, NL, SE | 2006 |
| DIP | DIP | Vasiliiu & Harand | GB | 2005 |
| EG BOnt | Research Project, National Social Science Foundation of China | Xiao et al. | CN | 2007 |
| EGODO | Reimdoc | Ortiz-Rodriguez et al. | ES | 2006 |
| eGTPM | Research Project, NTUA | Sarantis & Askounis | GR | 2010 |
| GEA | SemanticGov and OneStopGov | Peristeras et al. | AT, GB, GR, IE, IT | 2009 |
| Ontogov | OntoGov | Apostolou et al. | CH, ES, GE, GR | 2006 |
| Terregov | Terregov | Pérez & Labajo | BE, GB, GR, ES, FR, IL, IT | 2008 |
| Web Senior | Web Senior | Medjahed & Bouguettaya | USA | 2005 |

The obtained ontologies have been classified regarding their: (1) project (2) literature source (3) states involved and (4) implementation year. Once the primary studies have been selected, relevant information is extracted and results are described. In order to standardize the way in which this information will be presented, we have created a means by which to collect data from the selected studies. The systematic comparison framework consists of ten evaluation criteria. The criteria were developed from analysis of literature in general ontology development and e-Government:

Implementation Background: The environment in which the ontology has been implemented (practical if it has been applied to real world or theoretical if it is based on scientific research).

Design View: In which way has the ontology motivation/problem been manipulated during the idea/solution development.

Stakeholder: The beneficiaries of the specific ontology.

Adaptability: Ontology's capability in adapting to similar domains/systems.

Analysis Depth: The analysis depth of the specific development ontology initiative.

Number of Entities: The number of fundamental entities/concepts the ontology consists.

Scope: This criterion aims to capture the organizational extent represented in a public administration ontology model.

Administration Level: An e-Government ontology can cover the whole country (national level), a part of it (regional level) or a municipality (local level) in such a way determining its administration coverage. On top of those, there are collaborative ontology initiatives among countries (international level) in order to provide cross border interoperable services to citizens and businesses

Method of Ontology Construction: This criterion aims to detect the underlying methodological approach adopted for the e-Government ontology development.

Domain: Domains (Interior, Finance, Social Security, Agriculture, Education etc.) refers to large well-defined areas of the public sector where the tasks to be performed in relation to citizens and businesses are delivered by several different authorities cutting across tiers of authority.

2.3 Results Analysis

After carrying out the systematic review, the results were summarized and analyzed. We must emphasize that in order to identify the key analysis results, in the e-Government ontological field, is necessary to start from a systematic and contrasted ontology comparison framework in order to formally discover the features of the proposals. The analysis section therefore compares the set of identified proposals discovering how well these ontologies are defined, and how they could be integrated and reused.

3. E-GOVERNMENT ONTOLOGIES

An overview (Table 4) of the selected e-Government ontologies is provided below as an introduction to their evaluation which is presented in the fourth section.

Table 4. e-Government Ontology Comparison Results (B:Business, C:Citizen, CB:Cross-Border G:Government, L:Large, Lo:Local, M:Medium, N:National, P:Practical, R:Regional, S:Small, T:Theoretical)

| | Implementation Background | Design View | Stakeholder | Adaptability | Analysis Depth | Number of Entities | Scope | Administration Level | Method of Ontology Construction | Domain |
|--------------------|---------------------------|-----------------------------|-------------|--------------|----------------|--------------------|--|----------------------|---------------------------------|-----------------------|
| Access-eGov | P/T | Requirement-driven Approach | C, G | L | L | 40 | Integrate governmental services. A WSMO-based Framework Enabling Semantic Interoperability in e-Government Solutions | N | Seven Steps, WSMO | Public Administration |
| BRIT E | T | Goal oriented | B | L | L | Undefined | Interoperability in Europe | CB | Undefined | Public Administration |

| | | | | | | | | | | |
|-------------------|---|-----------------|---------|---|---|-----------|---|--------|--|-----------------------|
| DIP | T | Senario Based | B, C | L | L | 80 | Classification for citizens access to community information | N | Undefined | Public Administration |
| EG BOnt | T | Oblect oriented | B,G | L | M | 10 | System Integration, to modeling and collaborating e-government business knowledge | N | IDEF5 | Public Administration |
| EGOD O | P | Holistic | C, G | M | L | 58 | Document search | N | METHONTOL OGY | Legal |
| eGTP M | P | Goal oriented | B, G | L | L | 13 | Project Management | CB | Co-operative | Public Administration |
| GEA | T | Holistic | B, C, G | L | M | 19 | Internal and external communication of public administration organisations | CB | Combination of Top-down and Bottom-up | Public Administration |
| Ontog ov | P | Holistic | B, C, G | L | M | Undefined | Configuration and adaptation of e-Government services | N | Ontogov Framework | Public Administration |
| Terreg ov | P | Holistic | C, G | L | L | 100 | To enable local governments to deliver online services in the Social Care environment | L,R | Two phases (Research of conceptual definitions and links between concepts, Operationalizati on of the ontology | Social Security |
| Web Senior | P | Procedu ral | C | L | S | 19 | Assistance to elderly | L,R, N | Undefined | Social Security |

In **Access-eGov** (Schillinger et al., 2009) ontology the WSMO (Web Service Modelling Ontology) conceptual model has been adapted and modified properly to meet the requirements of the life event approach to modelling governmental applications. Available ontology resources from other projects were investigated and analysed to reuse them for the purposes of the Access-eGov project. Access-eGov reused the following ontologies:

- WSMO ontologies for description of date, time, and location;
- vCard ontology for addresses and personal data;
- Dublin Core for metadata and document types;
- Terregov, DIP, DAML, GEA, GOVML, AGLS metadata set, and IPSV ontologies for description of specific e-Government concepts.

BRITE's (Business Register Interoperability Throughout Europe) (Goens, 2010) establishes a new European cooperation ontology so that public bodies can effectively respond to the changes imposed on them by the new EU laws and new market requirements. The business registers are amongst those public operators most deeply affected by EU Company Law; they represent an enormous potential asset and catalyst for realising the objectives of the related EU legislation. BRITE ontology is an EU-wide instrument that makes it possible to exploit this potential by allowing them to adapt in a coordinated manner. BRITE ontology pursues to allow the Business Registers of Europe to effectively respond to legislative changes and contribute to building up the EU market. BRITE sets out advanced ICT and organizational cross-border solutions for public operators active in 'cross-border Business Registration' and in related 'e-Government' areas such as financial transparency, financial crime prevention and e-procurement. Its expected impact is wide, affecting the business community, policy makers, researchers, technical innovators, the media, and the European citizenship in general.

The **Data, Information and Process Integration with Semantic Web Services (DIP)** Ontology (Vasiliu and Harand, 2005) has been developed from the seamlessUK data model. This model cannot be considered an Ontology at all, as it only is a Taxonomy: a description and classification of terms, with some eventual synonyms. For this reason, the project attempted to improve and upgrade this taxonomy into an ontology. The new seamlessUK Ontology is a more complete model than the initial taxonomy but still lacks strong relations, good groupings of concepts and appropriate semantics.

DIP's objective has been to develop and extend semantic web and web service technologies in order to produce a new technology infrastructure for semantic web services (SWS) - an environment in which

different web services can discover and cooperate with each other automatically. DIP's long term vision is to deliver the enormous potential benefits of SWS to e-Work and e-Commerce.

e-Government has two mutually contradictory demands: specialization of knowledge management and integrated collaborative application. With the increasing of professional knowledge, knowledge will be an isolated island, namely the knowledge from the different departments can hardly used each other. To achieve one-stop e-Government requirements, **EG-BOnt** (Xiao et al., 2007) proposes an ontology-based approach to represent e-Government business knowledge and presents the architecture of e-Government knowledge collaboration management platform based on EG-BOnt. The EG-BOnt provides semantics foundation for exchange knowledge and effectively promotes common understanding to knowledge and semantic interoperability of heterogeneous systems. As future works, they plan to pay close attention to several directions such as the knowledge service strategy, representation of business rules and the intelligent knowledge retrieve.

EGODO (Ortiz-Rodriguez et al., 2007) is an ontology-based legal information retrieval approach, which aims to retrieve government documents in a timely and accurate way. This is an approach of an entirely new wave of legal knowledge systems. Utility of EGODO is twofold: On the one hand, it is a good way to guide user to the legal terms, thus avoiding him/her to make mistakes at the query construction; and on the other hand, mostly technical, it is a key to the development of semantic web and improving interoperability on the legal applications.

In the near future EgoIR is expected to be improved, focusing on further enhancement of the ontology based retrieval mechanism by means of Natural Language Processing (NLP) techniques for a user friendlier environment; on the automatic semantic annotation of the documents to improve the search process; and on security issues by providing a summary of the retrieved documents.

This ontology provides a reference framework for public sector decision makers and e-Government practitioners during knowledge sharing and development in a government transformation project. The defined ontology is useful as a framework to guide future research trying to improve e-Government project management using knowledge engineering techniques. **eGTPM** (Sarantis and Askounis, 2010) ontology is created in order to support stakeholders in keeping in contact, sharing resources, approaches, solutions and problems occurring in the implementation of e-Government projects. The benefit for public organizations is to have a chance to re-use experiences, to be guided in the implementation, to join a community of people involved in e-Government projects, to discuss and share problems and solutions. Specific aims of eGTPM are:

- Improvement of the management performance of the public organization in terms of efficiency, transparency and quality as a result of the transparent and configurable flow of information
- Enhancement of the public reputation of the organization through well organized and technically functional internal management processes
- Provision of a knowledge repository with re-usable components
- Standardization of the participating roles in e-Government projects
- Provision of visibility to e-Government resources in terms of results and templates
- Provision of visibility to the variety of projects and approaches on e-Government implemented in different areas and in different organizations

GEA (Peristeras et al., 2009) is a modeling effort which aims at introducing a consistent set of object and process models that describe public administration in a generic fashion. A key aspect of GEA is that it attempts to be technology-neutral, thus being applicable to different technological environments. GEA proposes object and process models for the overall governance system, covering two major areas: public policy formulation and service provision. In fact, the following models are proposed by GEA:

- The Object Model for the Overall Governance System
- The Process Model for the Overall Governance System
- The Object Model for Public Policy Formulation
- The Object Model for Service Provision (Public Service Model)
- The Process Model for Public Policy Formulation
- The Process Model for Service Provision

GEA ontology supports the provision of pan-European services to resolve semantic incompatibilities amongst public administration systems. The focus is put on the discovery, composition, mediation, and execution of services within complex scenarios, and the global ontology of semantic components needed for

web service description is provided. This approach requires an existence of web services on the side of public administrations.

The **OntoGov** (Apostolou et al., 2005) service ontology is an e-Government domain-specific service ontology, or a meta-ontology, proposed by the OntoGov IST project. The proposed ontology is heavily based on the two major generic service ontologies, namely OWL-S and WSMO.

The OntoGov project provides a semantics-based platform for the consistent composition, reconfiguration, and evolution of e-Government services. The solution includes a set of ontologies to describe and support the lifecycle of e-Government services. The OntoGov approach mainly focuses on the software engineering side rather than on detection and orchestration of the government services; as a consequence, the interpretation on how the ontologies can be used in practical scenarios can be rather vague. In addition, the maintenance and usage of the OntoGov solution requires expert knowledge and lacks a certain degree of transparency for public servants when using the system.

The **Terregov** (Pérez and Labajo, 2007) ontology is focused on the semantic requirements of governments at local and regional levels for building flexible and interoperable tools to support the change towards e-Government services. The Terregov solution provides a specialised ontology as well as a platform for enhancing existing government web services with a semantic description. Such semantically enhanced web services can then be detected, accessed, and orchestrated in an interoperable way. However, the Terregov solution only operates on a regional level of administration and, as such, it lacks a more global point of view. In addition, the Terregov solution requires a suite of already existing web services on the side of public administrations. The support for transforming other types of services, such into required web services is rather limited.

WebSenior (Medjahed and Bouguettaya, 2005), a prototype project of Virginia Polytechnic Institute and State University (Virginia Tech) and the Virginia Department for the Aging, uses ontologies to automatically generate Web services customized to senior citizens' needs and government program laws and regulations.

4. ANALYSIS OF E-GOVERNMENT ONTOLOGY MODELS

Building on the output of the previous section, this section synthesises and summarises the major review results in existing e-Government ontology models.

4.1 General e-Government Ontology

The systematic review has led us to observe that obtaining a general e-Government ontology has been identified as a necessity. However, despite the fact that current ontology proposals make important contributions, they do not solve the problem of obtaining an integrated e-Government ontology. This is not an easy task (there is no previous work dealing with this subject). Nevertheless, we consider that existing e-Government ontologies can be used as a general basis for reuse thanks to their properties of shareability and reusability, although it is first necessary to identify whether these proposals are adequate, and, to extract the key requirements that must be satisfied in order to obtain an integrated and unified e-Government ontology. Apart from EGODO, Terregov and Web Senior ontologies no specific public sector is being addressed.

4.2 Existing Ontologies should come Near the Real e-Government

The most used approaches are inspiration and synthesis. It seems that e-Government ontology development has been inspirational endeavour that depends heavily on the robustness and comprehensiveness of top-level concepts adopted from other ontologies. The e-Government ontology researchers do not build enough from the vast theoretical base pertinent to e-Government. It is also interesting to point out that the inductive and collaborative approaches are mostly absent. In respect to the former it is deemed important to stress here that many researchers, especially in the field of public management and to its closely related fields of public sector information systems and public policy, have stressed that more theory building through empirical or field based research is required (Heeks and Bailur, 2007). Hence, more rigorous and theoretically sound analysis is required to develop more realistic and robust e-Government systems.

4.3 e-Government Services

e-Government development has highlighted the e-Government services design and implementation as an important requirement and a very active research topic. Most of the ontology models addresses this issue. Moreover, due to its open architecture, eGovernment provides a range of new research questions for semantic web, such as interportal search (e.g. searching for additional resources on other portals in response to a primary user or agent request).

4.4 Static View

Only a few ontologies have formally represented and acknowledged the importance of time. These models could therefore be characterized as dynamic. Other models have adopted a rather static view on a e-Government.

4.5 Taxonomic Structure Prevails

Most ontology models reviewed have class–subclass structure. Although some classes overlap (e.g. Activity, Task, Process,), big differences in class structures among the e-Government ontology models still exist. The perception of ontology being some sort of taxonomy prevails. Ontology is not the quest of finding class structure since the latter is in the realm of epistemology. Classification structure is not inherent to the real world but constructed by human, therefore the optimal class structure does not exist. The e-Government ontology models reviewed here urge the effort to identify a deeper order and structure of reality. Unfortunately, this is far more complex yet far more rewarding than developing a set of classes.

4.6 Interoperability and Collaboration Tool

The eGovernment domain is unique because of the enormous challenges it faces in achieving interoperability and the need to manage complex causes of change (Sarantis et al., 2011). Setting up seamless eGovernment services requires information integration as well as process integration, involving a variety of objects with specific semantics. One key obstacle is the difficulty of automatically mediating the different meanings of data objects and interfaces.

Building e-Government ontologies is not a simple task when public administration experts have no background knowledge of ontology engineering techniques or they have not much time to spend during the task of supporting the public sector cognitive representation. Then, the use of graphical representation is crucial in order to facilitate communication between ontology engineers and public administration experts.

5. CONCLUSIONS

In the field of Public Administration it is difficult to formalize all existing concepts, which should be adapted to e-Government standards. The definition of an integrated Public Administration ontology has not, therefore, been considered as an isolated task, and the community should make greater efforts to combine and improve the ontologies developed. However, we have used a systematic comparison to identify that the existing e-Government ontology proposals, despite making important contributions to the Public Administration community, offer only partial solutions to the integration of knowledge into an integrated Public Administration ontology. We have therefore presented the key requirements that ontologies should take into consideration if they are to obtain an integrated and unified e-Government ontology. This integrated e-Government ontology should at least identify the essential and updated concepts (static knowledge), should allow user to infer knowledge (dynamic knowledge), and should be reusable and shareable (reusability).

Finally, as further work, the specific study identifies that the best way in which to obtain this integrated ontology is to study the current state of the art, comparing the most mature proposals through a formal comparison (concepts, relations, axioms, constraints etc.) in order to obtain a vision of the current situation,

and to detect aspects which should be improved to integrate and combine them, thus reducing the cost of developing new ones from scratch without taking those which already exist into consideration.

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FTTH IN MATURE BROADBAND MARKETS: QUO VADIS?

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ABSTRACT

Next-generation networks are being deployed across the globe. However, existing broadband infrastructure may hinder future investments in these networks in mature broadband markets. While broadband providers are faced by demand uncertainty, policymakers have to deal with uncertainty at both the supply and demand side of fiber broadband markets. Discussing the results of a large-scale user survey, this paper proposes different scenarios for dealing with the demand and investment uncertainty in Western Europe.

KEYWORDS

Private-public nexus, market, demand, investment, fiber broadband.

1. INTRODUCTION

All over the world telecommunication incumbents, utility companies and local municipalities are in the process of investing in next-generation networks. More recently the focus shifted from the backbone to the access network and the last mile problem. The global market for fiber to the home (FTTH) is growing fast, but market growth and investments are fragmented across different parts of the world. Whereas this business flourishes especially in Asia and Eastern Europe, investments in Western Europe (except for the Nordic countries) remain below expectations (Chaillou, 2010). These disparities in deployments around the world mainly result from the available telecommunication infrastructure of the incumbents or from a lack of resources. Indeed, existing broadband infrastructure is the primary barrier or enabler for FTTH deployment in Western Europe and largely explains why some regions are experiencing difficulties moving from copper or cable infrastructure to FTTH technology. Generally, technological, regulatory and market developments increase the uncertainty that the investments will pay off (I DATE, 2010). In the Belgian market, characterized by two well-established xDSL and cable networks resulting from universal service obligations, incumbents seem reluctant to roll out FTTH networks. However, in other European countries, such as Sweden, Norway and the Netherlands for example, governments and local municipalities have committed to sponsor broadband programs and supported the roll out of open access infrastructure (Kramer et al., 2006).

In its Digital Agenda, the European Commission (2010) defined its strategy for playing a leading role in the global ICT economy including the promotion of national deployments of broadband network infrastructure. Also Member States have released national broadband policies to foster economic growth and promote high-speed broadband offerings. It is believed that ultra-broadband access networks will attract new investments and enhance the establishment of the European information society by the provision of value-added services for public administration, education, healthcare, culture etc. However, the premise that superfast broadband will bring substantial economic and social benefits is not commonly shared and can even be criticized. Kenny & Kenny (2011), among others, suggest that billions of public money may be even wasted by being spent to deploying FTTH networks. Although these externalities may be unproven, future traffic congestion and network saturation urge the need for rolling out of next-generation networks.

2. THEORETICAL FRAMEWORK

The public-private nexus focuses on the interplay between technology supply, business strategies, consumer demand and market regulations. As Ruhle & Reichl (2008, p. 19) state, “*market uncertainty comprises two aspects: uncertainty on the demand side ('demand uncertainty') and uncertainty on the supply side ('investment uncertainty')*.” This urges the need for a more holistic overview of the three main stakeholders in the FTTH market: telecom operators, consumers and policymakers.

Since technological developments and consumer demands are constantly evolving, telecom operators are confronted with rising capital expenditures for upgrading existing networks and deploying new network infrastructure. In recent years, incumbents were forced to invest substantial amounts of money in backbone and access networks. However, the cost of deploying FTTH networks on a European level are estimated at €270 billion (up to €5 billion in Belgium) (Lannoo et al., 2006). EU Commissioner Kroes recently promised to stimulate the investments by offering €9.1 billion to incentivize incumbent's investments in fiber broadband, but incumbent broadband providers stay reluctant to deploy new infrastructures. But rather than for financial reasons, incumbents may fear cannibalization of their existing businesses and may wish to preserve their (existing) business model. As Montagne et al. (2010) argue, investments in next-generation access networks by telecom companies are mainly driven by competition and regulation, and only to a lesser extent by market demand. Rather than investing in fiber broadband, incumbents tend to upgrade existing networks. Whereas cable operators migrate to DOCSIS 3.0, telecom incumbents seem committed to VDSL2 to counter the FTTH threat. In addition, incumbents are implementing new techniques (like pair bonding and vectoring) to accelerate transmission speed. These companies also fear they will be obliged to grant wholesale access to smaller rivals and new entrants if they invest in FTTH. In this respect, regulatory uncertainty may act as a barrier for investments as well (van Gorp & Middleton, 2009). To cope with market uncertainty, operators mainly search for densely populated areas or start deploying networks only when a given percentage of the market intends to subscribe to the network. Given all these uncertainties, incumbents are currently not the driving force behind fiber broadband. Instead, the FTTH market is driven by alternative telecom operators and utility companies (electricity, water, housing) that are developing their own network infrastructure to compete in the market (Tadayoni & Sigurðsson, 2007). But also external companies such as investment funds or content providers decided to invest in FTTH. In most instances, these companies engage with local municipalities or governments to establish public-private partnerships (PPP) to be able to accumulate funds and knowledge. The strategy and goals of PPPs are various and range from overcoming market failure, or spurring economic growth to bridging digital divides (Cave & Martin, 2010; Nucciarelli et al., 2010, 2010; Sadowski, 2009). Not only goals may differ, also ownership structures can vary largely. The involvement of (local) governments ranges from facilitator to developer of a project, this may affect the business model, funding, infrastructure and how demand is handled (Troulos & Maglaris, 2011). One of the risks is that this investment results in an inefficient and patchy network with incompatible standards or documentation (Huigen & Cave, 2008).

In addition to these investor and infrastructure developer roles, governments can also operate as users and regulators (Gillett et al., 2004). In the past, regulation was conveyed at the national level and operators were, with the exception of the UK, monopolists (van Kranenburg & Hagedoorn, 2008). While liberalizing the industry in the 1990s, telecommunications became international and supervised by EU governmental institutions. In addition, telecommunication policy is marked by the enduring trade-off between competition and innovation. Policymakers could stimulate open competition, but are able to incentivize investments in network infrastructure (Cambini, 2009). It is often hard to predict the outcome of regulation. In the context of FTTH deployments, policies can focus on either open access regulation (service competition) or competitive networks (infrastructure competition). In any case, telecommunications policy and regulation should ideally facilitate economical activities and the provisioning of innovative services. Next to this more industrial policy, governments justify their investments in next-generation networks with the reasoning that they can execute policy objectives themselves. Stimulating economic development, providing access to e-government services and overcoming the digital divide are often referred to in this context (Ida & Horiguchi, 2008). However economic interest outweighs social factors. Specific attention should be devoted to bridging the digital divide, ensuring that all citizens have equal access to broadband infrastructure and that they can fully participate in the information society. As the digital divide is increasingly seen as a multidimensional concept complementing access with attitudes and skills, this entails e-inclusion policies that are specifically targeted

towards different groups of the population (van Dijk & Hacker, 2003, Verdegem & Verhoest, 2009). One of the factors that may complicate digital divide policies is that access is often a household decision whereas usage is an individual decision (Brown, 2008). Apart from the binary (but also false) opposition between 'haves' and 'have-not's', the roll-out of next-generation networks imposes a new digital divide between people with ultrafast broadband Internet and those with slower connections (Prieger & Hu, 2008). Broadband providers have also offered special packages to convert this segment into customers. Policymakers are entitled to stimulate or facilitate developments at both sides of the market. Therefore, next-generation access and the digital divide are sometimes seen as two sides of the same coin that demands an integrated approach to ensure that not only FTTH's economic benefits are realized, but also that the service generates social externalities. A problem that may arise is that investments are usually made by local governments whereas national or European institutions create the legal framework. It is therefore necessary that these initiatives are clearly aligned.

In order to deal with demand uncertainty, both public authorities and broadband service providers need to step beyond generic strategies and policies but have to consider the specific dynamics, and the geographic, social and demographic structure of local markets. These features may heavily affect the outcome of investments and regulation (Ragoobar et al., 2011). In densely populated areas, for example, fixed costs can be divided amongst more consumers. This decreases subscription fees, which may in turn spur consumer adoption (Frigo & al, 2004). Since critical mass is required to finance broadband projects, this explains why most FTTH deployments are currently limited to cities or specific areas (van Gorp & Middleton, 2009). In the remaining parts of the paper, market demand for FTTH in a Belgian city is assessed and the implications for the incumbents and policy are discussed.

3. METHODOLOGY

The empirical data presented in the paper were collected by means of an offline questionnaire. The assessment of the market demand for FTTH has been limited to the case of Ghent, the third largest city in Belgium housing more than 250,000 inhabitants and over 20,000 students. In total, a representative sample of 2,000 registered inhabitants were selected and invited to join the study. Eventually, 516 respondents filled out the questionnaire, resulting in a response rate of 25.8%. By comparing the sample with official statistics provided by the city of Ghent, it can be concluded that the sample is relatively representative for the total population of Ghent. After being familiarized with the innovation, people were asked about their opinion and attitudes towards the technology and its applications.

The demand assessment mainly relies on the diffusion of innovation theory elaborated by Rogers (2003). According to this theory, the diffusion of an innovation in society follows a bell-shaped pattern amongst five adopter segments: innovators, early adopters, early majority, late majority and laggards. However, traditional intention-based surveys ('*Would you be interested in ...?*') typically overestimate market potential (Bennett & Kottasz, 2001). Therefore, the product specific adoption potential (PSAP) scale was applied to obtain a more accurate reliable forecast of the market potential for FTTH. The PSAP method calibrates the overestimations of traditional intention surveys to a more reliable level of personal 'optimal' and 'suboptimal' product offerings (including pricing and features) (De Marez & Verleye, 2004). Although it may be hard to make valid predictions for a period longer than two years, the method has been applied and validated for several new technologies (De Marez et al.; 2011, Verdegem & De Marez, 2011). A limitation of this paper is that the respondents were not familiar with the technology since they were not able to test FTTH and its applications in practice. Furthermore, consumers' needs and expectations can evolve in the coming years. The potential of mobile technologies was also underestimated due to these factors. Since it takes a long time to roll out FTTH, this has to be taken into account.

4. RESULTS

4.1 Internet Connection

Due to their wide availability, cable (55.7%) and xDSL (34.4%) are the most popular access technologies amongst the respondents, which implies that a considerable amount of consumers have access to broadband networks. In general, people are quite satisfied with their current Internet connection, which suggests that people have little motivations for migrating to better performing network technologies without additional benefits. The respondents seem most satisfied with network reliability, capacity (download and upload volume) and bandwidth/speed (Figure 1). Although fiber broadband promises a better Internet experience regarding these particular features, people seem already relatively satisfied about them. A regression analysis indicates that these features have the largest impact on customer satisfaction.

On the other hand, respondents indicate load time and response time as future action points (towards an optimal quality of experience) for the Internet service providers. This is where FTTH technology is said to make a clear difference compared to existing networks, but this raises the question whether these features will convince consumers to migrate to fiber. The perceived high subscription costs and the rather poor price/quality ratio are two recurrent findings. Given the substantial deployment investments and the lack of economies of scale, it is questionable that FTTH service providers can successfully position a more expensive service without additional benefits in a competitive market.

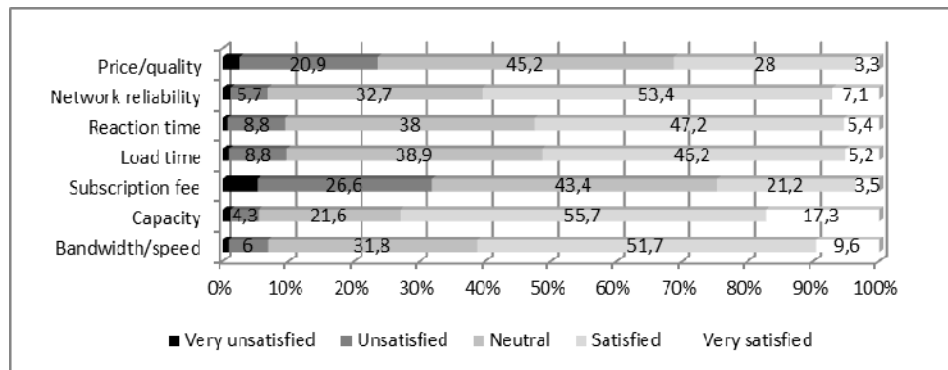


Figure 1. Satisfaction with current Internet connection (N: 470)

4.2 Market Demand

By applying the PSAP segmentation forecast method on the stated intentions of 516 respondents, a reliable view on the size and nature of the adopter categories for FTTH in Ghent can be obtained (Figure 2). Contrary to the expected normal shaped distribution, the end result is a double-peaked curve. This suggests that there is certainly some market potential for FTTH although providers have to deal with a rather dual market perspective. There is a substantial part of earlier adopters, as innovators (5.2%) and early adopters (10.3%) are overrepresented compared to Rogers' predicted pattern. On the other hand, 73% of the respondents are classified as either late majority or laggards. This significantly exceeds the theoretical assumption. In other words, market demand is characterized by a dedicated niche segment on the one hand and a rather large apathetic mass on the other hand. Typical for such dual markets is the presence of a 'chasm' that needs to be bridged when assuming full market penetration. Apart from attracting the innovator and early adopter segments, which acknowledge the added value of ultra-broadband, providers will need to bring other segments, which are more reluctant to migrate to FTTH, on board as well. This will have implications in terms of marketing and targeting the service to the community. With regard to adopter profiles, (statistically) significant relationships between behavioral innovativeness and age, usage, housing type and employment were found. Younger people and people that use the Internet more often, tend to be more interested in FTTH. Students, entrepreneurs and managers are also more likely to be innovators. There were significant differences between the amount of earlier adopter and later adopters in the examined regions. However, these

results are hardly applicable to other parts of the country or other countries, since socio-cultural differences and even market structures may cause different usage and adoption patterns. Regarding gender, education level, income level, urbanization level and family size, no significant relationships were identified.

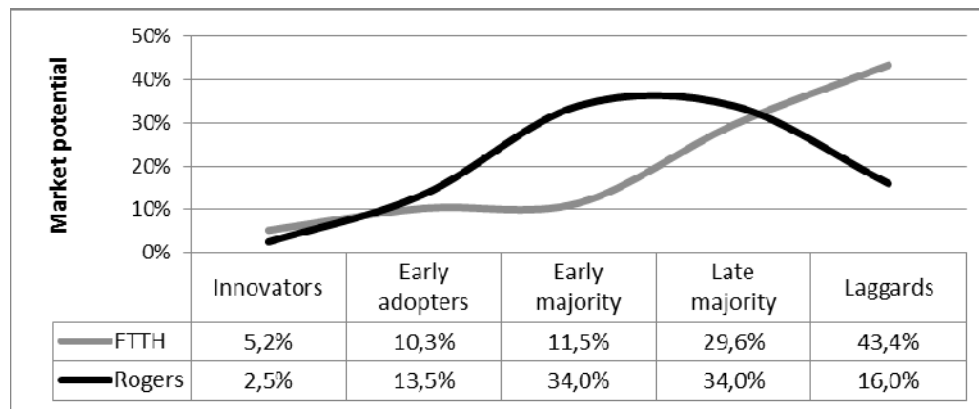


Figure 2. Overview of the market potential of FTTH in Ghent (N: 460)

4.3 Willingness to pay

As indicated, migrating to FTTH is only considered by a relatively small group of people (some 16% of total market), which are willing to pay a premium price on top of their current subscription fee for enjoying the benefits promised by FTTH. Generally, willingness to pay is (not surprisingly) significantly higher among innovator and early adopter segments. Whereas innovators are willing to pay an average premium of €9.98 a month, this price is limited to €5.88 amongst the late majority segment while the laggards do not want to pay additionally. The bulk of the innovator and early majority segments seem willing to migrate to ultra-broadband services (unlimited capacity, min. 50Mbps upload and download speeds) whereas the early and late majority segments prefer a broadband connection (limited capacity, 16Mbps download and 2Mbps upload speed).

In the other parts of the questionnaire price sensitivity was examined. Almost 72% of the sample is willing to upgrade to FTTH when this service would be provided at a price similar to the one they are currently paying for their connection. In this scenario, no change can be identified suggesting that this marketing strategy may be close to optimal, but hands no further incentives for providers to invest in new network infrastructure (since the price premium is zero). This interest drops to 11.3% when introducing the service at current prices increased with €10. When charging premium prices, market demand rapidly declines but also allows broadband providers to better monetize their investments in new network infrastructure.

4.4 Services

Obviously, this willingness to pay is influenced by the perceived added value for consumers. In this context, new applications may trigger market demand for FTTH. Innovators see added value in multi-screen usage, video telephony and high-quality video streaming, which quality of experience is assumed to substantially improved with FTTH. Laggards, on the contrary, are more interested in existing but basic services such as e-mailing and video websites. They especially stick to applications that they are already familiar with, and are not really interested in innovative services like health monitoring or advanced educational services. Since especially the early majority showed interest to these applications, innovative services that create social externalities, such as in the domain of healthcare, government and education, could be crucial in illustrating the value added of fiber broadband to this rather substantial segment. Online multiplayer gaming and security cameras were found the least convincing use cases for people to migrate to ultra-broadband access networks. For all of these services there was a significant difference between the adopter categories in terms of interest. At the moment the services that are only supported by FTTH are fairly limited. Most of these can be facilitated with the existing network architecture.

5. DISCUSSION

In this paper, the question was raised to what extent existing broadband infrastructure is a hampering factor in the roll-out of fiber based networks. It was argued that uncertainties at both the demand and supply side may slow down the development of these markets and that policymakers are entitled to stimulate or facilitate development at both sides of the market. In general, the results show that demand for fiber-based networks is relatively low and that a large part of the market is indifferent to superfast broadband. This limited market demand is marked by several indicators. Firstly, people seem relatively satisfied with the speed and capacity of their current Internet connection. Secondly, the majority is not convinced by the proposed services and see little added value of innovative services. Furthermore, willingness to pay is crucial. The results suggest that only a small part of the population is willing to pay a premium price for fiber broadband, but that almost 72% of the sample is willing to migrate to fiber when it is offered at current prices. Since the survey was held in a mature broadband market, however, the results may not be applicable for those markets where broadband infrastructure is still under-established. The wide availability of performing broadband connections that are offered at competitive prices may largely influence adoption decisions. Providing bundles at competitive prices would create convenience and may spur FTTH adoption rates. In this context, socio-cultural and economic contexts may affect adoption rates of FTTH connections and investment uncertainties. However, this uncertainty is mainly influenced by the degree of competition in the market and the impact of regulation since these factors have an impact on the willingness to invest in new networks.

Based on the level of these demand and investment uncertainties, four different scenarios can be outlined (see Figure 3). In each of these scenarios, a combination of both market uncertainties are discussed. For each scenario, opportunities for public and private actors are described and a possible strategy for overcoming uncertainties is proposed. Although these scenarios may be regarded as static and oversimplified, we believe this model helps identifying those market situations where government intervention may be needed to facilitate the development of fiber broadband markets.

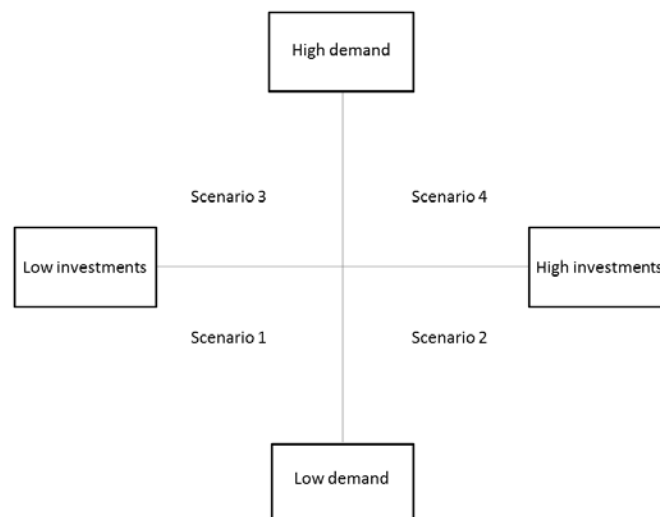


Figure 3. Overview of the proposed scenarios

Scenario 1: When market demand is low and operators are not eager to invest in new infrastructure, this scenario is characterized by a chicken-or-egg problem. Operators are reluctant to roll-out FTTH as there is limited demand while this demand is not triggered by absence of infrastructure. In this context, operators are likely to upgrade existing infrastructure so that there may be an important role for government for stimulating FTTH development in such markets. A possible solution for overcoming this Catch-22 problem could be the establishment of a publicly owned network. In such a scenario, local authorities invest in passive network infrastructure (backhaul) and provide open access to interested telecom operators and service providers to use this network. This way, governments secure that fiber broadband infrastructure is deployed. Incumbents tend to react fiercely to these projects so there are no guarantees that these market players will lease network

capacity and that consumers will migrate to FTTH. Thus, the appropriateness of public intervention in such markets can be questioned since investments are high and market uncertainties remain.

Scenario 2: In this “*If we build it, they will come*” scenario, broadband providers or other companies are investing in next-generation networks and try to trigger market demand. They can achieve this by bundling services, reducing prices and stimulating complementary innovation in compelling services. By aggregating market demand, these providers can assure critical mass, realize economies of scale and provide consumers access at lower prices. To overcome this high investment and to increase the ARPU (average revenue per user), companies can decide to apply new business models. This can have an effect on net neutrality. On the other hand it is also possible that more service providers are active on the same network so that the choice increases and net neutrality is not an issue. Governments can play a role in providing e-government services or by subsidizing the purchase of modems that are needed for fiber broadband. However, this may trigger the interest of competition authorities as this approach is not technology-neutral.

Scenario 3: Ideally, market demand should attract investments, but regulatory and especially financial thresholds may hamper willingness to investment. One possible strategy to overcome these barriers is setting up PPP constructions since lack of appropriate funding may be the main reason for telecom operators for not investing in fiber broadband. In this context, the provision of public subsidies can act as a catalyst for investments on the supply side. This can stimulate other operators to invest in additional infrastructure and increase competition in the market. However, the question arises to what extent a duplication of fiber broadband infrastructures (i.e. the ladder of investment approach) is socially and economically desirable. Sharing the network investments is another option.

Scenario 4: The combination of high market demand and high investments is the optimal situation for a fast FTTH roll-out and secures a high take-up rate. In first instance, no government intervention is needed as this is an example of perfect markets. However, this does not guarantee that operators will provide wholesale access to other operators. Consequently, competition in FTTH markets is not assured. This might stimulate policy intervention in order to stimulate rivalry and decrease prices.

The implications of this paper are both practical and theoretical. The results might help local municipalities and other interested companies while assessing the feasibility of fiber broadband deployments. Especially in mature broadband markets, these conclusions are applicable and may raise a couple of related issues. The delicate interplay between the different stakeholders should be considered since the dialectic between market, policy and users might affect the outcome of the FTTH diffusion. Further research should focus on the determinants for demand and investments, and on approaches to deal with uncertainties on both sides of the market. Hence, the model proposed in this paper can be applied to manage the risks related to the deployment of fiber broadband infrastructure.

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AN APPROACH TO DOCUMENT CLUSTERING USING HYBRID METHOD

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ABSTRACT

This paper deals with e-government documents multilayered clustering based on hybrid approach that combines Fuzzy-C-mean algorithm, cosine similarity and semantic similarity measures. The system described here is intended to reduce response time between citizen's questions and government answers, either to eliminate or to minimize the role of subject matter experts. Layers of documents are defined by key terms that are discovered by a clustering engine that we named ADVANSE. After short overview of clustering algorithms the paper concentrates step by step on the functionality of ADVANSE. Finally, concluding remarks emphasize some important features of this approach and gave future research directions.

KEYWORDS

E-Government, Document clustering, Fuzzy C – mean algorithm, Cosine similarity.

1. INTRODUCTION

A growing amount of information related to the government rules, regulations, amended provisions, legal precedence and interpretive guidelines are distributed on different government portals, so that citizens can browse, search and use them. Some of these portals are equipped with search engines that provide text based search of documents. However, government documents are often extensive, containing cross references with other related documents. Moreover documents are semi-structured with potentially similar and often ambiguous content, terminology and context. Regardless of the fact that these portals are provided for the use by common citizens, above mentioned facts create serious impediment for their searching, understanding and use by them.

Citizens without much knowledge in this domain interacting and using these government portals are often disappointed by the difficulties that must be overcome and efforts they have to make in order to access or gather the requested information, and by the lack of effectiveness and orchestration of the various procedures. Domain experts must be engaged to examine the various cases and select the appropriate service or information requested by citizen. Typically, such a scenario should consist of the following: Citizen makes a request for specific information elaborating his specific case; government officer receives the request, examine the request, clustering the nature of the problem and send it to specific domain expert; domain expert evaluate the citizen's case and prepare the requested information. Some of the citizen's cases are related to previous and could be easily answered. However, sometimes, collecting and consolidating all the information could be very difficult and time consuming. Moreover, the number of requests usually significantly exceeds the available number of government domain experts that may to process requests, which additionally increases the cost and time for requesting and receiving services.

In general we may agree with definition that electronic government is government's use of technology, particularly Web-based Internet applications, to enhance the access to and delivery of government information and services to citizens, business partners, employees, etc. (Wang, et al, 2005). If so, the question is, how to find a proper document or set of them from the bunch of, usually distributed, documents that meet citizen's requirements. This paper proposes a hybrid solution for multilayered document clustering based on Fuzzy C – mean algorithm (derived from K – mean algorithm) in which the membership function is

expressed with the term frequency and inverse document frequency in the initialization phase. During the system exploitation, cosine similarity is used for clusters determining.

2. RELATED WORK ON CLUSTERING ALGORITHMS

Clustering have attracted much attention in research community for years gained either by different applications requirements such as pattern recognition, image processing and information retrieval, etc., the overview of which is given in (Jain et al, 1999) or by new technological enablers such as XML (Algergawy et al, 2011), Web services (Platzer, et al., 2009), semantic technologies (Tagarelli and Greco, 2010), agents (Garruzzo and Rosaci, 2008) and various combinations of these that are able to handle clustering of distributed objects of different kinds (Keeney et al, 2008).

Clustering, information retrieval and contextual responding represent the main system functions in the services that e-government offers to the citizens. Those functions can be performed automatically, by using different algorithms and methods. There are different taxonomies of similarity/distance measures (Kuroпка, 2004). They can be grouped in three basic categories: algebraic, probabilistic and measures based on set theory, as shown in Table 1

Table 1. A classification of text similarity algorithms by mathematical model used

| Algorithm/Mathematical model | Set theoretic | Algebraic | Probabilistic |
|---------------------------------------|---------------|-----------|---------------|
| Jaccard Correlation Coefficient (JCC) | X | | |
| Euclidian distance | | X | |
| Kullback-Leibler (KL) divergence | | | X |
| Cosine similarity | | X | |

Jaccard Correlation Coefficient (JCC) is similarity measure which depends on set theory. Documents are represented as set of terms. Jacquard correlation is the ratio between intersection and union of those sets. It is zero if there are not terms in the intersection. Maximum value is 1 when both of the documents have the same term sets. Terms are usually mapped to distinct integer values by using appropriate hash function. This function can be predefined – deterministic, or randomly selected from the hash function set (e.g. universal hash family for strings). In this case, if there is collision between hash values in the same document set, rehashing is necessary. In JCC measuring, different document lengths are solved by padding shorter document with zeros before comparison. Similar to JCC is Dice.

Euclidian distance uses the graphical representation of documents in the space model. It represents algebraic measure in which the documents are represented as the sets of terms (points in the space). Terms can be represented by weights – different measures in the model (usually it is combination of term frequency and inverse term frequency, so called *dfidf*, or probability measures). The Euclidian space has as much dimensions as considered terms. It is usually used for clustering as a default measure in K – mean algorithm (MacQueen, 1967; Vattani, 2011). Manhattan and Minkowski distances (Guo, 2004) represent the measures derived from Euclidian distance.

Kullback-Leibler (KL) divergence is similarity measure which depends on probabilistic theory). Compared texts are represented with probability distributions of terms they consist of. For example, if KL divergence is lower, compared documents are more similar (they have similar probability distributions). KL divergence is non – symmetric (result depends on the order of comparison), non – negative and unbounded (from zero to infinity) measure. Therefore, other divergence measures are derived from this one: averaged KL divergence and Jensen Shannon (JS) divergence. Both of them are based on averaging, but JS divergence is much more complicated. It depends on generating of artificial distribution as average of two measured distributions and after, measuring divergence between real distributions and generated one. This way JS divergence is symmetrical, and its value is always less than KL and averaged KL divergence.

Cosine similarity (Salton and Wang, 1978) is algebraic measure of angle between these vectors. Cosine similarity is one of the most commonly used text similarity measure because of its simplicity and because it is not dependent on the text length. The compared texts are represented as resulted term vectors.

Beside the similarity measures mentioned above, there are lot of other measures and classifiers: Jaro–Winkler distance – algebraic measure for short strings comparison (Winkler, 2006); Naive Bayesian classifier (Pedersen, 2000) – general purpose probabilistic measure for multidimensional classification problems; –

using of covariance of two term vectors (text objects) and their standard deviations; Dice – Sorensen coefficient (Kondrak, et al, 2003) – similar to JCC, but it simplifies problem by converting compared strings into bigram sets (sets of neighbor character pairs) and by dividing number of common bigrams (intersection) with full number of bigrams in both strings.

All aforementioned measurement techniques give different results depending on the characteristics of compared texts: length, language, described domain, content and even the writing style. Therefore, similarity techniques implemented in the system have to be accommodated with text characteristic. For example, if two documents have different size, but they consist of the same terms, their similarity is 1 (maximum value). This property is especially useful in case when it is necessary to compare content which have different length, e.g. to compare a question which consists of one, or few sentences with whole document.

3. CLUSTERING IN ADVANSE

E-government systems are intended to assist citizens to make decisions. As described earlier, in the actual e-government systems, the questions answered by Subject Matter Experts (SMEs). The response time varies from one to several days. It depends on the availability of SME. Other hand, a number of questions and answers accumulate over time. They could be considered as a kind of the knowledge base (KB). This KB could be good basis for the Advanced Answering Engine (ADVANSE) development. ADVANSE uses clustered resources (documents, existing questions and answers) for responding to the citizen. Documents are stored in the repository, while the questions and answers are stored in the database. All these resources are used by ADVANSE application.

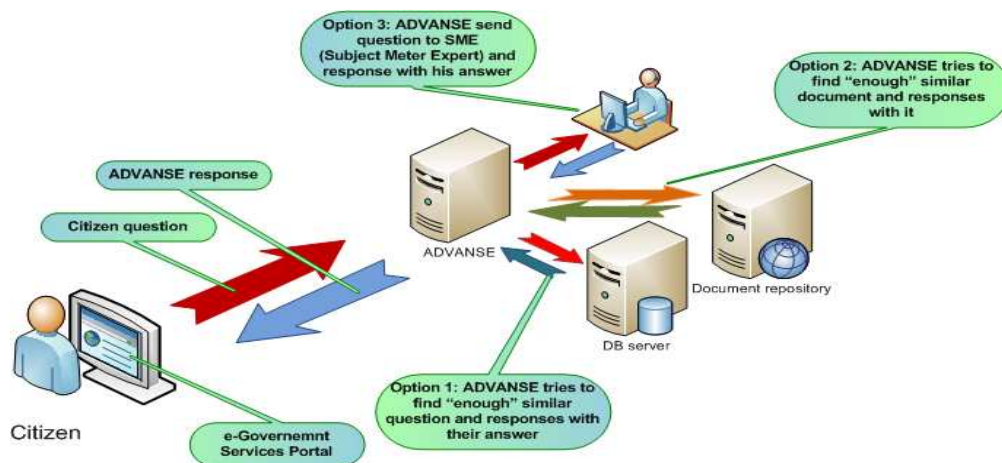


Figure 1. Interaction between citizens and system

Interaction between the citizen and the system can be processed by ADVANSE in different ways (Fig.1). The system can respond with some of existing answers if the related question is “enough” similar to the citizen’s one.

If there is not any “enough” similar question in the database, the system tries to find “similar” document. Finally, if the first two options are not possible, ADVANSE forwards the question to the SME for responding in traditional way (send the “safety” answer to the citizen at the same time – formal message with appropriate explanation, recommendation, or references to the other resources).

3.1 General Content Model

There are three content types in the system: citizen’s questions, governmental documents and SME answers. The content model for particular domain (i.e. finance, or law) represents a corpus that is layered (Fig.2). The layer of questions is on the top, layer of answers is in the middle and layer of documents is on the bottom. Layers of documents and questions are clustered by key terms. There are documents and questions that

belong more than one cluster. That means there are several key terms in one document, or in one question. Therefore the clusters represented as the sets that are intersected with each other. Answers represent the products of the system regardless of they created manually or automatically. The answers are connected to the questions as well as to the documents. The connections can be formed freely. One answer can be connected with many questions and vice versa. The same is about the connections between answers and documents.

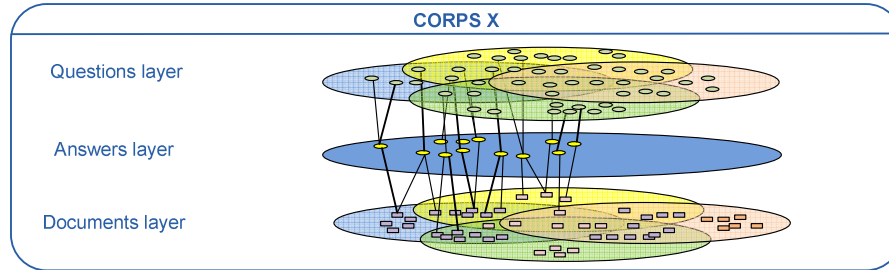


Figure 2. Predefined categories vs. clustering categories

The connections have different strength. They are exactly weighted by two factors. The 1st one is the degree of similarity and another one is derived from citizen evaluation. The degree of similarity is calculated by system and it represents an objective value. The evaluations performed by citizens depend on their individual expectations and attitudes. Therefore this measure has subjective nature, but that becomes more objective as the answer has more evaluations. Generally, there is no limit to the number of clusters that one answer belongs.

3.2 Initial Generation of Clusters

The content which has to be clustered is heterogeneous and layered (documents, already existing questions and answers answered by SME). Therefore clustering is performed by predefined key term set. Domain key sets can be provided by using some existing public corps of domain terms, or by SMEs. A key term can be a single word or multiple words with specific meaning (key phrase). The clustering initialization could be performed in different ways: random partition (Hamerly and Elkan, 2002), Forgy partition (Garijo, et. al, 2002), Kaufman (Laan, et al, 2003). Except the Kaufman method, all others need predefined number of clusters. Because Random partition method is used, number of key terms is used as number of initial clusters. Clustering is performed by using Fuzzy C – mean algorithm (so called FCM) (Zou, et al, 2008). Unlike the most popular K – means algorithm (it forms clusters with the clear boundaries and without intersections), FCM provides possibility that one data portion (question or document in our case) can belong to more than one cluster. FCM objective function is based on simple K – mean objective function (1).

$$f_{fcm} = \sum_{i=1}^n \sum_{j=1}^k m_{ij}^f \|x_i - c_j\|^2 \quad (1)$$

FCM objective function is multiplicative: practically it consists of k (number of clusters) K – means functions because it has to express the fact that every data portion belongs to every cluster in some degree. This membership degree is expressed by membership function m_{ij} . It means that every question or document x_i has j membership functions. This function has normalized values (between 0 and 1) and it can be modified by factor f . This factor is common for whole data set and it affects on behavior of fuzzy reasoning. Its values can be equal or more one. In our solution this factor is ignored ($f=1$). This means that the system works in fully fuzzy mode. The right end part of function represents Euclidian distance [ref] between cluster centroid and concrete data point (same as in the K – means function). During exploitation, the system repeats clustering in some conditions. This means that new clusters can be formed, and cluster boundaries can be changed. Clustering process is usually triggered by the number of new questions, or some other criteria (e.g. low level of citizen satisfaction about responded answers). This way, the system is improving itself continuously over time.

3.3 Determination of Clusters

ADVANCE has to find the cluster which contains the questions similar to the new one. If there are a large number of clusters and lot of questions in clusters, it will be very difficult to provide the calculation how much is a new question similar to each existing question. The better solution is using of cluster centroids as a kind of meaning value which can represent all of the cluster members. Because the clusters are formed by using Fuzzy C – mean algorithm, the similarity can be expressed by degree of membership. ADVANCE calculates the membership function ($m_{i,q}$) of a new question by using the frequency of specific term in the question ($tf_{i,q}$) and inverse term frequency ($idf_{i,q}$). (Wu, et al, 2008) (eq. 5).

$$m_{i,q} = \log(tf_{i,q} + 1) \log \frac{N_q}{N_{q,i}}, \text{ if } tf_{i,q} \neq 0 \quad (2)$$

The inverse term frequency is represented as ratio of total number of questions in the cluster (N_q) and number of questions that contains key term ($N_{q,i}$). The value of membership function is normalized by using logarithm values. If the term doesn't exist in the new question, the membership function has minimum value ($m_{i,j} = 0$). Maximum membership ($m_{i,j} = 1$) happens when the new question (after filtering) contains only appearances (one or more) of key term. Because of using of fuzzy concepts, ADVANCE has ability to handle the questions that have more than one key term (phrases). In this case it measures membership functions for each particular word in the phrase. Theoretically, the question belongs to as many clusters as many key terms it contains. Practically, it is filtered by predefined threshold. ADVANCE assigns the zero valued membership functions for terms which are not presented in the question or its $m_{i,j}$ is less than threshold value. This means that every question and cluster have membership functions matrix (*mf* matrix). The zero value membership means that the question doesn't belong to the specified cluster. These matrixes are used by ADVANCE to determinate corresponding cluster(s).

3.4 Questions similarity

If cluster is determined, ADVANCE will compare citizen question with the existing questions in the cluster. Comparison is performed by using modified Cosine similarity. Cosine similarity is the most commonly used text similarity measure. Questions are considered as a term vectors consist of ordered pairs of terms and their frequencies. This way the questions can be presented with resulting vector and similarity is greater if the angle between resulting vectors is closer. The direction of each term vector (component of the result question vector) is different and calculated by the system. Other words, if there are N terms, than N vectors in N directions are defined. ADVANCE calculates directions (angles) by using appropriate hash function (Stain, 2007) on term strings. Cosine similarity does not depend on the question (document) length. It just depends on the vector (term) composition. Also, Cosine similarity does not depends on the order of terms.

Its intensity can be also expressed by using *tfidf* of compared questions (eq.6). This simple, but effective mechanism is especially useful for processing of large number of questions.

$$COS_{SIM}(q_1, q_2) = \frac{\sum_{i=1}^N tfidf_{i,q1} * tfidf_{i,q2}}{\sqrt{\sum_{i=1}^N tfidf_{i,q1}^2} * \sqrt{\sum_{i=1}^N tfidf_{i,q2}^2}} \quad (3)$$

Similarity is calculated as division of dot product and magnitudes of two compared vectors, where N represents number of all considered terms. ADVANCE performs similarity calculation as many times as many questions are stored in the cluster. There are several resulting strategies: the best one, top N results, or results above the threshold. If there are many results (questions) it will be confusing to present so many answers to the citizen. Other side if the best one is used, maybe citizen will not be satisfied about just one answer. Maybe top N results will be the most appropriate if it is possible to dynamically change N (fine tuning). One question can be related to one or many answers. These relations are weighted by so called relation strength. This value depends on different factors (eq. 7). When SME creates new answer, system

assigns *initial strength* (V_{ini}) to the relation. This value is important in the beginning of using of the system, when the number of feedbacks is too much low.

$$S_{qa} = V_{ini} + I_{nf} * R_{pn} \quad (4)$$

The product of two factors: *feedback importance* (I_{nf}) and *positive & negative ratio* (R_{pn}), represents other part of the strength equation. It becomes important when the number of feedbacks exceeds the threshold value. Feedback importance is calculated by using the number of positive and negative feedbacks. Another factor in product is *positive & negative ratio*. Its value is calculated by dividing the summary result of positive and negative grades with whole number of feedbacks.

4. CONCLUSION

Hybrid solution proposed in this paper fully depends on the nature of the e – government services: content and functionality. The most of the formal documents that can be used for system responding are held in the document repositories (CMS). Otherwise, data as citizens' questions and SME answers are stored in the system DB. Therefore, ADVANSE content model is layered and clusters are partially overlapped. On the other hand, the system needs questions, answers and documents to be semantically connected. These features have influenced the overall system design, especially for using different similarity measuring techniques. Therefore, ADVANSE can process the citizens' requests in different and flexible ways. The system provides the conditions for early high – quality responding (for each case), and expectation is the citizens will be much more satisfied then before.

ADVANSE is a part of wider project aiming to provide intelligent decision support system that will collect, cluster and analyze data from various data sources including, but not limited to, social, biological, and economical systems in order to make government's decisions easier. Thus, future research will take place in several directions such as implementation and testing the other algorithms, development of clustered data warehouses for different domains and fully semantically-enabled clustering engine for clustering information from heterogeneous data sources.

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ELECTRONIC AND MOBILE G2C SERVICES: GREEK MUNICIPALITIES' AND CITIZENS' PERSPECTIVES

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ABSTRACT

Electronic and mobile government services represent a tremendous impetus to move forward in the 21st century with the potential to bring about a higher quality and more cost effective services to enhance the relationship between citizens and government. In this paper, the municipalities' electronic services provided to citizens are examined based on the assessment of their websites. As a result, a typology of electronic and mobile services is proposed. Furthermore, the users' perspective is inquired in order to depict the awareness, the usage and the attitude of citizens in relation to the electronic and mobile services provided by the municipalities in Northern Greece. Therefore, electronic services are used only by a small percentage of Greek citizens due to lack of awareness and trust in electronic government. Mobile services are regarded to be beneficial, while high cost and lack of network connection seem to be barriers for their usage.

KEYWORDS

E-/m-government, G2C, e-/m-services typology, municipalities' websites, citizens' perspective

1. INTRODUCTION

The global evolution of electronic and mobile government is a reflection of technical developments, competitiveness and efficiency pressures to modernize public administrations. The e-government is expected to raise the quality of public services, reduce the costs of their provision and lead to more transparent government (José dos Santos, 2005). M-government has been considered either as an additional, new channel that complements the existing e-services or as a response for the creation opportunity of new services that exploit the benefits of mobility (Ostberg, 2003; Gorlenko & Merrick, 2003; Fidel et. Al, 2007). It has been designed to provide citizens (G2C), businesses (G2B), employees (G2E) and governmental organizations (G2G) with more effective and efficient services, as well as to ensure convenient access to faster and personalized services anywhere, anytime (Borucki et. Al, 2005).

This paper focuses on both electronic and mobile services provided to citizens by the local authorities aiming to draw the picture of their adoption degree by the Greek municipalities and the citizens' perspective.

Regarding e-services, the EC has developed and published a list of online public services for citizens. Although some actions towards structuring basic framework constructs of the fixed internet services have taken place (Capgemini, 2007), it is vague whether the municipalities have adhered to the European standards and developed high-level electronic services. Regarding mobile services, on the other hand, there are scarce examples that are implemented in the public sector in various countries, such as UK (Borucki et. Al, 2005), Saudi Arabia (Abanumy & Meyhew, 2005) and South Africa (Patel & White, 2005), which constitute ad-hoc mobile applications in various public domains such as health, traffic, education, etc. Which of them are critical for the improvement of the citizens' routine and for the authorities' convenient service delivery? Could these m-services be formulized in categories and follow a specific typology?

The object of this paper is to investigate e- and m- government evolution of municipalities in Northern Greece. A typology of the provided e-services enriched by their possible extension to m-services is presented. Furthermore, the citizens' awareness, use and attitude towards electronic and mobile services is inquired.

This paper is organized in four sections. In section 2, a literature review giving the governmental e- and m-services' background is presented. This is followed by Section 3, where the applied methodology and study's results are analyzed including the proposed typology and the survey's statistics. The final section

concludes with a discussion commenting on the data gathered and recommends some ideas for future research directions.

2. LITERATURE REVIEW

Advances in e-government oriented technologies and services are taking place with a considerable speed worldwide. E-government efforts aim to benefit from the use of most innovative forms of information technologies, particularly web-based Internet applications, in improving governments' fundamental functions. These functions are now spreading the use of mobile and wireless technologies and creating a new direction: mobile government (Kushchu & Kuscu, 2003).

2.1 E-government Approach

The rapid spread and development of Information and Communication Technology (ICT) in the field of government has led to the (e-government) in order to accelerate economic and social progress (El Kiki, 2006). Particularly, e-government is being continuously developed due to a number of important reasons: (i) deliver high quality eservices to citizens and businesses, (ii) enhance public sector efficiency, (iii) reduce government administrative burden, (iv) allow for cost savings in public administration and (v) improve transparency in government decisions and actions (Fidel et. Al, 2007; Georgiadis & Steiakakis, 2010; Kushchu & Kuscu, 2003).

The presence of various barriers and drivers influence the overall development of e-government (Germanakos, 2007). Reddick (2004) categorizes the benefits into six large groups and introduces twelve hurdles that impede the adoption of e-government. The most important are: lack of technology/ web staff, lack of information about e-government applications and issues regarding privacy. In addition, Dongmin K. & Benbasat I. (2010) point out that trust towards the system of e-government, as well as the security and safety of citizens' personal data are two major barriers to adopting e-services, too.

Regarding e-government projects, interesting developments have taken place in various countries such as Sweden, Italy, Denmark and the UK (Snellen & Thaens, 2008; Löfstedt, 2007). Rannu (2003) also presents Estonia in forefront of e-government services due to the willingness of the Estonian government.

The EC has developed and published a list of 12 online public services for citizens (Capgenimi, 2007) constituting a basis of benchmarking the progress of the EU member states in the sector of e-government. On a national level, the Greek Central Association of Municipalities and Communities (KEDKE, 2011) initiate a typology of 18 eG2C services. These services and their definitions are presented in Table 1.

2.2 M-government Approach

Mobile government, despite the initial stage of development, influences the strategies and the tools that are developed for the implementation of e-government services. The high penetration of the mobile devices and the anywhere-anytime access to the wireless networks force the governmental entities to redefine the way they interact with citizens (Kushchu & Kuscu, 2003).

Several studies (El Kiki & Lawrence, 2006; Wu et al., 2009; Georgiadis & Stiakakis, 2010; Amailef & Lu, 2007) have identified four main dimensions of m-government: "m-communication", "m-services", "m-democracy" and "m-administration". Furthermore, Kim et al. (2004) have investigated the merits that m-Government can provide to e-Government. Some of them can be summarized to the enhanced convenience of the citizens and governmental employees thanks to the ubiquitous access to the services, and the implementation of customized services and governmental Citizen Relationship Management, due to the personalized character of the mobile devices. These merits are guaranteed to maximize benefits of using information and, in turn, create further advanced e-Government services.

Some of the most important barriers of the mobile devices are the small size of the screen and keypad, the limited battery lifetime, lack of network connection, and the citizens' learning disability of how to use mobile services (Ishmatova & Obi, 2009)

Although m-government is a rather new field a number of countries worldwide have already implementing various m-government services. For instance, Finland introduced a system to pay for parking

via mobile phone in multiple cities saving time, trouble and money. Denmark, the Netherlands and Germany, likewise, offer pay-by-phone parking in certain cities (Snellen & Thaens, 2008). In Korea, m-government services are divided into six service categories, such as information search, electronic civil petition, urgent notification, public commercial transaction and tax payment service.

In Greece, there is a limited number of studies about the governmental m-services. In particular, Kapogiannis (2004) examines the reasons why m-services are required in businesses and points out m-Taxis as the unique suggested m-service regarding taxes. According to Karadimas & Papantoniou (2008) and Ntaliani et al. (2008) m-government in Greece is still in its infancy and they propose some additional future m-services that could improve the governmental organization. Vrechopoulos (2009), finally, writes about factors predicting the m-services adoption by the Greek citizens.

Table 1. Definitions of Municipal e-government services

| Services | Definition |
|---|--|
| 1. Payment of Taxes – Fees – Fines | Payment via Web Banking/ (No) Debt - arrears certificates. |
| 2. Job Searching Services | Demand - offer job announcements/ Job search with specific criteria |
| 3. Reg./Modification/Deletion of Personal Data | Data management in municipal records, civil & male registry. |
| 4. Certificates Issuing | Application for certificates issuing/ request application status. |
| 5. Certificates& Permissions of Building topics | Issuing of certificates & permissions about building topics. |
| 6. Training and Vocational Education Services | Adults and special population groups' education programs/ borrowing books from the public library. |
| 7. Health-related and Social Care Services | Registration to municipal kindergartens and camps, appointments for health services, etc. |
| 8. Public Transport and Road Services | Parking cards, purchase of season cards for public transport, etc. |
| 9. Environmental, Lighting, Cleaning and Recycling Services | Household waste or recycling bins/ street lighting installation, etc. |
| 10. Sports, Culture, and Entertainment Services | Online tickets purchase/ book, cultural/ entertainment activities etc. |
| 11. Entrepreneurship and Local Development Services | Information on entrepreneurship, local development and job searching issues. |
| 12. Cemetery Services | Concession (of a family tomb, ossuaries space and exhumation, etc. |
| 13. Water Supply and Sewerage Services | Connection to water supply and sewer network, applications for troubleshooting. |
| 14. Foreigner Services | Acquisition of nationality/ citizenship and residence permission. |
| 15. Requests / Complaints | Requests/ proposals submission, complaints regarding omissions and erroneous municipality actions. |
| 16. Electoral Catalogues Searching | Location of citizens' polling place. |
| 17. Municipal Council's Decisions Searching | Access to the decisions of the municipal council. |
| 18. General Information Services | General information searching. |

3. STUDY METHODOLOGY & RESULTS

In this section, a detailed description of the study methodology and the survey results are included. The research is twofold. Initially, after gathering and analyzing relevant academic papers, journal articles and European official documents, focusing also on the benefits and barriers of using electronic services, a website investigation is conducted in order to determine which electronic services are provided by Greek municipalities. Getting feedback from the literature review and the findings of the website investigation, a quantitative research is conducted via questionnaire to explore the citizens' perspective towards electronic and mobile local government services. While the questionnaire is a quite appropriate method for descriptive studies and can attain high levels of external validity (Palvia et. Al, 2007). Therefore, feedback from this research enriches the present literature. The framework of the study is visually presented in Figure 1.

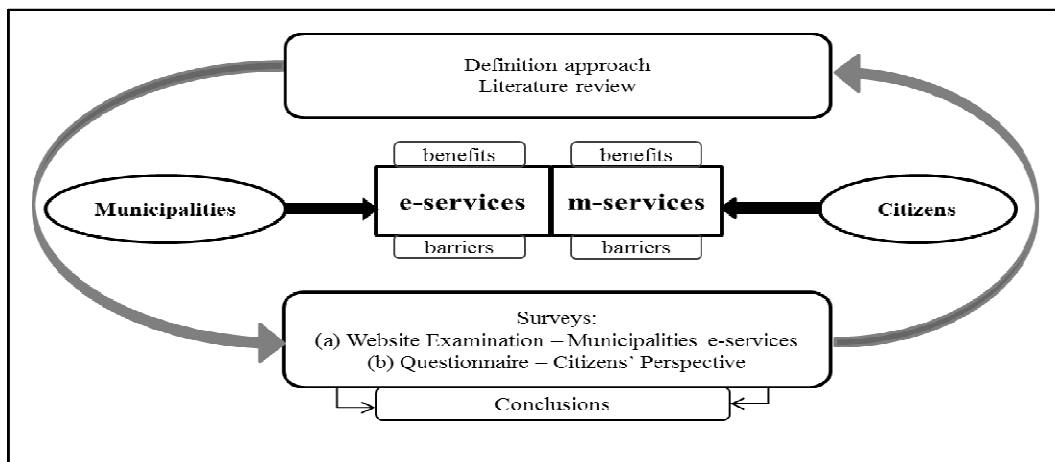


Figure 1. Study Framework

3.1 Website Examination

Regarding KEDKE's typology (2011) 18 local government e-services are suggested. Based on this list, an investigation on the existence of the suggested e-services was conducted with regards to 45 municipalities' websites in the extended area of Thessaloniki, Greece.

Specifically, a cross-check comparison was conducted between the KEDKE list and the services available online. Finally, each service's popularity was measured by the number of the municipalities that provide it on their website. Based on this investigation, which took place between April 4th and April 15th, 2011 a first typology of local government e-services provided on the websites was developed. Services that are not provided in any of the websites are excluded from this typology.

According to the website investigation results, it is worth mentioning that only one municipality out of 45 does not operate a website. Regarding e-government services, 11 out of 44 municipalities do not offer any e-service, that is to say, 33 municipalities provide e-government services. The data collected are analytically presented in Table 2. Furthermore, a categorization of local government mobile services is developed based on the literature review and best-practices worldwide. It should be noted, the m-services used in this categorization, are those that could be applied as an extension of the e-services provided with the use of mobile devices. Hence, a final typology of the electronic and mobile local government services is formed. This typology could contribute to e and m-government research by both academics and practitioners that participate in the development of web-based platforms and services for the municipalities.

3.2 Questionnaire – Citizens' Perspective

Data are collected by means of a questionnaire administered from May 2nd until July 1st, 2011. The questionnaire was distributed to a sample of people in a hard-copy form, while its electronic version was posted on social networks (facebook, twitter) and sent to various mailing lists (students and non-students). The questionnaire was pretested before being widely distributed; a pilot study of a sample of twenty-five responses was used to identify possible problems in terms of clarity and accuracy. Thus, comments and feedback from respondents improved the final presentation of the items. Twenty-seven questionnaires were dropped from the study because of incomplete answers by the participants.

The questionnaire consists of three sections: the first five questions were used to provide information on the respondent's profile, while eight questions determine their attitude towards e-government services (command of the e-government services provided, frequency of e-government services use, benefits and barriers). Finally, the last nine questions examine their intention to use m-government services (willingness for m-government services, benefits and barriers). All questions are closed-type and the majority of the questions in the second and third section follow the 5-point Likert scale.

The respondents comprising the population of interest are 215 in total, 91 (42,3%) out of which are male and 124 (57,7%) are female. The vast majority of them (54,9%) are between 18-34 years old. 135 people

(62,8%) have received higher education studies and 49 (22,8%) have graduated the high school. The detailed demographic characteristics of the sample are presented in Table 3.

Table 2. Typology of Municipal e & m services

| Already adopted e-services | No of Municipalities | Suggested m-services |
|--|----------------------|--|
| 1. Payment of Municipal Taxes – Fees – Fines | 33 | ✓ Payment of Taxes ✓ Payment of Fines |
| 2. Job Searching Services | 33 | ✓ |
| 3. Registration/ Modification/ Deletion of Personal Data in Municipal Records | 5 | |
| 4. Applications for Certificates issuing | 33 | ✓ |
| 5. Issuing Certificates, Permissions and other administrative actions concerning Building topics | 15 | |
| 6. Training and Vocational Education Services | 4 | |
| 7. Health-related and Social Care Services | 5 | ✓ hospitals & pharmacies on duty |
| 8. Public Transport and Roads Services | 5 | ✓ m-traffic and m-parking services |
| 9. Environmental, Lighting, Cleaning and Recycling Services | 3 | |
| 10. Sports, Culture, and Entertainment Services | 10 | ✓ m-ticketing services |
| 11. Entrepreneurship and Local Development Services | 0 | |
| 12. Cemetery Services | 0 | |
| 13. Water Supply and Sewerage Services | 20 | |
| 14. Foreigner Services | 0 | |
| 15. Requests / Complaints | 33 | ✓ |
| 16. Electoral Catalogues Searching | 28 | ✓ |
| 17. Municipal Council's Decisions Searching | 33 | ✓ |
| 18. General Information Services | 44 | |

Table 3. Demographic characteristics of the sample

| | Gender | | Age | | | | | | Education | | |
|----|------------|------------------|----------------|------------|------------|-------------------------|--------------|--------------|-------------|------------------------|-------------|
| | M. | F. | 18-24 | 25-34 | 35-49 | 50-65 | 65< | <18 | High School | University/ Tech. Col. | Master/ PhD |
| No | 91 | 124 | 118 | 54 | 23 | 17 | 2 | 1 | 49 | 135 | 31 |
| % | 42.3 | 57.7 | 54.9 | 25.1 | 10.7 | 7.9 | 0.9 | 0.5 | 22.8 | 62.8 | 14.4 |
| | | | | | | | | | | | |
| | Occupation | | | | | Position in the Company | | | Total | | |
| | Student | Private employee | Public servant | Freelancer | Unemployed | high level | medium level | junior level | | | |
| No | 90 | 58 | 20 | 27 | 20 | 25 | 27 | 57 | 215 | | |
| % | 41.9 | 27 | 9.3 | 12.6 | 9.3 | 11.6 | 12.6 | 26.5 | 100 | | |

According to the data in Table 4, the large majority of the citizens never use any of the services. Only: “General Information Searching”, “Electoral Catalogues Searching” and “Job Searching Services” seem to be used by a part of our sample.

Table 4. Frequency of e-government services use

| E-government services use | Never % (No) | Seldom % (No) | Occasionally % (No) | Often % (No) | Very Often % (No) |
|---|-----------------|------------------|------------------------|-----------------|----------------------|
| 1. Payment of Taxes – Fees – Fines | 88.4% (90) | 6.0% (13) | 3.3% (7) | 1.4% (3) | 0.9% (2) |
| 2. Job Searching Services | 65.1% (140) | 16.3% (35) | 9.3% (20) | 7.4% (16) | 1.9% (4) |
| 3. Reg./Modif./ Del of Personal Data | 87.0% (187) | 7.9% (17) | 4.2% (9) | 0.9% (2) | 0.0% (0) |
| 4. Certificates Issuing | 71.2% (153) | 14.9% (32) | 11.2% (24) | 2.8% (6) | 0.0% (0) |
| 5. Certificates & Permissions Issuing about Building topics | 82.3% (177) | 9.8% (21) | 6.5% (14) | 0.5% (1) | 0.9% (2) |
| 6. Training and Vocational Education Services | 74.0% (159) | 13.0% (28) | 8.4% (18) | 3.7% (8) | 0.9% (2) |
| 7. Health-related and Social Care Services | 79.1% (170) | 12.1% (26) | 6.0% (13) | 1.9% (4) | 0.9% (2) |
| 8. Public Transport and Road Services | 62.8% (135) | 14.0% (30) | 12.1% (26) | 9.3% (20) | 1.9% (4) |
| 9. Environmental, Lighting, Cleaning and Recycling Services | 83.3% (179) | 7.9% (17) | 6.0% (13) | 1.4% (3) | 1.4% (3) |
| 10. Sports, Culture, and Entertainment Services | 69.8% (150) | 14.9% (32) | 8.4% (18) | 3.7% (8) | 3.3% (7) |
| 11. Water Supply and Sewerage Services | 82.3% (177) | 7.0% (15) | 5.1% (11) | 3.7% (8) | 1.9% (4) |
| 12. Requests / Complaints | 86.0% (185) | 7.9% (17) | 3.7% (8) | 1.4% (3) | 0.9% (2) |
| 13. Electoral Catalogues Searching | 61.4% (132) | 17.2% (37) | 15.3% (33) | 4.7% (10) | 1.4% (3) |
| 14. Council's Decisions Searching | 82.8% (178) | 10.2% (22) | 3.7% (8) | 2.8% (6) | 0.5% (1) |
| 15. General Information Services | 57.7% (124) | 12.6% (27) | 14.0% (30) | 10.7% (23) | 5.1% (11) |

According to the data (Table 5), citizens consider all the benefits highly important. Particularly, benefits as “I can use e-services anytime”, “I save time” and “I complete business activities quickly” seem to be the most important ones, according to the citizens. In fact, “E-services are user friendly” and “E-services are easy to use” are key-factors concerning future implementation of e-government services. On the other hand, as far as barriers are concerned, we notice that the most outstanding barrier is the “Lack of awareness of e-services provided”, 84.7% of our sample is unaware of the e-services provided. “Lack of trust in e-government system of the municipality” and “Lack of security when using e-services” are impeding factors, too, whereas, “Low familiarity with new technologies” is not a preventative factor for Greek citizens.

Table 5. Benefits and Barriers of e-government services

| Benefits/Barriers | Not at all % (No) | Very little % (No) | Somewhat % (No) | A lot % (No) | To great extent |
|---|----------------------|-----------------------|--------------------|-----------------|--------------------|
| Benefits | | | | | |
| 1. I save time | 6.0% (13) | 6.5% (14) | 26.5% (57) | 34.4% (74) | 26.5% (57) |
| 2. I complete business activities quickly | 9.3% (20) | 8.8% (19) | 26.5% (57) | 28.4% (61) | 27.0% (58) |
| 3. I can use e-services anytime | 5.1% (11) | 8.8% (19) | 19.1% (41) | 34.9% (75) | 32.1% (69) |
| 4. E-services are easy to use | 6.0% (13) | 12.1% (26) | 40.5% (87) | 28.4% (61) | 13.0% (28) |
| 5. I learn fast/easily how to use e-services | 7.4% (16) | 6.0% (13) | 37.7% (81) | 35.3% (76) | 13.5% (29) |
| 6. E-services are user friendly | 5.6% (12) | 12.6% (27) | 40.0% (86) | 31.6% (68) | 10.2% (22) |
| 7. E-services upgrade my quality of life | 7.0% (15) | 10.2% (22) | 28.8% (62) | 27.9% (60) | 26.0% (56) |
| Barriers | | | | | |
| 1. Lack of awareness of e-services provided | 5.6% (12) | 9.8% (21) | 22.8% (49) | 28.4% (61) | 33.5% (72) |
| 2. Low familiarity with new technologies | 50.7% (109) | 19.5% (42) | 16.7% (36) | 8.4% (18) | 4.7% (10) |
| 3. Low quality of the e-services provided | 11.2% (24) | 24.2% (52) | 39.1% (84) | 20.5% (44) | 5.1% (11) |
| 4. Lack of trust in e-government system of the municipality | 15.8% (34) | 15.8% (34) | 30.7% (66) | 23.3% (50) | 14.4% (31) |

| | | | | | |
|---|------------|------------|------------|------------|------------|
| 5. Lack of security when using e-services | 15.8% (34) | 19.5% (42) | 24.7% (53) | 22.3% (48) | 17.7% (38) |
| 6. Difficulty in learning how to use e-services | 35.3% (76) | 23.3% (50) | 26.5% (57) | 10.7% (23) | 4.2% (9) |
| 7. Low connection/ data transfer speed | 24.7% (53) | 27.9% (60) | 22.8% (49) | 16.7% (36) | 7.9% (17) |
| 8. Not interesting services | 17.7% (38) | 28.4% (61) | 31.2% (67) | 14.4% (31) | 8.4% (18) |

As it comes up from Table 6, the citizens seem to be very interested in using the majority of mobile services. Particularly, the results show that 86,9% (answers between occasionally and very often scale) of the citizens are willing to use “health-related” services and 84,7% of them have the tendency to use “m-ticketing” services. It is also remarkable that 60,5% of the citizens answered that they would like to use “Council’s Decisions Searching” service seldom or never.

Table 6. Intention to use m-government services

| M-government services | Never % (No) | Seldom % (No) | Occasionally % (No) | Often % (No) | Very Often % (No) |
|--|-----------------|------------------|------------------------|-----------------|----------------------|
| 1. Payment of Taxes | 24.7% (53) | 17.7% (38) | 27% (58) | 20.9% (45) | 9.8% (21) |
| 2. Payment of Fines | 18.1% (39) | 17.7% (38) | 24.7% (53) | 27% (58) | 12.6% (27) |
| 3. Job Searching Services | 16.7% (36) | 12.1% (26) | 16.3% (35) | 23.7% (51) | 31.2% (67) |
| 4. Applications for Certificates issuing | 7.4% (16) | 12.1% (26) | 23.3% (50) | 31.6% (68) | 25.6% (55) |
| 5. Health-related Services | 4.7% (10) | 8.4% (18) | 20.9% (45) | 26.0% (56) | 40.0% (86) |
| 6. m-traffic and m-parking services | 13.5% (29) | 12.6% (27) | 15.8% (34) | 16.7% (36) | 41.4% (89) |
| 7. m-ticketing services | 6.0% (13) | 9.3% (20) | 22.3% (48) | 23.3% (50) | 39.1% (84) |
| 8. Requests / Complaints | 20% (43) | 22,8% (49) | 22,8% (49) | 20% (43) | 14,4% (31) |
| 9. Electoral Catalogues Searching | 19.1% (41) | 22.8% (49) | 33.5% (72) | 14.4% (31) | 10.2% (22) |
| 10.Council’s Decisions Searching | 27.9% (60) | 32.6% (70) | 19.5% (42) | 12.1% (26) | 7.9% (17) |

The citizens were asked about the reasons why they would use m-services and which barriers would make them reluctant to them. The most important reasons are that the citizens save time while using m-services, likewise, they conduct the service they need anytime and anywhere. However, the total cost of m-services and the lack of network connection seem to be the most important hurdles that would prevent citizens from using m-services. The results are shown analytically in Table 7.

Table 7. Benefits/Barriers of m-government services

| Benefits/Barriers of m-services | Not at all % (No) | Very little % (No) | Somewhat % (No) | A lot % (No) | To great extent |
|---|----------------------|-----------------------|--------------------|-----------------|--------------------|
| Benefits | | | | | |
| 1. M-services are easy to use | 3.3% (7) | 8.4% (18) | 33.5% (72) | 31.2% (67) | 23.7% (51) |
| 2. M-services upgrade my quality of life | 4.7% (10) | 7.4% (16) | 28.4% (61) | 33.5% (72) | 26.0% (56) |
| 3. I save time | 2.3% (5) | 6.5% (14) | 17.7% (38) | 29.8% (64) | 43.7% (94) |
| 4. I use m-services anytime & anywhere | 3.3% (7) | 6.5% (14) | 17.7% (38) | 32.1% (69) | 40.5% (87) |
| 5. M-services support business activities | 16.3% (35) | 18.1% (39) | 23.3% (50) | 25.1% (54) | 17.2% (37) |
| Barriers | | | | | |
| 1. Lack of transactions security | 3.3% (7) | 14.9% (32) | 21.4% (46) | 25.6% (55) | 34.9% (75) |
| 2. Lack of trust in m-services | 5.1% (11) | 17.7% (38) | 25.6% (55) | 26.5% (57) | 25.1% (54) |
| 3. Fear of receiving spam messages | 7.0% (15) | 27.9% (60) | 22.3% (48) | 25.1% (54) | 17.7% (38) |
| 4. Short battery life time | 13.5% (29) | 39.1% (84) | 27.4% (59) | 11.6% (25) | 8.4% (18) |
| 5. Tech-limitations of m-devices | 13.0% (28) | 35.8% (77) | 31.6% (68) | 14.4% (31) | 5.1% (11) |
| 6. Difficulty in learning how to use m-services | 27.0% (58) | 31.2% (67) | 26.0% (56) | 10.2% (22) | 5.6% (12) |
| 7. Lack of network connection | 4.2% (9) | 8.4% (18) | 23.7% (51) | 40.5% (87) | 23.3% (50) |
| 8. Low data transfer speed | 3.7% (8) | 12.6% (27) | 33.5% (72) | 33.0% (71) | 17.2% (37) |
| 9. High cost of m-services | 2.8% (6) | 11.2% (24) | 24.2% (52) | 32.6% (70) | 29.3% (63) |

4. CONCLUSIONS

The ultimate goal of the electronic and mobile government is to enable an increased portfolio of services to citizens in an efficient and cost-effective manner.

However, results show that only a minority of the questioned citizens uses e-services and this is because of the lack of awareness and trust in e-government systems. On the other hand, it is verified that m-government in Greece is at its birth stage. Although the citizens seem to recognize the beneficial character of the m-government services, lack of network connection and their high cost strongly impede their usage.

This paper is an attempt to picture the situation in a specific part of the country giving the Greek municipalities a fundamental evaluation of their level of e-services achievements. It, also, fills in the literature gap regarding the lack of governmental services classifications; it contributes with the proposition of an e-and m-services typology focusing on the G2C applications in the Greek environment. Furthermore, the study gives the Greek municipalities feedback about the citizens' acceptance of the provided e-services plus their interest around future m-services. This could give them encouraging or discouraging input for continuing or pausing building on e-/m- government, respectively.

Ending this paper, it should be mentioned that this study comprises the first part of an ongoing research extending on all the Greek municipalities. Additionally, the sample of the citizens can be expanded, so that we have higher representative and more accurate results; alternatively, for the safe generalization of the results, this study could be repeated with sample from the same population, in order to achieve external validity. A next step would be a comparison of the adoption of e- and m-services by both municipalities and the citizens, including several European countries. Technical, financial, and human resources variation between EU municipalities could be taken into consideration (Peinel & Rose, 2006).

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AN ANALYSIS OF EFFECT OF E-GOVERNMENT READINESS ON BUSINESS CLIMATE, CORRUPTION PERCEPTION, AND THE RATE OF NEW ENTREPRENEURS

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ABSTRACT

This article aims to understand the relationship between e-government, business climate, the corruption perception and its impact on the rate of new entrepreneurs. Data was collected from various databases, for the years 2008 and 2010, using a panel data, instead of a cross sectional design. The reports used were The Doing Business Report and E-Government Survey from the United Nations, Corruption Perception Index by Transparency International and GEM DATA from Global Entrepreneurship Monitor. After joining the databases correlation analysis and panel least squares regressions were performed to test the relationships between the variables. The results indicate that when a country is more “e-gov” ready it reaps some benefits such as a more dynamic business sector and less perception of corruption as well. The probable causes of the relationships are discussed, including a suggestion for a more integrative approach to make it possible for less developed countries to diminish the gap of e-government sophistication. Future research to understand the difference of impact of e-government in developed and developing countries are also suggested.

KEYWORDS

E-Government; Entrepreneurship; Doing Business; Competitiveness

1. INTRODUCTION

The e-Government is not thought as a management fad, it came to stay ! With the unquestionable worldwide availability of the Internet, first as a media to conduct research, then evolving to more widespread use to conduct business, being later followed by the governments as a source of information for its taxpayers and citizens (West, 2000; Morgesson & Mithas, 2009).

Nowadays, e-Government is not only information technology (IT) in the government, but a new interface with governmental stakeholders. Even though the e-government initiatives are usually based on the e-commerce model and adapt much of its technology, there are some important differences between the two initiatives, as Jorgensen & Cable (2002) point out: concerning access, structure and accountability.

The e-government is not only the government sending information to its citizens, it's more: First the government to citizen, whereby the citizens access government information and services online, but also the electronic communication between government and business, which allows online interaction between government and the private sector, on processes like obtaining licenses, paying taxes, issue of permits, etc, and also government to government, improving the exchange of data and information between the various levels of governmental agencies, to also deliver services and allocate responsibilities between different spheres of government (Moon, 2002).

Even though there are some dispute about the e-government frameworks and definitions, the benefits of the sharing governmental information is not disputed anymore. For example, public finances can be easily consulted by anyone with internet access, being a real hindrance to corruption in many countries (Andersen, 2009; Brunetti & Weder, 2003). The information can be used to provide guidance, advice and communicate important news and announcements. Updated statistics in governmental sites can help citizens and business

to take more informed decisions (World Bank, 2003). Reduction of administrative costs, and time spent on government employees are also pointed out as results of successful implementation of e-government (Jaeger, 2003). Gupta and Jana (2003) state that e-government is no longer just an option but a necessity for countries aiming for better governance.

The list of services offered by e-platforms is growing to be par with the total services provided in the traditional governmental buildings. This tendency is easily observed in the most developed countries, where their citizens already can make most of their transactions without the need to be physically present at a governmental office, while in less developed countries the same level of interaction is not observed and most citizens have to be physically present and wait for long times before they can get documents, consult data or even pay their taxes (UN, 2009). This is usually because of the lack of structure of information and communication technology, or low e-readiness. A great number of e-readiness measures have been developed (Grigorovici et al., 2003). The measures use widely varying definitions for e-readiness and different methods for the assessments which are very diverse in their goals, approaches and results (Bridges.org, 2005b), having that in consideration, the United Nations created an index known as E-Government Readiness Index, that is composed by other sub-indexes: the Human Capital Index, that is a composite of the adult literacy rate and the combined primary, secondary and tertiary gross enrolment ratio (UN, 2009), the Telecommunication Infrastructure Index 2008 composed of five primary indices relating to a country's infrastructure capacity as they relate to the delivery of e-government services.

The e-participation questions expand the survey by emphasizing quality regarding connected presence. These questions focus on the use of the Internet to facilitate sharing of information by governments to citizens (UN, 2011). Therefore, a country's e-participation index value reflects two important things, first the usefulness of the features and also the extent to which they are deployed compared to all other countries. The Web Measure Index 2008 is based upon a five-stage model (Andersen & Henriksen, 2006), while in the 2010 report it was renamed to Online Service Development (UN, 2011), both were built upon the previous levels of sophistication of a UN Member State's online presence. As a country migrates upwards through the various stages, it is ranked higher in the Web Measure Index (UN, 2009). The most developed state is known as the connected government, and once the country improves the content delivery, security, customer and data management, level of service they go up, as shown below:

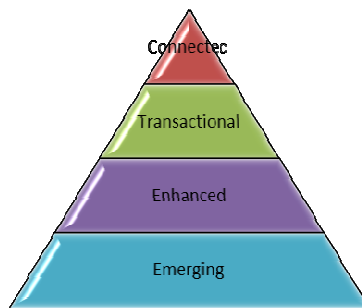
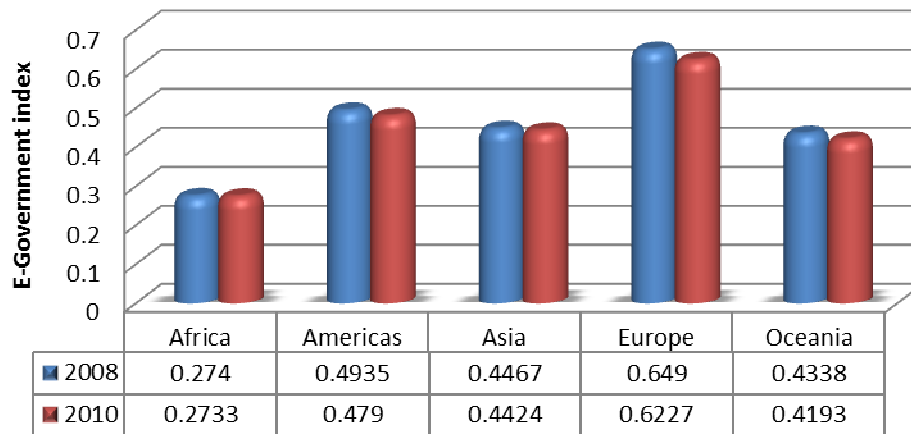


Figure 1. UN Online Service Development
Source: UN e-Government Survey 2011

The Emerging stage is the first step that a Government takes to enter the e-realm, and represents the most basic form of electronic presence, consisting basically of a web page or official webpage. In the second stage, the enhanced stage has more information in public policy and governance, with links that provide easier navigation to archived information, like documents, forms, reports, laws and newsletters (UN, 2009). In the Interactive Stage online services like downloadable forms are provided, with many starting activities included in an interactive portal with services that enhance the convenience of the citizens (UN, 2009), this stage is not present formally in the 2010 UN report and will be joined to the enhanced stage in the analysis.

The third stage, known as Transactional is determined by the introduction of processes that promote interactions between citizens and government, like options for paying taxes, applying for ID cards, passports and other documents, with all transactions being conducted fully online (UN, 2009). The fourth stage, the Connected Government Stage is the most developed level of sophistication of the e-government and implies a governmental transformation into a connected entity that responds to the needs of its citizens by the development of an integrated back-office. Although the more developed nations since the beginning took the

lead in the e-Government, letting most of the world in a more modest state of adoption of more sophisticated e-government. This seem to be a concern to be tackled with, since although the e-Government has been improving in reach, number of services, etc. The gap between the countries seems to remain untouched, as we can see in the figure bellow:



Source: UN E-Government report 2008/2010

Figure 2. E-Government Index by Region

The services provided by a consistent e-government structure can be very useful for its citizens and business as well, especially when the services are provided for business, being able to provide shorter times to start a firm, to obtain a construction permit, to hire and fire people, to import and export goods, all them could benefit from a fast, responsive and complete e-government strategy. All those characteristics are known as facilitators for enterprise creation and maintenance, as measured by The Doing Business Report, that provides a quantitative measure of regulations for starting a business, dealing with construction permits, employing workers, registering property, getting credit, protecting investors, paying taxes, trading across borders, enforcing contracts and closing a business—as they apply to domestic small and medium-size enterprises (World Bank, 2009; World Bank, 2011).

Finally, the last report utilized was the Corruption Perception Index (CPI) 2009, which is published since 1995 by Transparency International, ordering the countries of the world according to "the degree to which corruption is perceived to exist among public officials and politicians". The Corruption Perceptions Index (CPI) measures the perceived level of public-sector corruption in 180 countries and territories around the world (Transparency International, 2010).

2. METHOD

The analyses were performed with the software: SPSS 19 (IBM) and EVIEWS 11.0. They were used to compute non-parametric correlations, linear regressions, and data treatment. Before the data could be used, some procedures had to be performed. This study used a panel design, where a variable like corruption perception is measured more than once for the same subject (figure 3). According to Hsiao (2003), panel data have been increasing popular, mostly because the great availability of data in this format, being more able to answer substantial questions than a single set of indicators, that is commonly used in cross sectional data.

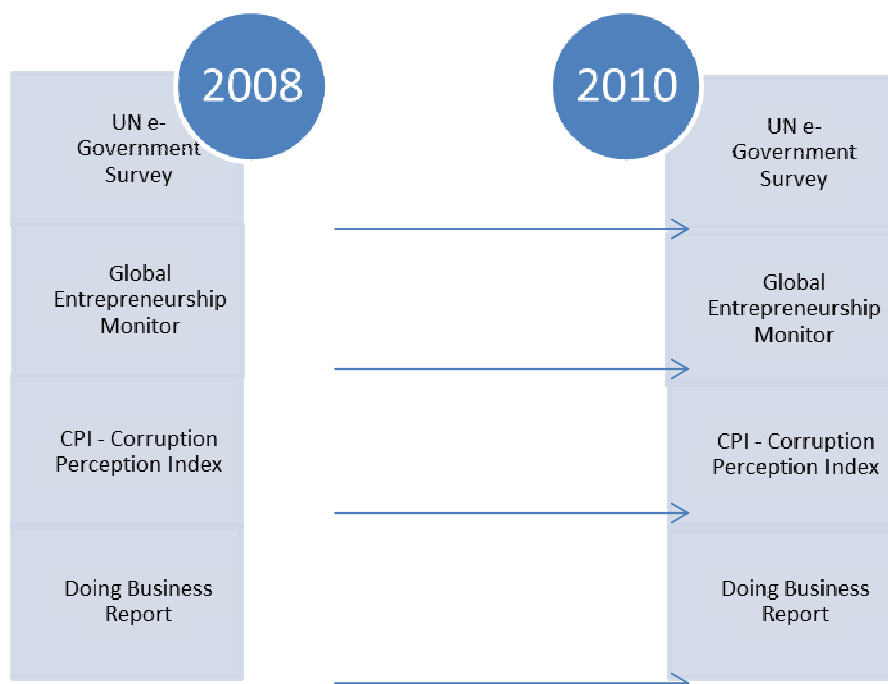


Figure 3. Scheme for the Data for the Study

The data was obtained for two years (2008 and 2010), due to availability of data for all the reports, so were imported the Reports for Doing Business 2008 and 2010 edited by the World Bank (World Bank, 2009), UN e-government survey 2008 (UN, 2009) and UN e-government survey 2010 (UN, 2011) in PDF format, and imported into Microsoft Excel 2010. Also were used the Global Entrepreneurship Monitor Data for 2008 and 2010 (GEM, 2011) for the Variable: **Entrepreneurship Rate**, measured as the percentage of population from 18 to 64, who are either a nascent entrepreneur or owner-manager of a new business. The Corruption Perception Index published by Transparency International had 180 countries in its database in 2008 and 2010 version, with two variables named CPI. Subsequently data was merged into a single list, for both years, with the country name being the key variable in both databases, with spelling difference between the files corrected, and data inputted in a panel format.

3. ANALYSIS

To compute the relationship between the variables the Spearman's correlation coefficient was also used. According to Miles and Shevlin (2001) when the relationship between two variables is not normally bivariate or when one is measured at a ordinal level the more widely used Pearson coefficient may not be the best estimative of the correlation of the variables. The Spearman coefficient measures the intensity of relationship between ordinal variables, using ranking position instead of the observed values, therefore not being affected by asymmetries of the data, lack of linearity, presence of outliers and non-normality of the data (Miles & Shevlin, 2001). Therefore non-parametric correlation analyses were performed with the main study variables. The results are presented in the table 1:

Table 1. E-government indexes and ease of doing business variables

| | E-Government Index | Entrepreneur Rate | Corruption Perception Index |
|---|-------------------------------|------------------------------|--|
| E-Government Index (e-readiness) | 1,000 | -,584** | ,752** |
| Entrepreneur Rate | -,584** | 1,000 | -,612** |
| Corruption Perception Index | ,752** | -,612** | 1,000 |
| Start Business Rank | -,480** | ,334** | -,524** |
| Dealing with Construction | -,368** | ,303** | -,500** |
| Registering Propriety | -,480** | ,158 | -,462** |
| Getting Credit | -,669** | ,228* | -,556** |
| Protect Investors | -,465** | ,156 | -,445** |
| Pay Tax Rank | -,362** | ,267** | -,532** |
| Trade Accross Border | -,666** | ,531** | -,729** |
| Close Business Rank | -,555** | ,480** | -,520** |

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

For the data relations being considered, a higher E-government readiness was associated with lower Corruption Perception (higher values mean lower corruption perception according to index), suggesting that countries that have more advanced e-government projects enjoy at least less perception of corruption. As expected all dimensions of Ease of Doing Business were inversely associated with perception of corruption, that is the best the country ranks in ease of doing business, the less corrupt it appears, though causality relation cannot be inferred. Also countries that have lower Corruption Perception seem to sport a higher rate of population owning a business than the countries that are more perceived as corrupt.

The Entrepreneurship rate was correlated with e-government and doing business indicators, standing all positively associated, as can be seen in the table 2:

Table 2. Spearman Correlations

| | Entrepreneur Rate | Rank Online Services | Startup Ranking | Getting Credit Rank |
|-------------------------------|------------------------------|---------------------------------|----------------------------|--------------------------------|
| Entrepreneur Rate | 1,000 | ,383** | ,334** | ,228* |
| Online Services Rank | ,383** | 1,000 | ,425** | ,660** |
| Start-up Business Rank | ,334** | ,425** | 1,000 | ,493** |
| Getting Credit Rank | ,228* | ,660** | ,493** | 1,000 |

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

After performing the correlational analysis, the Panel Least Squares analysis was performed to regress the various predictors into the entrepreneur rate, to see what variables hold relation to the proportion of new business owners in a given country (TEA- total entrepreneur activity as named by the Global Entrepreneurship Group, GEM, 2011). For this procedure were selected the variables that could be possible predictors according to the literature, then those variables were inserted in a stepwise procedure, implemented in the E Views statistical package, the output is presented in the table 3:

Table 3. Regression Parameters for Panel Least Square Regression

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|--------------------|-------------|-----------------------|-------------|----------|
| C | 3.744886 | 1.084825 | 3.452064 | 0.0008 |
| E-GOV-RANK | 1.51E-05 | 1.72E-06 | 8.789026 | 0.0000 |
| R-squared | 0.440789 | Mean dependent var | | 11.31000 |
| Adjusted R-squared | 0.435083 | S.D. dependent var | | 8.784807 |
| S.E. of regression | 6.602745 | Akaike info criterion | | 6.632645 |
| Sum squared resid | 4272.432 | Schwarz criterion | | 6.684749 |
| Log likelihood | -329.6323 | Hannan-Quinn criter. | | 6.653733 |
| F-statistic | 77.24698 | Durbin-Watson stat | | 1.431014 |
| Prob(F-statistic) | 0.000000 | | | |

Model- Panel Least Square

The model was able to explain almost 45% of the variance on the rate of new entrepreneurs ($F=77,24$; $p<0,00$). But, again the e-government ranking was inversely correlated to the rate of new entrepreneurs. This is shown by the positive coefficient in the rank, meaning the higher value, therefore lower in the rank, higher would be the estimated percentage of business owners in the country, being somewhat counter intuitive according to the e-Government literature. Since the e-government readiness is composed by the 3 indicators, human capita, infra-structure and services, we tried to regress the TEA (percentage of new entrepreneurs 16-64 years old) and found out that infra-structure was the most correlated component to TEA, again in an inverse relationship.

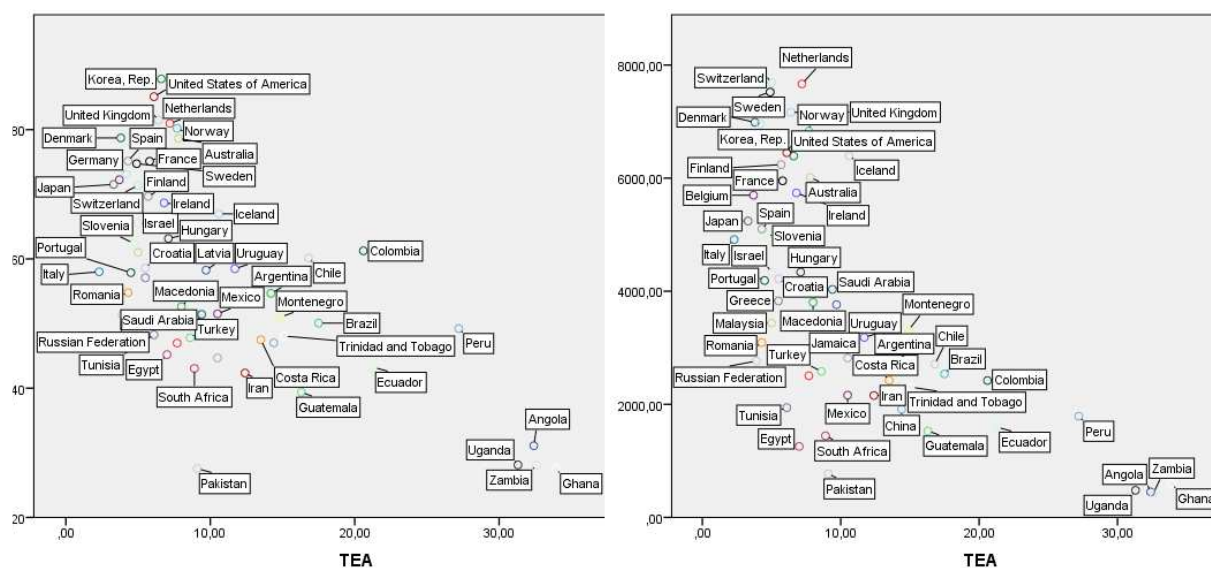


Figure 4. E-government readiness and infra-structure indexes (y axis) compared with TEA.

The figure 4 is very revealing because shows a clear pattern of less developed country (using infrastructure as a proxy) with higher percentage of owner or manager of a new or nascent business. This countries could be also economies that have a big or recent growth and therefore present us with that unlikely at first sight result, not bearing a direct relation to the e-Government readiness initiative being a most likely a spurious correlation if the take the e-government readiness or it reflects a trend if we take a closer look of the components of the e-Government indicator.

4. CONCLUSIONS

The results were in the most part according to the expected relationships, according to the literature review, in this case the most important is the relationship between the e-government and the ease of doing business dimensions, since most of them had statistically significant relationships indicating that the e-Government readiness may be indeed be a vital player on making the private business more competitive and less bureaucratic, therefore improving the country production, job and enterprise creation. It is important to reaffirm the e-government readiness strong and statistically significant relationship ($r=0,752$) with lower corruption perception, and more important that the positive relationship between lower perception of corruption and good ranking on doing business dimensions, meaning that the better the business climate is, the less bureaucratic the less likely it will be plagued by corruption, since the everything works, without any “extra” help needed from unscrupulous public officers that might be profiting from a not so developed business atmosphere.

We would like to have our voice make very serious point now. Although the services provided by the e-Government have been improved in number and quality worldwide, with virtually no exception, the gap between the regions is exactly the same present in 2008, and not likely to change any time soon. Since there is a consensus that the e-Government can be a good preventer of corruption and at the same time improve the opportunities for a country to receive investments or to grow, it is imperative that the less fortunate countries receive support so they can close the gap, implementing a successful web present, improving their processes, accountability of resources use and application.

It's important to note that the composition formula for the e-government readiness index indicates that to furnish a successful web-presence is not the sole answer for a successful e-govern implementation (UN, 2009). The dimensions of formal education and infrastructure are determinant to the use of the electronic platforms by the recipients, the country citizens. The more prepared the population is to use the tools provided, the higher would be the effectiveness of a given e-govern initiative.

In the same way, studies point out that in the implementation of e-government projects the main problems usually are not technical, but instead were policy issues (EGOV, 2003). Some of the greatest challenges to maximizing the potential of e-government may involve social dimensions of information policy related to the Internet (JAEGER & THOMPSON, 2003). This implies that the demand side of e-government should be regarded as well, that is the interaction between the citizens and the government (Reddick, 2005). This dimension is affected mainly by the awareness of the citizens and their skills to use the created resources, and use it to its full potential. For the future research, we suggest that some be targeted toward the understanding of how the e-government initiatives impacts developed and in development countries in a diverse manner, in such items as enterprise creation, new investments, job creation, and in the well-being of the citizens.

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CHILDREN AND E-SOCIETY: IDENTIFYING BARRIERS TO PARTICIPATION

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ABSTRACT

Children are widely seen as direct beneficiaries and indeed often as the primary targets of information society policies, particularly those geared towards enhancing learning opportunities, access to information and building inclusiveness and participation in society. The European Union's *Digital Agenda* places a safer and better internet for children at the heart of its policy platform. And yet, more often than not, children's e-society participation has been a cause of concern and anxiety for policy makers, particularly with ever-increasing early adoption of new internet technologies and services by children and young people. Such concerns have been motivated by the responsibilities held by public agencies to ensure adequate protection for young people whilst seeking to encourage and foster children's online opportunities. Thus, e-society may be said to constitute a set of tricky policy dilemmas and challenges with regard to children's participation. To date, the balancing of risks and opportunities has been informed more by assumptions of the benefits and the dangers that e-society might pose for children and young people. *EU Kids Online*, a pan-European survey of children's use of the internet, has attempted to fill this research gap by providing the first fully comparable data on issues of risk and safety gathered directly from children themselves in 25 European countries. Drawing on its research findings, this paper will focus on the extent of children's embeddedness within e-society, examining dimensions of e-literacy, the availability of appropriate e-content and resilience in relation to risks encountered online. The paper argues for greater policy and research attention to children's perspectives on e-society, as a means of fostering greater trust and participation for society as a whole.

KEYWORDS

EU Kids Online, e-participation, digital safety

1. INTRODUCTION

Participation in policy making, public debate and all the aspects of decision-making that affects citizens' lives is a goal eagerly pursued by governments and civil society alike. Harnessing the potential of Information and Communication Technologies (ICTs) to make the process of government more accessible and accountable to its citizens is a major policy objective of the European Union and national governments alike (Commission of the European Communities, 2009). E-society, encompassing the full spectrum of society's information and services, offers a vision of how citizens' lives may be enhanced through the application of ICTs. Children feature prominently in this policy framework though often in incomplete and sometimes inconsistent ways. Yet, the figure of the 'digital native' (Prensky, 2001) and allied concepts, offer a powerful image of how tomorrow's adult citizens will benefit from immeasurably improved processes of government, decision making and support for community needs (Tapscott, 1999, Rheingold, 2002, Calvert, 1999).

This paper looks at children's relationship to e-society by examining the evidence about how they access, use and engage with opportunities online. Children are the subjects of many policies in relation to information society issues and as the adopters of new technologies are often seen in the vanguard of new modes of learning, engagement and participation in e-society (Rice, 2006). Yet, their participation is also sometimes the subject of public anxiety and societal concerns about the implications of unrestricted access to information and services that were not necessarily designed for them (Livingstone, 2003). As such, considering the role of children in e-society is part of a broader policy mix of building trust in the information society, on the basis that how children's opportunities are supported can be seen as a touchstone of e-society for all.

To date, children's engagement with the information society has more often than not been the subject of idealized discourse but with relatively patchy empirical knowledge of how much young people do, or do not, participate in the online world. Arguably, the policy priority, particularly in the first decade of the internet's existence, has been to enhance children's access and to avoid the dangers of a digital divide (Becker, 2000, Bolt, 2000). Now, with growing awareness of the complexity of digital inclusion (Livingstone and Helsper, 2007) and a better evidence base concerning children's use of internet technologies, there is greater appreciation of the need for evidence and ongoing research to support the potential that ICTs offer children. In this context, findings from the EU Kids Online project, the thematic network funded under the Safer Internet Programme, provides valuable baseline data about how children access and use the myriad opportunities available to them. Such evidence is needed in the first instance to inform policy-making regarding the safety of young people's experiences of the internet. But it is also about guiding future policy actions in order to support better online experiences. Therefore, the paper addresses policy recommendations arising from the research which both seek to address the gaps in current policy provision and which seek to foster enhanced participation.

2. ENHANCING THE KNOWLEDGE BASE

The Safer Internet Programme (SIP) is part of a larger set of measures under DG Information Society and Media designed to ensure Europe is a competitive knowledge economy and harnesses the benefits of ICT for all its citizens. Alongside early efforts to liberalise the market for technology and audio-visual services, measures to protect minors and combat the downsides of the internet were a prominent feature of the European audio-visual space. Arising from an EC Action Plan on promoting safer use of the internet in 1999 (European Commission, 1999), the programme has in successive phases promoted effective action against illegal content on the internet, and initiatives designed to minimize potentially harmful, though not necessarily illegal uses and content (European Commission, 2003). Pre-eminent in this policy framework has been an emphasis on protection with a set of designated responsibilities on multiple stakeholders – industry, educators, civil society, regulators – to promote and protect children's interests (European Commission, 2006). Notably lacking in its early years was any commitment to research or knowledge enhancement of children's interests or perspectives.

EU Kids Online has sought to fill this research gap. Drawing initially on a database of some 400 studies detailing different aspects of the uses, activities, risks and opportunities for young people, EU Kids Online has classified risks documented in the literature (Livingstone and Haddon, 2009) and distinguished between *content*, *contact* and *conduct* risks, recognising children as actors and participants as well as consumers of content, in need of protection.

In the second phase of the project (2009-11), EU Kids Online conducted a unique, face-to-face survey in homes of 9-16 year old internet users, with their parents from 25 countries across Europe. A total of 25,142 children and their parents were interviewed during 2010. The purpose of the survey was to provide a rigorous evidence base to support stakeholders in their efforts to maximise online opportunities while minimising the risk of harm associated with internet use.

The focus of the research was on specific risks identified in the literature and followed a path through the context of uses and activities online through risks encountered, focusing ultimately on the outcomes for children, particularly those who are adversely affected or harmed. In so doing, however, the survey provides a unique perspective on how children across Europe are participating in online activities, what opportunities are they pursuing and what challenges they face in their day to day use of internet technologies and ICTs.

3. BALANCING RISKS AND OPPORTUNITIES

As a pioneer in promoting safer internet policies from the mid 1990s on, the European Commission has attempted to balance the conditions for a free single market for audiovisual services and products with the promotion of safety awareness, codes of practice, guidelines and measures to protect minors in the information age (Charlesworth, 2000, Tambini et al., 2008).

E-inclusion policies in Europe, from the Bangemann report onwards, including successive policy frameworks such as the i2010 initiative to the current *Digital Agenda* (European Commission, 2010), have framed the European Union's commitment to an information society for all. Fundamentally, this represents the longstanding commitment that Europe has made towards global leadership in ICT through massive investment in research as well as pioneering and implementing e-government services and applications for all citizens. Alongside this, a host of legislative and regulatory measures exist beginning with the 1996 Green Paper on the protection of minors and human dignity (European Commission, 1996a) followed by a Communication on illegal and harmful content on the internet (European Commission, 1996b), and recommendations on the protection of minors (1996 and 2006) and the implementation of its multi-annual action plan on promoting safer use of the internet (European Commission, 1999, European Commission, 2004). This wide ranging array of regulatory and policy formulation provides the underlying infrastructure across the European Union, codifying the principal instruments upon which digital safety and online child protection is promoted. The core pillars of this approach include self- and co-regulation, filtering and content classification, hotlines to report illegal content and awareness-raising strategies and education about internet safety. Beginning with priority actions dedicated to countering illegal online content, successive developments have seen greater attention focused on shared responsibility between stakeholders, on promoting greater awareness of security and safety issues, educating users to improve their skills and enhance their capacity to assume responsibility for their own safety.

Beyond Europe, this agenda has assumed a prominent role in discussions on current and future internet regulation. For example, the Council of Europe has promoted the public service value of the internet and the need to empower and support users online (Council of Europe, 2006). A Council of Europe study in 2006 did much to highlight the range of risks and harm online, reinforcing the need for balanced and proportionate policy responses (O'Connell and Bryce, 2006). Likewise, the International Telecommunications Union (ITU) as the sponsor of the World Summit on the Information Society Initiative, has developed a global child online protection initiative seeking to ensure adequate provision in all members states for regulation, awareness-raising and education measures (ITU, 2009). In the same way, a digital safety agenda has featured in successive meetings of the Internet Governance Forum (IGF), been adopted by UNICEF as an important issue particularly within developing countries, and incorporated within broader debates on media and information literacy as promoted through UNESCO (UNESCO, 1999).

What this indicates is that children, perhaps in contrast to other areas of public life, have not been invisible when it comes to e-society. Children are often foremost in policy considerations, just as they are in the vanguard of adoption of new internet services and devices. What has been notably absent, however, is a robust evidence base upon which to build better policy, inform the fraught nature of the public debate about children on the internet, and to guide the evaluation of measures which are in place.

4. WHAT THE EVIDENCE IS TELLING US

Data from the EU Kids Online survey, in addition to its focus on risks and safety issues, also provides evidence of the depth of children's embeddedness in the online world (Livingstone et al., 2011). Key findings in relation to access, use and activities, emphasizing opportunities over risks are important indicators of the inclusion as well as gaps to participation in e-society. This is not to underestimate the importance of experiences of risk but to suggest that part of the effort in combatting adverse effects on children is to place greater emphasis on positive opportunities.

4.1 Children's use of the Internet

Eurobarometer has estimated that 75% of children in Europe are online. Just three countries (Italy, Greece and Cyprus) were below 50% (Eurobarometer, 2008). In six countries (Finland, Netherlands, Estonia, Denmark, Sweden and the UK), over 90% of children used the internet.

For internet-using children in EU Kids Online, 87% were found to go online at home. While there is growing variation in how children access the internet, it is interesting to note that the home environment remains the most important location for internet use. However, it is clear that there is a growing privatization of online use through the greater prevalence of other connected devices. Importantly, just under half of

children (49%) in Europe go online from the privacy of their own bedroom. While age, socio-economic and national variations exist, the fact that such large numbers have more or less privatized access suggests that the traditional advice of keeping the home PC in a public place needs to be augmented.

The internet is also increasingly accessed by some form of mobile device. As children are often early adopters of new technologies, it is unsurprising that mobile use is very prevalent in some countries. Most children (58%) do still access the internet via a shared personal computer (PC), although access via their own PC is next most common (35%). Mobile access is a growing trend: smart phones are used by 12% on average and 31% go online via their standard mobile phone. Again, age, SES and national variation is much in evidence.

Another indication of the degree of embeddedness in children's lives may be gauged in the frequency and amount of daily use. Going online everyday, it may be assumed, is required for communication activities and maintaining online relationships. In the survey, 57% of children were found to use the internet every day or almost daily and 92% go online at least weekly. In general, children spend 86 minutes online in an average day. SES matters especially for daily use: 64% of children from high SES homes are daily internet users compared to 49% from lower SES homes. Age also matters for daily use: just a third of younger children (9-10 years of age) compared to 77% of 15-16 year olds go online. The age at which children first go online is also declining across Europe. Currently, the average age of first internet use is 9. Yet, children who are in the 15-16 age group say that they were 11 when they first used the internet while 9-10 year olds while 9 to 10 year olds were 7 on first internet use.

4.2 Activities

What do children do online and what activities may be seen as participative or indicative of engagement in e-society? EU Kids Online asked about 17 different kinds of activities ranging from learning, communication, entertainment and creative activities. Of these, use of the internet for schoolwork was found to be highest of all activities. This was followed by entertainment-oriented activities such as watching video clips online and communicating online, reflecting the wide number of social activities that are conducted online. More creative activities such as uploading content, writing a blog or spending time in a virtual world were found to be less frequent.

In all, there is evidence of considerable breadth in children's internet use, with younger children doing on average over five activities and teenagers doing eight or nine activities. As earlier research has suggested, these findings support the 'ladder of opportunities'. This hypothesises that certain basic activities tend to be done first, and by most children. However, more creative or participatory activities come later, and are undertaken by fewer children.

Further analysis is now being done on this data to identify underlying factors in the wide range of uses of the internet and to attempt to develop a typology of user types and gain more of an overview of children's online activities.

In order to gain an insight into underlying patterns in such a wide range of activities, classifying activities under the headings of communication activities (using IM, visiting SNS sites, e-mails and chatrooms), creativity (created characters, posting photos or messages on a website), gaming (playing online games, watching videos online) and learning activities (using the internet for schoolwork, reading watching the news). Following a cluster analysis of underlying trends reveals a number of distinct patterns or user types (Hasebrink et al., 2011).

What this analysis shows is that there is an increasing range of activities, varying in composition and complexity that rises with age and displays an underlying disposition to certain kinds of online activities. This is consistent with the concept of the 'ladder of opportunities' introduced by Livingstone (Livingstone et al., 2005) which argues that children advance through a series of graduated steps starting with the most basic activities and progressively taking on more skilled, complex and creative opportunities. In a cluster analysis, six groups increasing in age and mix of activities have been identified as follows:

i) 'Low use/learning oriented'

This group includes many younger children, and averages 11.4 years old. They use the internet rather little, focusing mainly on schoolwork, watching video clips and reading/watching the news. Few have an SNS profile and they do few risky online activities. Although they encounter few online risks, when they do, they tend to be upset.

ii) **'Low use/social networking site oriented'**

Also relatively young (average 11.5 years), this group is less likely to use the internet for schoolwork or news and more likely to use SNS. They also encounter online risks though they tend not to find these upsetting.

iii) **'Moderate use'**

A bit older than the first two groups at 13.1 years on average, these children spend more time online and have a much wider range of activities. They are, too, more likely to encounter online risks.

iv) **'Diverse and risky opportunities'**

Averaging 13.4 years old, these children spend almost two hours a day online and do the widest range of activities, including some more advanced and creative activities on the ladder of opportunities. They also do more risky online activities. Although not the oldest group, they encounter the most risk online but are the least likely to be upset.

v) **'High use/entertainment oriented'**

These children are older (average 14 years) and more often boys. They are online for most minutes per day (201 minutes on average) and do a fairly wide range of activities. They like playing games against the computer and watching video clips, and they do relatively little schoolwork, news or creative activities. Their exposure to risk is quite high, and some use the internet excessively.

vi) **'Focused social web use'**

This is the oldest group (average 14.2 years), with more girls than boys, and they use the internet for longer, doing more activities, than the average. They are unlikely to play games online, but are the most likely to use SNS. They also read/watch news, use instant messaging, post photos or music and write blogs. Their online risk encounters are similar to groups 4 and 5 but they report slightly higher levels of upset.

4.3 Digital Skills

The range of activities reported by children, a crucial dimension of participation in e-society, is one indicator of the underlying skills possessed by children. A second way in which this is measured is through self-reporting and in the survey children were asked (11-16 year olds only) how many of 8 digital safety skills they could perform. What the results show is that children could perform on average just 4 of the 8 skills asked about. Teenagers in general are more skilled and notably 11-12 year olds appeared to lack basic skills such as changing privacy settings on a social networking profile, comparing information from different websites, blocking unwanted content or messages or changing filter preferences. Boys claim more skills. Most skills, over four, were reported in countries such as Finland, Sweden, the Netherlands and Estonia. Least skills, less than three, were reported in Hungary, Romania, Italy and Turkey. In addition, 36% (though only 13% 9-10 year olds) say it's very true that "I know a lot more about the internet than my parents"

In terms of the digital literacy and safety skills that children are gaining across Europe, the 'glass half full' approach would emphasise that the majority of 11-16 year olds can manage most of the specific skills we asked about. Moreover, one third are very confident, and a further third are a bit confident that they are the generation that knows a lot about using the internet, especially compared with parents.

However, the 'glass half empty' conclusion is that one third says it is not true for them that they know more than their parents about using the internet. Further, of the eight skills we asked them about, on average they can only do four of them, and more than four in ten do not know how to block messages, bookmark sites, find safety information, change privacy settings or determine whether websites are reliable.

4.4 Perceptions of Harm

While activities and skills are measures of how children engage in e-society, these experiences are not all positive. In the research, exposure to risk was a major finding in relation to pre-determined categories as well as overall subjective experiences of harm. In addition to sexual imagery, bullying, sexual messaging and meeting contacts offline first met online, other risks topics included harmful user generated content (such as suicide sites, hate speech and sites promoting anorexia or self-harm). Personal data misuse, though less in evidence, was another feature of online risk which children reported as something which negatively affected them.

Also, it must be remembered that risks and opportunities online go hand in hand. Looking at the incidence of risk mapped against the range of online activities across Europe (Figure 1), a clear relationship emerges between risk and opportunity and that the more children go online, they more they will encounter risks for which they need to be prepared.

There is a fundamental distinction, however, between risk and harm. There is much evidence in the literature to support the view that risk is an essential part of learning and central to building resilience. Some countries have succeeded in promoting online opportunities while not increasing the overall exposure to risk but this is an ongoing challenge faced by all countries.

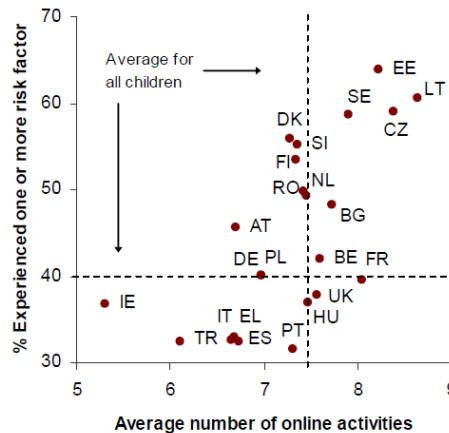


Figure 1. Risks and online opportunities (Livingstone et al 2011)

5. CONCLUSION

A central objective of the EU Kids Online survey is to inform and guide policy making in the area of internet safety. A key emphasis of this policy framework is to create not only a *safer* but also a *better* internet and in this context, its recommendations contribute to promoting children's participation in e-society. The thrust of policy in this field is a shared multi-stakeholder responsibility with implications for a number of policy actors within the overall environment in which children engage in the online world. Here, four main points are presented insofar as they impact on improving the quality of children's online engagement.

Firstly, is the notion of the ladder of opportunities. This is an idealised map of how children can learn and develop in experience of the online world through graduated steps of increasing complexity.

- The first step – common to all children – is when children first go online and use the internet for schoolwork and playing games alone against the computer.
- The second step which in addition to schoolwork and games, adds watching video clips online (e.g. YouTube). The second are all ways of using the internet as a mass medium – for information and entertainment. Notably, a third of children in some countries (Ireland, Austria, Greece, and Turkey) do just these activities.
- The third step involves using the internet interactively for communication (social networking, instant messaging, email) and reading/watching the news. Half of children in Ireland, Austria, Germany, Greece, Italy, Poland and Turkey only reach this step.
- The fourth step includes playing with others online, downloading films and music and sharing content peer-to-peer (e.g. via webcam or message boards). Children in Sweden, Lithuania, Cyprus, Belgium and Norway are most likely to reach this step.
- Only a quarter of children reach the fifth, most advanced and creative step. This involves visiting chatrooms, file-sharing, blogging and spending time in a virtual world.

With one third of children confine themselves to the top three, most basic activities. Here, there is a clear case where children do 'progress' very far up the ladder of opportunities for educational and digital literacy initiatives should be prioritized.

Secondly, in response to the overall perception of the quality of online content, and particularly in the case of younger users who were the least satisfied with the available online provision, it is important to develop new resources, new content targeted to their needs. This is a finding that the European Commission has already taken up with the establishment this year of a "European Award for Best Children's Online Content" as well production guidelines for websites and online content for younger users. This is a valuable step, but high profile national initiatives supported by the large media producers and broadcasters, who are often host the most popular content, should also be promoted. More generally, the needs of younger users need to be taken into account. As more and more children go online at ever-younger ages, rethinking the nature of content provision and support for participation needs to be undertaken highlighting the possibilities for advancing children's learning and engagement as young citizens.

Thirdly, a key dimension that emerges in the data is that socio-economic divides remain a persistent barrier in terms of promoting equality of inclusion in e-society. While digital divides do not necessarily appear across 'digital-haves' and 'digital-have nots', there are significant differences in the quality and degree of access enjoyed by different groups in different countries. The persistent issues of digital divides, and socio-economic factors in determining inequalities of access and opportunity need to be addressed. For children who lack convenient broadband access, governments should ensure that digital exclusion does not compound social exclusion. It is important that while all should benefit from public information resources, special efforts are made to ensure these reach the disadvantaged or information-poor.

Finally, perhaps the most important major gap in current approaches to the digital landscape for children is any provision for fostering digital citizenship. Given the rapidly changing nature of the technologies involved, the emerging applications which pose new challenges of their own, and that direct parental supervision is much less relevant to children's online usage, the only sensible priority is to encourage children to be responsible for their own behaviour and safety as much as possible. The number one recommendation therefore has to be: *A focus on empowerment rather than restriction of children's usage*, emphasising responsible behaviour and digital citizenship, treating children as a competent, participatory group encouraging self-governing behaviour. Children, young people and their parents, in other words, should not always be seen as the target of awareness-raising but also as active agents with a central role in promoting and supporting safer internet practices.

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SELECTING BETWEEN OPEN SOURCE AND PROPRIETARY SOFTWARE: THE PUBLIC ADMINISTRATORS' CASE¹

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ABSTRACT

The necessity for the public sector to change over to communicating digitally is imminent. From the economic perspective, the changeover poses great challenges, as huge investments will have to be made in Information Technology (IT) in the public sector. It is therefore natural, in connection with these investments, for detailed assessment to be made of what forms of technology it is anticipated to be used, and who controls the development and ownership of this technology. This work constitutes a review of literature on pre-existing comparative studies regarding the technical, social, economic and organizational factors on Free Open Source Software (FOSS) usage. Furthermore, this work includes guidelines that Public Administrations (PAs) should follow for the selection between open source and proprietary software. Main goal of this paper is to add to knowledge resources that can help public stakeholders understand the technical / social / economic / organizational environment and reach informed decisions when selecting the appropriate software. The paper can also be useful for FOSS developers, users and communities who are either directly or indirectly involved in the software market.

KEYWORDS

Open source software; public administration; guidelines;

1. INTRODUCTION

Software (SW) can be shortly defined as the executable code that controls computer behavior and operations. The term is used, however, to describe a wide range of programming languages, applications, procedures and all related documentation resources. SW also refers to a full cycle of processes from basic architecture to development, packaging and distributing. It is responsible for controlling, integrating, and managing the individual hardware components of a computer system so that other software and the users of the system see it as a functional unit without having to be concerned with the low-level details of the computational system.

European governments are increasingly considering the use of Free and Open Source Software (FOSS) as a means of reducing costs, increasing transparency and sustainability. A number of argues have taken place on the costs and benefits of open source software. Moreover much discussion and interest has been expressed from the perspective of information technologists.

Although there are different definitions of Free and Open Source Software (FOSS), there are some basic principles on which FOSS relies on. These refer to the freedom to run a software program for any purpose, to study and modify a software program by accessing its source code and to distribute copies of a software program, whether modified or not. Additional prerequisites for FOSS programs include: no discrimination against persons, groups or fields of endeavor and distributable, technology-neutral licenses that are not specific to a product or restrict other software. These freedoms and principles are defined by the Free Software Foundation (<http://www.gnu.org/philosophy/free-sw.html>) and the Open Source Initiative (<http://www.opensource.org/osd.html>).

This manuscript examines these advantages and disadvantages of FOSS solutions and analyses the main factors that affect FOSS use and adoption by Public Administrators (PAs). Moreover this work describes some basic and important guidelines that should be followed for the evaluation and adoption of any software.

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The basic steps for evaluating all programs, both FOSS and proprietary SW, are essentially the same. However, the way that these steps are performed in an evaluation process is different for FOSS programs than for proprietary ones. A key difference for evaluation is that the information available for FOSS programs is usually different than for proprietary programs.

Indeed, most FOSS programs have a great deal of publicly available information that is not available for proprietary programs: the program's source code, analysis by others of the program design, discussions between developers about its design and future directions, discussions between users and developers on how well it is working (or not), and so on. An even more fundamental difference between FOSS and proprietary programs is that FOSS programs can be changed and be redistributed by customers. This difference affects many factors, such as support options, flexibility, customizability and costs. Proprietary programs generally do not give the user the right to view, modify, and redistribute a program, and it would not make sense to ignore these vital differences. Some administrators may decide that they wish to only use FOSS programs. However, even in that case, the user still needs to be able to evaluate FOSS programs, because there is always the need to know how well a given program meets the user's needs, and there are often competing FOSS programs.

The remainder of this paper is structured as follows: Section 2 describes in detail the work related with our study. A detailed list of guidelines for selecting between FOSS and proprietary software is provided in Section 3. Finally in Section 4 our conclusions and some proposals for future work are drawn up.

2. COMPARATIVE STUDIES / SURVEYS ON FOSS USAGE

This section constitutes a review of literature on pre-existing comparative studies and surveys regarding the technical, organizational, economic and social factors on FOSS usage. The surveys were executed in various regions or sectors where FOSS is applied.

In FLOSS (2002), a survey that is intended to yield information about FOSS use in several countries of the European Union is presented. Due to budgetary restrictions, interviews could only be conducted for a limited number of countries (Germany, Sweden and the UK). One of the results of this survey is that FOSS usage rates not only differ by country, but also within countries. Another survey (Ölsson and Rönnbäck 2010) that was conducted in Sweden answers the question of how common the usage of FOSS is, by informing the public that 50% of the local authorities use FOSS, mainly in operating systems. Moreover, as the survey pointed out, there is a great need for support in procurement and utilization of FOSS.

The purpose of the study of Danish Board of Technology (2002) is to illustrate the socio-economic differences between the use of FOSS and proprietary software in PAs in Denmark. The conducted socio-economic analysis assesses the total loss that follows from decisions taken against the background of limited information and imperfect market competition. The survey of Rentocchini and Tartary (2007) presents some obstacles to the adoption of Information and Communications Technology (ICT) by PAs. The survey noted immediately that there are differences among municipalities with different intensity degree. Municipalities with a high intensity of FOSS adoption, rate the low flexibility of suppliers and the low interoperability of applications as the main obstacles to a correct implementation of the ICTs. For the two other groups, namely moderate intensity and no intensity, main obstacles are the low number of employees and high costs.

Considering the survey presented in (Public Sector Forums 2009), it was conducted in UK and according to it, almost two-thirds of those surveyed believe the benefits of open source generally outweigh the drawbacks. However the general consensus is that local government fails to give sufficient consideration to open source in software procurements. The research finds that open source use in local government will, overall, only keep increasing. The majority view (42%) is that local authorities will increase their use of FOSS over the next three years. Around a third of those surveyed expect current levels of adoption to remain unchanged during this period. This highlights a significant degree of uncertainty among sections of local government over plans for future adoption.

Taking in mind the analysis of Moolman (2011), it must be noted that technological factors affect FOSS in a large scale. People that support the adoption of FOSS believe that FOSS shows more stable behavior than proprietary software. Dedrick and West (2008) claim that in organizations the use of FOSS still has to be motivated on utilitarian grounds. Technological factors that show a relevance to FOSS adoption include maturity, performance, stability, usability, security such as availability and quality of support.

As stated in (Moolman 2011), previous experience with FOSS plays a significant role in the ability to choose such kind of software. It is rather usual that organizations with little or no experience in FOSS are better off choosing software. This happens due to the fact that mature FOSS solutions supported by commercial companies and universities generally present a lower risk as they have been adopted by many organizations and documentation and support is available. It is quite interesting to observe that several FOSS projects considered immature when measured with maturity models are mature enough for adoption, given that the adopting organization has some FOSS experience (Ven et al. 2008).

The same authors mention the maturity of the organization dealing with FOSS in (James and Van Belle 2008). Their measure of maturity also takes into account the intended application within the organization, availability of support and the maturity of the development community behind the software. They highlight maturity factors that are organization-centric, solution-centric or external entity-centric. They found that the maturity of the solution under review is dependent on its intended application within the organization.

Software maturity is a decision factor that depends on the environment in which the software is used (James and Van Belle 2008; Holck et al. 2005). Reliability is an important aspect of software maturity and mature software is also seen as reliable. Reliability comparisons between FOSS and proprietary software are almost futile as both software types cover a range of software from extremely stable to rather unstable.

An organizational factor that affects the adoption of FOSS is lack of awareness that can be remedied by having FOSS advocates and boundary spanners working in an organization. Definitely boundary spanners are effective in connecting organizations to new technologies and provide the skills and knowledge needed for successful adoption (Ven and Verelst 2009). FOSS champions successfully influence adoption decisions from within an organization, reducing some of the individual uncertainty and fear (Morgan and Finnegan 2007). The amount of influence FOSS champions have within an organization is determined by the institutional limitations in the organization and their position within the organization (Holck et al. 2005). There are many economic factors that can be considered in social environments and affect the adoption of FOSS. A business benefit that can be considered is cost reduction in relation to technical benefits and drawbacks of FOSS adoption (Morgan and Finnegan 2007).

The business case of FOSS adoption is driven by lower costs, but it is also dependent on the application area, company size and price elasticity in the market. Application area and adoption scale is important as it might be prohibitively expensive to make a company-wide switch from one platform to another (Holck et al. 2005). The level of strategic importance of software to the business also plays a role in adoption decisions. Software with low strategic importance and high price sensitivity tend to be better candidates for FOSS adoption (Kwan and West 2005).

Although the low price of FOSS products is the primary factor for using these products, there are also other economic perspectives, not only in using FOSS but also in developing products. Four economic incentives for the adoption of FOSS software and support its development by governments are the following:

- Control the costs of software licensing and upgrades,
- Control and increase the access to intellectual properties,
- Reduce the reliance on proprietary software,
- Promote software use in the public sectors.

It is interesting to observe that cost as a factor in FOSS adoption decisions depend on an objective measurement of cost. The authors in (Richter et al. 2009) found that for many companies, FOSS adoption is centered on value creation. The advantage however comes not only from costs which are saved but benefits from reliability, flexibility and a higher degree of innovation capability.

Developing countries, in general, adopt FOSS due to cost advantages. The effect of software license fees are more pronounced in developing countries as it makes up a larger part of total system cost when taking into account hardware and software. Lower labor costs mean that license fees constitute a bigger percentage of IT costs (Paudel et al. 2010). One interesting example occurs in the German public sector where low cost is one of the main drivers of FOSS adoption. The German foreign office started migrating to FOSS in 2002 and by 2005 it was the cheapest ministry in German government in terms of IT expenditure. In Brazil, government uses FOSS to save on license fees, keeping money that was previously paid to foreign vendors inside the country (Richter et al. 2009). Through collaboration with local industries costs can be minimized and national competitiveness in software industries can be improved (Hwang 2005).

Table 1. Factors affecting FOSS usage and adoption

| Factor | | Surveys | | | | | |
|-----------------|--|---------|---------|----------------------------|-------|---------------------|---------|
| | | FLOSS | Sambruk | Danish Board of Technology | EROSS | Public Sector Forum | CENATIC |
| Technological | Functionality | X | X | | | | |
| | Support | X | X | | | | |
| | Maintenance | X | X | | | | |
| | Management | X | | | | | |
| | Longevity | X | | | | | |
| | Reliability | X | | | | | |
| | Availability | X | | | | | X |
| | Security | X | | | | | |
| | Performance | X | | | | | |
| | Usability | X | | | | | |
| | Interoperability | X | | | | | X |
| | Integration | X | | | | | X |
| | Triability | X | | | | | |
| | Data Migration | X | | | | | |
| Organizational | Ability to find the right staff and competencies | | X | | X | X | |
| | Lack of awareness | | X | | X | X | |
| | Training issues | | X | | X | X | X |
| | Resistance to change | | X | | X | X | |
| | Strong leadership | | X | | X | X | X |
| | Management support | | X | | X | X | |
| | Availability of in-house skills and knowledge | | X | | X | X | |
| | Real world experience | | X | | X | X | |
| | Interoperability of applications | | X | | X | X | |
| Cost / Economic | Labor costs | | | X | X | X | X |
| | Control the costs of software licensing and upgrades | | X | X | X | X | X |
| | Control and increase the access to intellectual properties | | | X | X | X | X |
| | Promote software use in the public sectors | | | X | X | X | |
| Social | Knowledge sharing | | | X | | | |
| | Satisfaction of achieving something valuable | | | X | | | X |
| | Professional reputation and recognition among peers | | | X | | | |
| | Learning/Improving personal skills | | | X | | | X |
| | Legal aspects | | X | X | | X | |
| | Sense of belonging to the community | | | X | | | |
| | Enjoyment of developing | | | X | | | X |
| | Sharing knowledge | | | X | | | |
| | Improving products | | | X | | | |
| | Freedom in developing SW | | | X | | | |
| | Learning and developing new skills | | | X | | | X |
| | Sense of belonging to the community | | | X | | | X |

IT professionals from four continents have collaborated with the National Open Source Observatory (CENATIC), and their opinions and suggestions have served as the basis for the conclusions set out in the dossier presented in (CENATIC 2011). In terms of the criteria for adopting FOSS, the dossier concludes that the administrations are influenced by criteria such as vendor independence and flexibility, open standards and open development process. However, the public administrations are less easily persuaded by criteria such as faster procurement, best-of-breed solutions and political decisions and initiatives.

In Table 1 we analyze the most significant factors that occurred from the examination of the comparative studies and surveys.

3. GUIDELINES FOR SELECTING AMONG FOSS AND PROPRIETARY SOFTWARE

In this section, we describe some basic and important guidelines that should be followed by organizations or PAs for the adoption of any software. The basic steps for evaluating all programs, both FOSS and proprietary SW, are essentially the same. However, the way that these steps are performed in an evaluation process is different for FOSS programs than for proprietary ones. A key difference for evaluation is that the information available for FOSS programs is usually different than for proprietary programs. In Figure 1 we present the steps that should be followed for selecting among FOSS and proprietary software. The paragraphs that follow present these steps in detail.

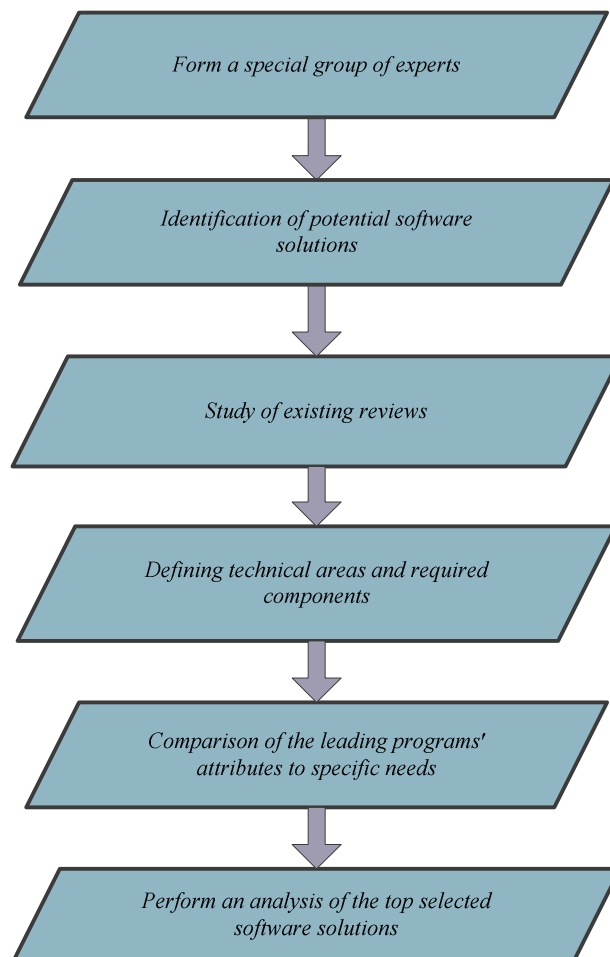


Figure 1. Guidelines for selecting among open source and proprietary software

3.1 Formation of a Special Group of Experts

Before the software search begins, it is necessary to form a search group of experts. This group should consist of the computer department and various department heads. This kind of approach has worked very well for many companies and PAs. By pairing the computer department that specializes in technology with the heads of departments who know the business needs, the interested company or PA develops a very strong software search team. This team should define the specific needs, the role in infrastructure and development projects, and cost saving trade-offs.

The most successful installations have been with companies that had this kind of committee, in which the computer department becomes the liaison between the users and the software implementation team translating technology to their requirements (FLOSS 2002).

3.2 Identification of Potential Software Solutions

A combination of techniques should be used in order to make sure that something important is not missed. An obvious way for the interested user is to make a questionnaire, if other users (organizations or PAs) also need or have used such a program. If they have experience with it, they should ask for their critique; this will be useful as input for the next step, obtaining reviews.

Moreover it is necessary to examine at lists of programs, including any list of “generally recognized as mature” or “generally recognized as safe” programs. Some products are so well-known that it would a terrible mistake to not consider them. It is advised to the interested user to ask only a few of the most relevant lists. Also general systems can be used to make requests, such as Google answers, where someone pays a fee to get an answer. The search group of experts is proper to make a more detailed search.

3.3 Study of Existing Reviews

After the identification of options, it is necessary to study all the existing evaluations about the alternatives. It is far more efficient to first learn about a program’s strengths and weaknesses from a few reviews than to try to discern that information just from project websites. It is critical that many evaluations are biased or not particularly relevant to any circumstance. An important though indirect “review” of a product is the product’s popularity, also known as market share.

Generally, a user should always try to include the most popular products in any evaluation. Products with large market share are likely to be sufficient for many needs, are often easier to support and interoperate, and so on. It is important to develop a documentation plan in support of communication and awareness of the organization’s governance strategy. In addition to traditional documentation, this may include training, internal public relations campaigns, and other educational opportunities.

Developers do not want their work wasted, so they will want to work with projects perceived to be successful. Conversely, a product rapidly losing market share has a greater risk, because presumably people are leaving it for a reason.

3.4 Definition of Technical Areas and Required Components

It is very important, in any software selection or migration project, to have a clear view of the technical areas (server, client and network) and software components (both open source and proprietary) that are required for installation and deployment. Server-based systems, for example, require pre-existing web or application servers and more advanced installation and configuration processes. Some applications also require a parallel deployment or co-existence of both open source and proprietary components that should be carefully taken into account in order to avoid compatibility failures.

3.5 Comparison of the Leading Programs' Attributes to Specific Needs

There are some attributes that should be taken into consideration as far as the choice between FOSS and proprietary SW is concerned. Important attributes include functionality, cost estimation (initial license fees, license upgrade fees, installation costs, staffing costs, support/maintenance costs, indirect costs such as training, transition costs, etc.), market share, local policies and other environmental and social factors. For example, licensing costs are not the only costs of a software package or infrastructure. It is also necessary to consider personnel costs, hardware requirements, opportunity costs and training costs. Often referred to as the Total Cost of Ownership (TCO), these costs give the clearest picture of the savings from using FOSS.

The benefits, drawbacks, and risks of using a program can be determined from examining these attributes. The attributes are the same as with proprietary software, of course, but the way that a user should evaluate them with FOSS and proprietary SW is often different. In particular, because the FOSS project and code is completely exposed to the world, the user must take advantage of this information during evaluation.

3.6 Performance of an Analysis of the Top Selected Software Solutions

After the evaluation, the organization picks the top candidates, and performs a more analysis of them. This step is, for the most part, done the same way for both proprietary and FOSS programs. The important attributes to consider are the same as in the previous step.

More effort is spent by actually trying things out instead of quickly reading the available literature. For example, to see what functionality a program provides, a user would run it and try out the functionality that he/she is interested in using (e.g., if the user is concerned about interoperability, he/she will acquire some sample same files or systems and see how well it works). A user should always carefully identify the version number of the program, because the description of the first version may not be the same in a later one. This is particularly important for FOSS programs, because many FOSS programs undergo rapid improvement.

A more important difference is that in FOSS there are sources of information about a program that may not be available for proprietary software. In particular, a user can also have a software professional examine the program's design documentation, source code, and other related materials. The conducted analysis can be categorized in analysis for adding functionality and analysis of software security

Once a decision has been made, it is time to begin the process to install the new program.

4. CONCLUSIONS AND FUTURE WORK

In this work a detailed list of guidelines for selecting among open source and proprietary software is presented. Concluding this work, it can be anticipated that FOSS will be more widely used over the next few years, as a smaller proportion of those organizations or PAs that do not use FOSS expect to do so in the next two years, while a larger proportion of the organizations that already use FOSS expect to increase their use of it. The decisive reasons why FOSS is used or is not used mainly relate to economic savings, awareness of FOSS, compatibility, the development of programs and user-friendliness.

Local and regional authorities are often better positioned to directly integrate open source systems and applications in their internal processes and IT architectures by clearly defining needs and specifications through public tenders. By adapting open source solutions to regional contexts through extensive customization and localization they can also see immediate effects and improvements in administrative tasks or in services delivered to local communities.

This study serves to improve the knowledge of FOSS use in PAs. However, further room for research into FOSS, an increasingly important aspect of ICT adoption and growth in PAs is suggested. Further research on FOSS adoption in PAs could include the quantitative study of FOSS adoption and the study into the availability and perception of FOSS vendors. One more proposal for future work would be the provision of policy recommendations on issues and challenges pertaining to the use of FOSS by European PAs. The aim of this policy recommendation work would be the contribution in providing policy orientations and proposed actions that can help governments, PAs and European institutions fully harvest the benefits of FOSS.

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FACEBOOK & TWITTER IN PUBLIC ADMINISTRATION: THE CASE OF MEXICAN LOCAL GOVERNMENTS

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ABSTRACT

Facebook and Twitter are wide spread social media applications. Both are used in business, politics and economics. However, very few evidence has provided about its value for networking and diffuse information. This research presents evidence of the 32 local states of Mexico, which use Twitter as a tool to communicate with their citizens. Using the twitter features – tweets, retweets, lists and followers – and the Facebook number of friends, we collect the data of September and November 2010 and provide a model of analysis that shows the evolution and use of this technological tool for politics. Four sections integrate this paper: an introduction to the problem, a literary review on the use of twitter in politics and public administration; a section that describes the model of analysis and methodology and a final section of conclusions.

KEYWORDS

Social media, twitter, Facebook, Social Media in Mexico, political networking.

1. INTRODUCTION

Twitter use in politics has several examples in its short life. For example, students in Iran opposed to the newly elected government using text messages through twitter to alert the world about the repression they were suffering every day from their government; political organization on Egypt, Tunisia has followed the same principle and defeat their ruling governments. In the United States, texting while driving is illegal in various states. President Barack Obama use Facebook to connect with voters and funding. Currently the government has implemented social media technologies to improve internal processes of government.

In Mexico, the debate in Congress in 2009, the Senate had to consider a large group of citizens who gathered in Twitter's social network, (# InternetNecesario) managed to stop an Internet tax, which had been approved, by the House and the senators stopped just in time. By placing the issue, after more than a hundred thousand messages in this network, the Mexican Twitters pressured to be received by senators and achieved their mission. In a similar effort although controversial, some citizens of Mexico City were able to evade police roadblocks Breathalyzer using Twitter's social network by sending the exact location to be evaded. Same which were subsequently threatened and punished by the authority, although there is loophole to stop them.

Another example is the student of the Instituto Tecnológico de Estudios Superiores de Monterrey, a private university, who sent Twitter messages about the intrusion of the military in Monterrey Campus, as well as raising awareness about the death of two students, which were initially classified as assassins, and post-revelation of this Twitter they were recognized as students of that institution. Thus challenging the media and press reports of the state and federal prosecutor.

A few studies have been published discussing the impact of Twitter on social media and users. The first was made by the authors compared micro-blogging to regular blogging and found out more engagement and reciprocity in Twitter users when compared to conventional bloggers, even this tool is a short messaging platform, more than a web 2.0 feature. Honey and Herring's (Honey and Herring, 2009). Research was focused on the conversations that can be maintained using this social platform, they found out that using the @ symbol to target messages to specific users makes this service more usable as a collaboration tool

Another research field of the Twitter tool is the recommendation function. Since the platform is limited to exchanging short text messages, recommending websites, videos or photo sharing is frequent. (Phelan et al., 2009) Studied this particularity of Twitter for promoting news and stories. The first research focusing on a deep understanding of this relatively new phenomena was made by (Zhao and Rosson, 2009); they discovered that this tool which eases information sharing also helps Twitter build up a common ground and sustain a feeling of connectivity among colleagues and friends. Later on Boyd et.al.(Boyd et al., 2010) Focused their research on the retweet function as a tool to promote regular conversations and increase the viral effect of short messages or pictures. Diakopoulou (Diakopoulos and Shamma, 2010) complemented Boyd and colleagues' research by adding the sentiment variable, the authors proposed the hypothesis that there is a relationship between an event and a affective response shown through a timestamp and a hashtag. However, the analyzed tweets were evaluative and did not reference the event itself and further research will try to prove consistently the sentiment hypothesis.

On the side of social movements and e-democracy relationship with twitter, previous research like Mosca (Mosca), establishes the concept of the political use of the Internet as: "using the Internet to gather political information, to discuss political issues and to perform acts of dissent online". Previous work of (McCaughey and Ayers, 2003, van-de-Donk et al., 2004) and (Pickerill, 2010) support this concept. More recent research supports the same conclusions like (Wall et al.) who researches the Irelands e-democracy and Wigand (Wigand, 2010) who measures the conversation of different stakeholders to build relationships with government, besides information sharing using Twitter provides evidence of the existence of the political use of the Internet. Calderaro (Calderaro, 2010) expands (Mosca) concept: "The Internet also includes tools other than the WWW, such as E-Mailing Lists, collaborative on-line software, Peer-to-Peer Networks, Instant Messaging tools, and so forth", even though this research is focused on email, it shows the potential of these tools in politics. On the other side, (Ayres, 1999) presents a less optimistic view highlighting the unreliable and unverifiable information that could circulate on the Internet on social movements' websites producing more uncertainty and confusion rather than a real political discussion. Furthermore, (Baumgartner and Morris, 2010) research of social network websites among young users, finds that participation on politics of this cohort are not more liable to participate than users of other media.

This literature review presents the importance of social media as a research field, is focused over the topic twitter and politics, however this research field is oriented on twitter an public administration, on this particular field there are not many publications so far - except from Wigand 2010 - that is the reason to introduce this topic using the politics and twitter as a path to understanding the field.

2. METHODOLOGY

This is an exploratory research; data were treated in order to discover relationships between variables (Kerlinger & Lee, 2002) to define a viable path for consequential research. Our focus is to understand the evolution of Twitter on the local government websites. We collected the observations from 32 local government websites, and we analyzed them considering two features of Twitter: followers and following, from Facebook it was only considered the subscription of friends. Thus, it was observed that there is correlation between them. From this finding, we established the weight represented by each tool with a factor analysis (Chauvin and Bowdish, 1998) (de Vicente, 2003) and (Costello and Osborne, 2005). Finally we developed an index of use of social networks (IRS) for the websites studied, which allows us to understand fully how they have used these tools.

From this index, we propose an evolutionary model of maturity in the use of social media, specifically in the use of twitter. The assumption of this model is that the greater the interaction among the users - both the sender and the receiver of the message - a constant flow of information can be measured to determine the degree of maturity. Thus, the evolutionary model measures two variables: the participation and the data flow, it is assumed that the more the participation, more the data flow. Both of them draw four stages where the two intersect:

Step 1.Exchange of information.- Minimum participation of the government website with the public and poor information flow.

Step 2.Collaboration.- Minimum participation of the government website with the public, but flow of relevant information.

Step 3.Cooperation.- Medium participation of the government site with the public and information flow.

Step 4. Knowledge.- Constant participation and constant flow of information on both directions.

These steps describe how to build a user-supplier or citizen to exchange data and knowledge about products or services of each of them. We collected data on three months: September, October and November 2010. The following section presents these findings.

3. FINDINGS AND DISCUSSION

The following data were obtained from the Twitter and Facebook accounts from the 32 local government websites and one account of the federal government (presidency website). There were no data of these accounts from the governments of Aguascalientes, Coahuila, Oaxaca, San Luis Potosí, Sonora, Tabasco, Tamaulipas, Tlaxcala and Veracruz. Therefore this sample has only 24 cases, 23 local government websites and the president Web site.

For the purpose of this research we analyzed the followers and following characteristics of each twitter account. The followers usually subscribe to the website and receive a permanent update of the information. Following are the subscriptions of the government sites to other twitter accounts in order to receive updates from them.

Mexico is a multicultural country, with large differences between urban and rural populations (PNUD, 2009).These differences between states as well. Therefore, to make a comparative study of TICs is more convenient to use as a common denominator the number of people with a PC in each state. Table1 shows this variable according to the National census.

According to the data of table 1, we can observe the digital division by state, the country capital City DF has the first place on PCs access, followed by Estado de México, the most populated state of the country, with a third of its population with Pcs access.

On the follower's section, this twitter tool allows the participants to receive updated information from the source they are subscribed to. Results are shown on Table 2. Federal Government with the presidency website as an example, has a constant increase on followers every month. The country capital – Distrito Federal – Queretaro and Guanajuato have the same behavior.

On the other hand, there are a few local governments, which lack on the use of the twitter tool, like Colima and Chihuahua. With a small change on followers are the states of Zacatecas, Sinaloa, Baja California, Campeche, Durango, Estado de México, Nuevo León, Puebla among others.

However, the number of followers with PC penetration on the local government reflects an important increase in the following states: Campeche, Baja California Sur, Chiapas, Querétaro, Yucatán, Hidalgo y Durango (see Table 2). Chiapas twitter account is an important case study, because in September and October it had an important increase of followers but it decreased dramatically during November. Also Chiapas has a low informatics penetration, this means less internet access by person (11.50%) and high increase of users; we do not have data which supports this changes; however we can guess that this great drop is due the implementation of an online strategy, that reduces the number of followers to be more selective and focused oriented.

Table 1. Number of people with PC access by state

| Government | PC penetration per 100 inhabitants | Inhabitants | PC penetration |
|---------------------|------------------------------------|-------------|----------------|
| Federal Government | 30.60 | 103,263,388 | 31,598,597 |
| Baja California | 41.90 | 2,844,469 | 1,191,833 |
| Baja California Sur | 43.30 | 512,170 | 221,770 |
| Campeche | 28.60 | 754,730 | 215,853 |
| Colima | 35.30 | 567,996 | 200,503 |
| Chiapas | 11.50 | 4,293,459 | 493,748 |
| Chihuahua | 38.40 | 3,241,444 | 1,244,714 |
| Distrito Federal | 53.80 | 8,720,916 | 4,691,853 |
| Durango | 30.80 | 1,509,117 | 464,808 |
| Estado de Mexico | 36.40 | 14,007,495 | 5,098,728 |
| Guanajuato | 25.20 | 4,893,812 | 1,233,241 |
| Guerrero | 18.20 | 3,115,202 | 566,967 |
| Hidalgo | 24.90 | 2,345,514 | 584,033 |
| Jalisco | 38.40 | 6,752,113 | 2,592,811 |
| Michoacan | 23.10 | 3,966,073 | 916,163 |
| Morelos | 32.00 | 1,612,899 | 516,128 |
| Nayarit | 29.10 | 9,949,684 | 2,895,358 |
| Nuevo León | 38.70 | 4,199,292 | 1,625,126 |
| Puebla | 22.30 | 5,383,133 | 1,200,439 |
| Queretaro | 35.00 | 1,598,139 | 559,349 |
| Quintana Roo | 29.60 | 1,135,309 | 336,051 |
| Sinaloa | 31.70 | 2,608,442 | 826,876 |
| Yucatan | 26.00 | 1,818,948 | 472,926 |
| Zacatecas | 30.70 | 1,367,692 | 419,881 |

On the other hand, Yucatán has shown a very fast increase of followers just in one month. In conclusion, only seven local governments have used twitter followers as an effective tool to interact and communicate with some citizens, maintaining a communication flow among them.

The second twitter tool is following that allows the proprietary to follow or subscribe to information or data from other citizen account. Collected data from the local government Web sites show very few contacts being followed. The number is less than one thousand, with the only exception of Queretaro that has a constant increase of accounts to follow with two thousand accounts every month, until reaching the eleven thousand following. (see Table 3)

One quarter of the local government twitter accounts that we analyzed do not use this twitter feature to enhance the communication, with their users. There are different reasons that could be analyzed in another research, like the International Cervantin Festival account from Guanajuato that has more people following, or the Michoacan governor account. On the other side, the chart of Local Government Websites that use more often this feature is lead by Queretaro which is followed very far away by Chiapas, Colima, Guerrero, Nuevo Leon and Morelos.

It is important to mention that these states are not the populated or rich states in the country, and Chiapas and Guerrero have a very low PCs penetration by habitant. Usually the people that is followed by a proprietary is an interest people or someone that provides valuable content, in the case of the E-government local portals the quality and characteristics of the people being followed is matter of another study, for our research purpose the data state s the potential of use or unknown from the portals webmasters.

On the Facebook side, the features to link and exchange information are less opened than Twitter. However this is the worldwide leader in social network participation(Nielsen, 2009). and in Mexico it has 18.8 million of users.

In the Mexican case, the use of Facebook in the Federal Government Website (the presidency site) had an important increase of friends, in two months it doubled the number of newcomers to the site, and from one month to the other it had an increase of 30 thousand (October-November) Despite the rest of the local websites, their increase in the number of friends could be of one thousand in the most optimistic case, the rest have modest increases. (See figure 3).

Table 2. Followers evolution on Twitter

| Government | September | October | November |
|---------------------|-----------|---------|----------|
| Federal Government | 77,142 | 100,849 | 113,148 |
| Baja California | 1,092 | 1,471 | 1,742 |
| Baja California Sur | 3,893 | 5,695 | 6,738 |
| Campeche | 4,559 | 6,470 | 7,661 |
| Colima | | | |
| Chiapas | 6,651 | 9,500 | 2,584 |
| Chihuahua | | | |
| Distrito Federal | 15,036 | 19,506 | 22,126 |
| Durango | 4,923 | 7,094 | 8,351 |
| Estado de México | 5,400 | 6,347 | 6,991 |
| Guanajuato | 6,276 | 8,890 | 10,530 |
| Guerrero | 1,243 | 1,730 | 2,070 |
| Hidalgo | 6,205 | 9,135 | 10,743 |
| Jalisco | 2,360 | 3,401 | 4,085 |
| Michoacán | 833 | 1,206 | 1,533 |
| Morelos | 681 | 942 | 1,094 |
| Nayarit | 1,213 | 1,352 | 1,425 |
| Nuevo León | 7,275 | 8,467 | 9,613 |
| Puebla | 384 | 527 | 603 |
| Querétaro | 8,214 | 11,110 | 12,875 |
| Quintana Roo | 20 | 51 | 99 |
| Sinaloa | 6,245 | 8,837 | 10,269 |
| Yucatán | | 8,039 | 9,539 |
| Zacatecas | 453 | 738 | 905 |

Table 3. Followers evolution on Twitter

| Government | September | October | November |
|---------------------|-----------|---------|----------|
| Federal Government | 557 | 567 | 586 |
| Baja California | 2 | 3 | 18 |
| Baja California Sur | | - | |
| Campeche | | | |
| Colima | 79 | 87 | 681 |
| Chiapas | 2,264 | 2,543 | 3814 |
| Chihuahua | | | |
| Distrito Federal | 1,795 | 1,792 | 3824 |
| Durango | 24 | 27 | 31 |
| Estado de México | 3,113 | 3,531 | 3841 |
| Guanajuato | 1 | 1 | 1 |
| Guerrero | 1,432 | 1,494 | 1492 |
| Hidalgo | 15 | 15 | 16 |
| Jalisco | 70 | 70 | 68 |
| Michoacán | 1 | 1 | 1 |
| Morelos | 749 | 762 | 860 |
| Nayarit | 65 | 66 | 66 |
| Nuevo León | 2,496 | 3,197 | 3321 |
| Puebla | 284 | 284 | 352 |
| Querétaro | 7,343 | 9,218 | 11003 |
| Quintana Roo | 1 | 19 | 19 |
| Sinaloa | 22 | 22 | 22 |
| Yucatán | | 438 | 442 |
| Zacatecas | | - | 0 |

However there are some local websites that do not use this social network platform like: Baja California Sur, Chiapas and Yucatán, nevertheless these are the same states that use Twitter more often as it was mentioned earlier. Nayarit is another state, which does not support the Facebook platform.

Besides, data show that some local Web sites Facebook accounts have very few friends, like the cases of Campeche, Guanajuato y Quintana Roo, which reflects a lack of use from the features of Facebook. On the contrary, Baja California jumps from 256 friends on October to 13,003 on November; this radical number could be the effect of a portal strategy to introduce the social networks in their communication tasks.

Table 4. Monthly increase of Friends from Facebook

| Government | September | October | November |
|---------------------|-----------|---------|----------|
| Federal Government | 57,924 | 83,067 | 105,005 |
| Baja California | 143 | 256 | 13,003 |
| Baja California Sur | | | |
| Campeche | | 215 | 269 |
| Colima | 2,299 | 2,958 | 3,472 |
| Chiapas | | | |
| Chihuahua | 543 | 1,280 | 1,843 |
| Distrito Federal | 2,370 | 2,751 | 3,146 |
| Durango | 2,701 | 3,927 | 4,788 |
| Estado de México | 2,155 | 2,602 | 3,069 |
| Guanajuato | 402 | 456 | 530 |
| Guerrero | 2,665 | 2,973 | 2,933 |
| Hidalgo | 1,054 | 1,930 | 2,360 |
| Jalisco | 3,155 | 3,611 | 3,982 |
| Michoacán | 819 | 948 | 1,614 |
| Morelos | 3,801 | 5,003 | 4,996 |
| Nayarit | | | |
| Nuevo León | 4,593 | 4,972 | 5,259 |
| Puebla | | | |
| Querétaro | 5,952 | 7,225 | 7,958 |
| Quintana Roo | 62 | 118 | 177 |
| Sinaloa | 1,737 | 2,023 | 2,126 |
| Yucatán | | | |
| Zacatecas | 2,298 | 2,360 | 2,433 |

Local Government websites with more use of Facebook platform related with the number of people with Pcs access are: Colima, Durango and Morelos. Querétaro, is the only state that uses both tools: twitter and Facebook. In order to find possible correlations among followers, following and friends from Facebook, we analyzed correlations among these variables (See figure 1). We treated data as an Spearman correlation because the size of the sample is only possible with non parametric statistics (Alvarez, 1994, Sprent and Smeeton, 2007)

From the Spearman correlation we observe a high correlation among the same groups. For example, there is a strong correlation among followers of September, October and November. The same correlation occurred with the Following and friends from Facebook. This could be validated data among each period and variable. The only meaningful correlation among variables occurs between Facebook number of friends and following from September, with a 0.05

This means that Twitter and Facebook features do not have a statistical correlation. This led us to integrate results into an integrated model. One way to do this is with a factor analysis (de Vicente, 2003). Using data from November because it is the most recent one and with the most cases. We found two related components: following (Twitter) and friends (Facebook) as information flow (See figure 1).

From these two variables, they are confirmed the two variables from the initial model: participation and information flow. To make the analysis using the model, we defined values like this: Participation (Following 48%) of value and Facebook Value 52%, information flow of following 100%. Results of the model are shown on Figure 3 using these variables applied to results.

Table 5 below figure shows the degree of evolution. Data show that the majority of the local government portals are in the first stage: exchange of information, because the information flow and participation is very poor according to the data collected of Twitter and Facebook.

Only four states are in the collaboration stage: Chiapas, Yucatan, Baja California Sur and Campeche, because these states use more than one of the platforms analyzed here. Some of them use Twitter or Facebook.

The case of Colima reflects a local Website that uses both platforms but with medium participation, we cannot say that it has a coordinated strategy to deliver information or content to citizens and promote interaction among government and citizens.

Table 5. Evolution Stages and Local Governments

| Group | Local Government | Features |
|-------------------------|--|---|
| Knowledge | Querétaro | Uses social networks as an strategy of participation, promoting a constant information flow among citizens and public servants, |
| Cooperation | Colima | Use social networks to promote citizen cooperation with authorities and a moderated information flow. |
| Collaboration | Chiapas, Yucatán, Baja California Sur y Campeche | Uses social networks to provide contents, data or information to the public, but with little citizen participation. |
| Exchange of Information | The rest of the Local states | Lack of use of social network platforms. Poor information flow and lack of citizen participation. |

Queretaro is the only local government site that reaches the top stage; according to the data analysis, the participation and information flow on Twitter and Facebook, enable this state to exchange knowledge among public servants and citizens. This data do not provide evidence of such fact, only states that the data point in such direction and the government from Queretaro is able to have a deep and constant interaction with its users.

4. CONCLUSIONS

Social networking is a new phenomenon that began to be studied. This research may serve to establish some basis for analysis on how governments are using these online platforms to generate strategies to approach their governed. However, there are more data to be collected and analyzed, tools in Twitter and Facebook allow understanding the behavior and the way the citizens and government officials use it.

The proposed model can be adapted to other studies related to social networks, however we need further research to confirm its usefulness and accuracy.

Despite these limitations, this study generated evidence to affirm that more governments are using social networks to reach out to their constituencies, and their efforts must be measured in order to decide what amount of money and time will spend on it with positive results. This research also shows a gap of research that need further studies to analyze advantages and disadvantages of social media technology.

Besides, this research also shows that the use of social networks do not depend on PC access or internet access, Local Governments like Chiapas have an important increase of use of these platforms and experience a digital division problem in their citizens.

Moreover, it can be concluded that most governments are just beginning to understand the benefits of social networks.

Several challenges are the product of this research study, such as determining: what is the right strategy to get closer to the governed through social networks? What impact could have a social network in building a more democratic government? What is the use of social networks within governments? Some of the issues that remain unresolved and are likely to be the product of discussions and future investigations in this new field of technological social networks.

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DOES ETHICS MATTER TO E-CONSUMERS: A CROSS CULTURAL DIMENSION

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ABSTRACT

In a previous study we explored the ethical aspects of e-commerce in Israel (Adam et al., 2007), we found that e-consumers (Israeli Jews) are willing in certain situations to overlook the ethical aspects of an online transaction and are willing proceed to purchase a product amid the risk. This result was unexpected since we assumed that e-consumers' perceived good ethical conduct of e-vendor is a prerequisite for an electronic purchase. After a repeat of the study in which the unexpected result was repeated, we hypothesized that that result is perhaps unique to the e-consumers culture in which the research has been made; the e-consumers we investigated were Israeli Jews. In the present study we aimed to test this hypothesis. Given that Israel is a multicultural society, and that Israeli Arabs and Jews are considered as two distinct cultures (See Pines, 2003 and Pines and Zaidman, 2003), we sought to compare between the two groups of e-consumers Israeli Arabs and Jews.

We were expecting a discrepancy of a variance between the ethical inclinations of these e-consumers groups. The methodology of the study aimed to unpack the ethical dimensions of online transactions in conflict situations between commercial and ethical factors. We used a set of mixed factors: Two commercial factors (product price and quality) and three ethical factors pertaining to the conduct of the e-vendor (assuring e-consumer privacy and security, guaranteeing e-vendor accountability, and accurate product description). In contradistinction with our expectations, the results are quite similar. In (Adam et al., 2007) our findings it was indicated that when e-consumers are confronted with a conflict situation in which the quality of a product and its price make it an attractive purchase (commercial factors), and yet the website espouses unfair business practices - as expressed in ignoring values such as accurate product description, e-vendor's accountability, and preserving consumer privacy and security - e-consumers are generally willing to ignore the unfair practices. In the present study, no significant difference was found between two different cultures, Israeli Arabs and Jews. In both cultures the e-consumers share in common the preferences to commercial factors over ethical factors in their inclination to purchase in the e-market. This study of e-consumers' ethical attitudes across digital cultures is done in unexplored terrain, perhaps, a comparative study among other cultures may offer other insights regarding the ethical dimension of a purchase in e-commerce transaction. Does ethics really matter to e-consumers.

KEYWORDS

eCommerce ethics, e-consumers, multi-culture, eBusiness, trust.

1. INTRODUCTION

The original aim of the research has been to compare the online shopping attitudes and inclinations of Israeli e-consumers with those of non-Israeli e-consumers from developing countries, that is, the attitudinal variance in different internet cultural communities (digital cultures). Instead of non-Israeli e-consumers, our choice was Israeli Jews and Arabs. Given that Israel is a multicultural society, we wanted to consider the possible variance between the cultural differences of Israeli Arabs and Jews regarding their effects on e-consumer's behavior. Israeli Arab and Jews are considered as two distinct cultures (See Pines, 2003 and Pines and Zaidman, 2003). The study of e-consumers' ethical attitudes across digital cultures is unexplored terrain. In a previous study, in which the ethical aspects of e-commerce in Israel were explored (Adam et al., 2007), we found that Israeli consumers (Jews) are willing in certain situations to overlook the ethical aspects of an online transaction. We developed a methodology that aimed to unpack the ethical dimensions of online transactions. We investigated conflict situations faced by Israeli (Jews) e-consumers: specifically the conflict between commercial and ethical factors. We used a set of mixed factors: Two commercial factors (product

price and quality) and three ethical factors pertaining to the conduct of the e-vendor (assuring e-consumer privacy and security, guaranteeing e-vendor accountability, and accurate product description). Our findings indicated that when e-consumers are confronted with a problem situation in which the quality of a product and its price make it an attractive purchase (commercial factors), and yet the website espouses unfair business practices - as expressed in ignoring values such as accurate product description, e-vendor's accountability, and preserving consumer privacy and security - e-consumers are generally willing to ignore the unfair practices (Adam et al., 2007). Since our study population was Israeli (Jews), we cannot know if ignoring unfair practices relates only to the set of values and standards of conduct used in the Jewish Israeli Internet culture, or whether e-consumers in other e-markets show a similar behavior pattern. The findings of the present research contribute to clarify this issue, no significant difference was found between two different cultures, Israeli Arabs and Jews. For a discussion on the difference of these two distinct cultures, see (Pines, 2003; Pines and Zaidman, 2003). Our previous research was preliminary and exploratory in nature; thus, presently, we were able to begin a process of corroborating it and comparing its results with those from another Israeli culture. Although we wanted to conduct our study among several non-Israeli cultures, at present, we find that the effect of two distinct cultures, Israeli Arabs and Jews, on e-consumer's behavior, is insignificant. In the present research Israeli Arabs and Jews share in common the preferences to commercial factors over ethical factors in their inclination to purchase in the e-market. However, in future research, we perhaps still need to pursue further more the questions: Does ethics really matter to non-Israeli e-consumers, and if so, to what extent? Is ethics also ignored in other Internet cultures when the price and quality of a product are attractive? Perhaps a better understanding of this problem-situation can be achieved, i.e., consumers' attitudes towards purchasing in these cultures.

2. E-COMMERCE ETHICS: OVERVIEW

Establishing trust and fair dealings in business, though necessary for successful economics, was never an easy task in the traditional market (Sowell, 2002), and the task at the e-agora is not easier (Grabner-Kraeuter, 2002; Roman and Cuestas, 2008). Moral plurality in the global village reflects the variety of societies and cultures of which it consists. Technology facilitating e-commerce has developed at a great pace, whereas political institutions, tradition, law and custom lag behind. In the e-agora at the center of a global village in which the villagers can neither meet their vendors face to face, nor examine the merchandise in traditional ways, trust is still an elusive target (e.g. Efendioglu and Yip, 2004). Whereas social order backed by law, regulations and enforcement mechanisms supports the possibility of successful transactions in the traditional market, this is not the case for the e-agora: notwithstanding the establishment of international law, the enactment and enforcement of regulations in the global village remain a great challenge. This problem is magnified for the e-agora, as a nexus of e-markets puts the growth of business and its contribution to society in the global village at risk.

Research Question

How do e-consumers from different cultures with different social and moral norms solve dilemmas in which the commercial and ethical aspects of an internet transaction are in conflict, such as when a commercially advantageous deal presents itself in an ethically disadvantageous context and vice versa? Whether or not moral plurality facilitates or inhibits e-commerce may be assessed by examining two issues. The first issue, which is the focus of this paper, is whether non-ethical business conduct in the e-agora has different outcomes in differing cultures or societies. The second issue (which is not dealt with in the present study) is whether non-ethical business conduct impacts negatively on the rate of growth of the e-agora, and if it does, to what extent?

The research question may be unpacked as follows. E-consumers are exposed to a variety of risks, yet they lack the trust in the e-vendors that could moderate these risks. Thus, one of the main issues facing e-vendors is how better management of risk exposure may improve the tendency of potential e-consumers to buy (Ridings et al., 2002). Ethical conduct has a significant role to play in this regard, as ethical conduct allows for the creation of trust. As a preliminary to the study of trust, we confine our research to e-commerce ethics (Adam et al., 2007) and extend it in our paper to a cross cultural study. We focus on cross cultural research between Israeli Arabs and Jews following Ayala M. Pines (2003) who asserts that Israeli Arab and

Jews subscribe into two distinct cultures, and that makes both ideal for cross cultural research [(p. 98), See more in (Pines and Zaidman, 2003)].

3. RESEARCH DESCRIPTION

Does ethics matter to online shoppers who come from differing cultures in the same society, and if so, to what extent? The findings of our earlier study which was focused on the perceptions of Israeli Jewish e-consumers of the their e-market indicate that in conflicting situations in which there was an ethical dilemma between commercial considerations and ethical factors pertaining to the behavior of an e-store, the primacy of commercial factors prevailed. Note that at our earlier study, the focus was on a conflict between either a commercially attractive deal at an e-store having dubious ethical norms, or less attractive deal with a more ethically upright e-store (Adam et al., 2007). We did not examine in our previous study the possible impact of the conduct of e-consumers. That is to say, we assumed for the purpose of our previous study that the transaction does not involve ethically problematic behavior on the part of the customer, such as giving false details, paying using a stolen credit card etc, but rather the consumers' willingness to be exposed to a risky environment. Now, we assumed that there are several needs that are shared by all humans with respect to commerce. One of which is the need for fairness in business conduct (Sowell, 2002). Fairness in e-business dealings is not easy to come by, it may well be a function of a series of parameters which we stipulate as ethical factors, such as respecting customers' needs for privacy and security as well as fair disclosure of the goods and accountability on the part of the e-vendors.

In our previous study of the perception of online shoppers in the Israeli e-market: Parameters such as respecting customers' needs for privacy and security as well as fair disclosure of the goods and accountability of the e-vendors were compared with two commercial factors, product price and its quality (Adam et al., 2007).

We investigated conflicting situations: specifically the conflict between commercial and ethical factors. Our findings indicated that when e-consumers are confronted with a problem situation in which the quality of a product and its price make it an attractive purchase (commercial factors), and yet the website espouses unfair business practices - as expressed in ignoring values such as e-vendor's accountability, and preserving consumer privacy and security - the e-consumers are generally willing to ignore the unfair practices (Adam et al., 2007). Is this a universal phenomenon or particular to the cultural and social norms of the Israeli customers (our sample was drawn from the Jewish population in Israeli society)? Does ignoring unfair practices relates to the set of values and standards of conduct used in one specific internet society and culture, in our case the Israeli-Jewish culture-market? Do other customers in Israeli society will show a similar behavior pattern in conducting online shopping in the e-market? We would explore this last question in the present study.

4. METHODOLOGY

Our research methodology proceeds from the assumption that assessing the factors involved in a purchasing situation separately is at odds with the actual experience of e-consumers. Once consumers seek and find a product on the web, it is likely that they assess whether the website is trustworthy by evaluating a mix of factors, rather than a single factor. Yet, up until now, research has focused primarily on the analysis of isolated factors. By examining a mix of factors we are able to investigate their different impacts and to more closely approximate the actual decision-making process likely to be employed by e-consumers. The methodology we propose to use also enables inter-factor conflict situations to be examined (Adam et al., 2007).

The present research seeks to investigate the attitude of e-consumers from two different cultures (Israeli Arabs and Jews) to five factors: two commercial factors (product price and quality); and three ethical factors (accurate product description, e-vendor accountability, and assuring e-consumer privacy and security). We have created an experimental design that will examine the impact of these five factors on the motivation of e-consumers to purchase goods and services via e-commerce channels. The experimental design is based on the blocking of five factors with 2 values each (Box et al., 1978). High-level interactions are confounded in the

blocking design (Bilitzki and Sadeh, 2005). This design will allow for a factorial analysis of the five factors, including their main effects and second-level interactions.

We limited the number of possible variable combinations and their values, since presenting a large number of profiles could be a burden on the short-term memory of survey participants, thereby affecting the results of the experiment. The desiderata for selecting the examined combinations of variables were as follows:

1. Ensuring a limited number of profiles
2. Achieving the minimum number of values for the independent variables
3. Reducing the number of variables
4. Ensuring that the profile represents the character of an actual website

The portfolio of websites is huge even when only a small number of characteristics are of interest (Alpert et al., 2003; O'Donnell, 2002). Therefore, the methodology for dealing with e-commerce sites should address all possible combinations. Factorial analysis was therefore our method of choice, as it has a strong history of previous use in the study of other complex environments, such as engineering and quality assurance (Sadeh et al., 2006).

The number of possible factorial combinations is 2^k , where k is the number of factors, while each factor may have two values, low and high. Based on these considerations, we decided to limit the number of independent variables, which are the factors (k) in this design, to 5: two commercial factors and three ethical factors. A profile of a website with five factors will be drawn. There are 32 possible profiles, but each respondent will be asked to evaluate only 16 profiles according to the blocking paradigm.

We have 365 of replicas of the same design in different region, which is our sample size. The data has been collected in 2009 from groups of e-consumers that share similar characteristics, e.g. graduate students. The cross-cultural impact between and within cultures is explored and statistically tested using this experimental design.

| | Arabs culture=1, | Jews culture=0, | Jews culture=0, | Total |
|----------------------------|---------------------|--------------------|--------------------|-------|
| | 2009 | 2009 | 2006 | |
| Questioner 1 (sites 1-16) | 64 | 68 | 60 | 192 |
| Questioner 2 (sites 17-32) | 53 | 60 | 60 | 173 |
| Total | 117 | 128 | 120 | 365 |

5. RESULTS

5.1 Demographic Characteristics and Internet Experience

Table 1 below compares the demographic characteristics of the 2 groups:

Table 1

| | | Arabs n 118 | Jews n 128 | Arabs % | Jews % |
|-----------------------|-----------------|-------------------|------------------|------------|-----------|
| Gender | Male | 57 | 61 | 48% | 48% |
| | Female | 60 | 67 | 51% | 52% |
| Martial Status | Single | 57 | 67 | 48% | 52% |
| | Divorced | 1 | 3 | 1% | 2% |
| | Married | 58 | 58 | 49% | 45% |
| | Widower | 1 | 0 | 1% | 0% |

| | | | | | |
|-----------------------|--------------------------|----|----|-----|-----|
| Having Kids | Yes | 40 | 48 | 34% | 38% |
| | No | 77 | 80 | 65% | 63% |
| Age | 18-22 | 30 | 31 | 25% | 24% |
| | 23-29 | 38 | 49 | 32% | 38% |
| | 30-39 | 34 | 33 | 29% | 26% |
| | 40-49 | 8 | 8 | 7% | 6% |
| | 50-59 | 5 | 4 | 4% | 3% |
| | 60+ | 2 | 3 | 2% | 2% |
| Monthly salary | Far below average | 0 | 0 | | |
| | Below average | 12 | 14 | 10% | 11% |
| | Average | 32 | 22 | 27% | 17% |
| | Above Average | 40 | 41 | 34% | 32% |
| | Far Above average | 28 | 45 | 24% | 35% |
| | | 5 | 6 | 4% | 5% |

The main findings of Table 1 are:

1. About half of the subjects Israeli Arabs and Jews are male.
2. In both groups, about half are single, about half are married. 34% of Israeli Arabs and 38% among Israeli Jews have children.
3. 24% of the Israeli Arabs and 25% of the Israeli Jews are at the age group of 18-22. 32% of the Israeli Arabs and 38% of the Israeli Jews are at the age group 23-29. 29% of the Israeli Arabs and 26% of the Israeli Jews are at the age group of 30-39.
4. The monthly income of about a third of the subjects, regardless of ethnic group, is close to the average national salary.

To conclude, the demographic characteristics of two groups are quite similar.

In Table 2 we compare the internet experience of the 2 groups.

Table 2

| | | Arabs | Jews | Arabs | Jews |
|-------------------------------------|--------------------------|--------------|-------------|--------------|-------------|
| | | n | n | % | % |
| Internet experience | | 118 | 128 | | |
| | Less than a year | 5 | 3 | 4% | 2% |
| | 2-3 years | 13 | 9 | 11% | 7% |
| | 3-5 years | 20 | 24 | 17% | 19% |
| | 5-7 years | 24 | 22 | 20% | 17% |
| Purchasing goods in e-stores | More than 7 years | 55 | 70 | 47% | 55% |
| | Never | 12 | 11 | 10% | 9% |
| | Barely | 38 | 53 | 32% | 41% |
| | Occasionally | 57 | 52 | 48% | 41% |
| | Frequently | 9 | 11 | 8% | 9% |
| | Commonly | 1 | 1 | 1% | 1% |
| When and where surfing? | Home | 110 | 127 | 93% | 99% |
| | Work-office | 35 | 49 | 30% | 38% |
| | elsewhere | 12 | 16 | 10% | 13% |
| | none | 0 | 0 | 0% | 0% |

| | | | | | |
|-----------------------------------|----------------------------------|-----|-----|-----|-----|
| Main activities on the net | e-mail | 103 | 122 | 87% | 95% |
| | Chats and forums | 33 | 50 | 28% | 39% |
| | Searching for information | 100 | 117 | 85% | 91% |
| | Entertainment | 64 | 75 | 54% | 59% |
| | Purchasing | 63 | 46 | 53% | 36% |

The main findings are:

1. In terms of the internet experience, 67% of Israeli Arabs and 72% of Israeli Jews have more than 5 years of experience.
2. 57% of Israeli Arabs and 51% of Israeli Jews purchase goods in e-stores "Occasionally", "Frequently" or "Commonly". The others never or barely purchase goods in e-stores.
3. Most of the subjects surf at home.
4. The main on-line activities of the subjects are e-mailing, searching for information, entertainment or purchase.

Overall, the internet experience and surfing habits of the participants in both groups are quite similar.

5.2 Comparison Of "Intention To Buy" In The Two Groups

Table 3 presents the intention to buy online of Israeli Arabs and Jews.

Table 3

| | Price | Quality | Fair Disclosure | Accountability | Privacy | Arabs Mean | S.D | Jews Mean | S.D | p- value |
|------------|-------|---------|--------------------|----------------|---------|---------------|-------|--------------|-------|--------------|
| Profile 1 | High | Low | Low | Low | Low | 5.734 | 2.858 | 5.209 | 2.643 | 0.276 |
| Profile 2 | Low | Low | High | High | High | 3.516 | 2.443 | 2.896 | 2.629 | 0.165 |
| Profile 3 | Low | High | High | Low | High | 3.109 | 2.418 | 3.060 | 2.570 | 0.910 |
| Profile 4 | Low | High | High | High | Low | 3.000 | 2.225 | 3.015 | 2.415 | 0.971 |
| Profile 5 | High | Low | High | High | Low | 3.891 | 2.655 | 2.642 | 2.429 | 0.006 |
| Profile 6 | High | High | Low | High | Low | 2.875 | 2.567 | 2.672 | 2.427 | 0.642 |
| Profile 7 | Low | Low | Low | High | Low | 6.313 | 1.967 | 7.179 | 2.302 | 0.022 |
| Profile 8 | High | Low | High | Low | High | 3.938 | 2.593 | 4.060 | 2.373 | 0.779 |
| Profile 9 | High | High | High | Low | Low | 2.969 | 2.138 | 2.746 | 2.025 | 0.542 |
| Profile 10 | Low | High | Low | High | High | 3.125 | 2.510 | 2.940 | 2.430 | 0.669 |
| Profile 11 | High | Low | Low | High | High | 3.625 | 2.427 | 2.731 | 2.233 | 0.030 |
| Profile 12 | High | High | High | High | High | 0.969 | 2.123 | 0.493 | 1.341 | 0.126 |
| Profile 13 | Low | Low | High | Low | Low | 7.344 | 2.125 | 7.164 | 2.397 | 0.651 |
| Profile 14 | Low | Low | Low | Low | High | 5.619 | 2.744 | 5.328 | 3.126 | 0.575 |
| Profile 15 | High | High | Low | Low | High | 3.143 | 2.481 | 2.791 | 2.345 | 0.407 |
| Profile 16 | Low | High | Low | Low | Low | 4.857 | 2.514 | 5.075 | 2.531 | 0.624 |
| Profile 17 | High | Low | Low | Low | Low | 2.352 | 2.658 | 2.557 | 2.460 | 0.668 |
| Profile 18 | Low | Low | High | High | High | 3.741 | 2.365 | 3.049 | 2.217 | 0.108 |
| Profile 19 | Low | High | High | Low | High | 4.667 | 2.000 | 3.590 | 2.052 | 0.005 |
| Profile 20 | Low | High | High | High | Low | 4.667 | 2.503 | 3.934 | 2.407 | 0.113 |
| Profile 21 | High | Low | High | High | Low | 3.907 | 2.535 | 3.869 | 2.553 | 0.936 |
| Profile 22 | High | High | Low | High | Low | 4.926 | 2.532 | 4.902 | 2.612 | 0.960 |
| Profile 23 | Low | Low | Low | High | Low | 1.944 | 2.528 | 1.902 | 2.226 | 0.923 |
| Profile 24 | High | Low | High | Low | High | 3.481 | 2.255 | 3.967 | 2.456 | 0.274 |
| Profile 25 | High | High | High | Low | Low | 4.667 | 2.548 | 4.557 | 2.487 | 0.817 |

| | | | | | | | | | | |
|------------|------|------|------|------|------|-------|-------|-------|-------|--------------|
| Profile 26 | Low | High | Low | High | High | 5.759 | 2.119 | 4.754 | 2.440 | 0.021 |
| Profile 27 | High | Low | Low | High | High | 4.185 | 2.291 | 4.410 | 2.155 | 0.589 |
| Profile 28 | High | High | High | High | High | 9.019 | 1.868 | 9.033 | 1.602 | 0.965 |
| Profile 29 | Low | Low | High | Low | Low | 1.426 | 2.400 | 2.000 | 2.582 | 0.221 |
| Profile 30 | Low | Low | Low | Low | High | 1.537 | 2.455 | 1.754 | 2.343 | 0.629 |
| Profile 31 | High | High | Low | Low | High | 5.407 | 2.024 | 5.344 | 2.128 | 0.871 |
| Profile 32 | Low | High | Low | Low | Low | 2.815 | 2.585 | 2.377 | 2.430 | 0.351 |

In the majority of profiles (22 out of 32) the rating of the intention to buy online of the Israeli Arabs is higher than that of Israeli Jews. In 6 out of the 32 profiles (profiles 5,7,11,18,19,26) there is a significant difference between Israeli Arabs and Israeli Jews in terms of their "intention to buy" online.

Of these results, the most interesting is profile 18 where the rating of the commercial factors is low while the rating of the ethical factors is high. We find that in online shopping, Israeli Arabs consider the ethical factors more as more important than the Israeli Jews.

The variance in the results in these findings is quite high. It requires further analysis which requires ANOVA analysis.

The impact of ethical variables on the intention to purchase online is analyzed using ANOVA with 2-way interactions. The results are provided in Table 4.

Table 4

| Variable | Coefficient | t-stat | p-value | Jews | Arabs |
|--------------------------------|-------------|---------|---------|--------|----------------|
| Constant | 3.8244 | 70.5016 | 0.0000 | 3.8244 | 4.1072 |
| Price | 0.8856 | 16.2679 | 0.0000 | 0.8856 | 0.6061 |
| Quality | 0.8873 | 16.1904 | 0.0000 | 0.8873 | 1.1081 |
| Disclosure | 0.4246 | 10.8385 | 0.0000 | 0.4246 | 0.4246 |
| Accountability | 0.6343 | 15.9317 | 0.0000 | 0.6343 | 0.6343 |
| Privacy | 0.6710 | 17.0431 | 0.0000 | 0.6710 | 0.6710 |
| Price X Quality | 0.1187 | 2.9533 | 0.0032 | 0.1187 | 0.1187 |
| Price X Disclosure | 0.0648 | 1.6513 | 0.0988 | 0.0648 | 0.0648 |
| Price X Privacy | 0.2253 | 5.6876 | 0.0000 | 0.2253 | 0.2253 |
| Accountability X Quality | 0.1212 | 3.0608 | 0.0022 | 0.1212 | 0.1212 |
| Accountability X Privacy | 0.0904 | 2.2902 | 0.0221 | 0.0904 | 0.0904 |
| Quality X Privacy | 0.2177 | 5.5040 | 0.0000 | 0.2177 | 0.2177 |
| Culture | 0.2828 | 3.5974 | 0.0003 | | |
| Culture X Price | -0.2795 | -3.4904 | 0.0005 | | |
| Culture X Quality | 0.2208 | 2.7875 | 0.0053 | | |
| Culture X Disclosure X Quality | 0.1212 | 1.9278 | 0.0540 | | 0.1212 |
| Culture X Disclosure X Privacy | -0.1856 | -3.1429 | 0.0017 | | -0.1856 |

The main findings presented in Table 4 are:

1. Overall, the Israeli Arabs have higher "intention to purchase" ratings than the Israeli Jews (the constant is 3.82 and 4.10 among Israeli Arabs and Jews respectively).
2. All commercial and ethical factors have significant effect on the "intention to purchase". 32% of the variance can be explained by these 5 main factors- Attractive Price, Quality, Fair Disclosure, Accountability and Privacy & Security.
3. The factor of Attractive Price has lesser effect among Israeli Arabs compared to Israeli Jews (Coefficients are 0.60 and 0.88 among the Israeli Arabs and Israeli Jews, respectively).
4. The factor Quality has higher effect among Israeli Arabs compared to Israeli Jews (Coefficients are 1.10 and 0.88 among the Israeli Arabs and Jews, respectively).
5. There is no significant difference between the Israeli Arabs and Jews in terms of the ethical factors.
6. The following interactions have positive impact on the "intention to purchase" among both Israeli

Arabs and Jews:

- Attractive Price and Quality
- Attractive Price with Fair Disclosure
- Attractive Price and Privacy
- Accountability and Quality
- Accountability and Privacy

Over all, these findings indicate the strong effect of two factors, Attractive Price and Accountability on both groups.

5.3 Repeat Study: Comparison of "Intention to Buy" in 2006 and in 2009

In an earlier study (Adam et al., 2007) which presents outcome of 2006 research, we have found that in the case of a conflict between the commercial and ethical factors, where the website offers goods attractively priced, while subjecting consumers to unfair ethical practices, the typical e-consumer tends to give more weight to the commercial factors than to the ethical factors. Since no significant differences have been found between the two groups, we have decided to compare the entire sample of 2009 with the entire sample of 2006 in the present study.

Table 5 presents the means, S.D.'s and the t values between the two groups (2006 group and 2009 group) with regard to all 32 profiles.

Table 5. Mean ratings, S.D. and t values among 2006 and 2009 groups for the 32 profiles

| | | | | | | 2009 | 2005 | 2009 | 2005 | p-value |
|-----------------|----------------------|-----------------|---------------------|----------------|--------------------|-----------------|-----------------|----------|----------|----------|
| Web Site Number | Price Attractiveness | Product Quality | Product Description | Accountability | Privacy & Security | Mean Rating (%) | Mean Rating (%) | S.D. (%) | S.D. (%) | |
| 1 Lo | w | High | High | High | High | 55 | 60 | 28 | 23 | 0.1701 |
| 2 Hi | gh | High | Low | Low | Low | 33 | 32 | 26 | 25 | 0.8675 |
| 3 Hi | gh | Low | Low | High | Low | 31 | 37 | 25 | 23 | 0.0966 * |
| 4 Hi | gh | Low | Low | Low | High | 30 | 32 | 24 | 21 | 0.6482 |
| 5 Hi | gh | High | Low | Low | High | 33 | 27 | 27 | 19 | 0.0779 * |
| 6 Lo | w | Low | High | Low | High | 28 | 22 | 25 | 16 | 0.0419 * |
| 7 Hi | gh | High | High | Low | High | 66 | 66 | 22 | 17 | 0.8992 |
| 8 Lo | w Hi | gh | Low | High | Low | 41 | 36 | 26 | 22 | 0.1662 |
| 9 Lo | w | Low | Low | High | High | 29 | 26 | 21 | 16 | 0.2515 |
| 10 Hi | gh | Low | High | Low | Low | 31 | 37 | 25 | 22 | 0.0964 * |
| 11 Lo | w | High | High | Low | Low | 32 | 31 | 25 | 18 | 0.5466 * |
| 12 | Low Lo | w | Low | Low | Low | 8 | 2 | 20 | 6 | 0.0019 * |
| 13 Hi | gh | High | Low | High | High | 73 | 73 | 23 | 19 | 0.9501 |
| 14 Hi | gh | High | High | High | Low | 55 | 56 | 30 | 31 | 0.8610 |
| 15 Lo | w | Low | High | High | Low | 30 | 30 | 25 | 19 | 0.9370 |
| 16 Hi | gh | Low | High | High | High | 50 | 55 | 25 | 21 | 0.1636 |
| 17 Hi | gh | Low | Low | Low | Low | 25 | 25 | 26 | 22 | 0.9863 |

| | | | | | | | | | | |
|-------|----|------|------|------|------|----|----|----|----|----------|
| 18 Lo | w | Low | High | High | High | 35 | 40 | 24 | 22 | 0.1597 |
| 19 Lo | w | High | High | Low | High | 42 | 40 | 22 | 22 | 0.6492 |
| 20 Lo | w | High | High | High | Low | 44 | 39 | 25 | 25 | 0.2100 |
| 21 Hi | gh | Low | High | High | Low | 39 | 38 | 26 | 25 | 0.7965 |
| 22 Hi | gh | High | Low | High | Low | 50 | 45 | 26 | 27 | 0.2737 |
| 23 Lo | w | Low | Low | High | Low | 20 | 20 | 25 | 20 | 0.9423 |
| 24 Hi | gh | Low | High | Low | High | 38 | 41 | 25 | 21 | 0.3926 |
| 25 Hi | gh | High | High | Low | Low | 47 | 47 | 25 | 28 | 0.8779 |
| 26 Lo | w | High | Low | High | High | 53 | 45 | 24 | 24 | 0.0302 * |
| 27 Hi | gh | Low | Low | High | High | 44 | 44 | 23 | 21 | 0.9959 |
| 28 Hi | gh | High | High | High | High | 92 | 93 | 14 | 11 | 0.7801 |
| 29 Lo | w | Low | High | Low | Low | 18 | 19 | 26 | 21 | 0.7609 |
| 30 Lo | w | Low | Low | Low | High | 17 | 20 | 25 | 22 | 0.4979 |
| 31 Hi | gh | High | Low | Low | High | 54 | 45 | 21 | 26 | 0.0194 * |
| 32 Lo | w | High | Low | Low | Low | 26 | 23 | 26 | 24 | 0.4879 |

Only in 4 profiles (profiles 6,12, 26 and 31) there are significant differences between the groups. We may conclude that the phenomenon described above still holds, at least among Israelis.

6. DISCUSSION

The purpose of our present study is to test the hypothesis whether or not the preference of commercial factors over ethical factors in on-line shopping is particular to Israeli Jews. This hypothesis was negated since Israeli Arabs make similar choices even though these two Israeli groups are considered as two distinct cultures. Thus, the inclination to online shopping in two ethnic groups across differing cultures where commercial factors prevail over ethical factors is similar. The question remains open is whether this result will repeat itself across other cultures as well. In addition to that, we would like to explore the question whether the preference of commercial factors over ethical factors in on-line shopping impacts negatively on the rate of growth of the e-agora? We find it hard to give up our basic assumption that the perceived ethical conduct of e-vendors is critical for online shopping.

7. CONCLUSION

In the future, studies conducted among several cultures will give us both a better and deeper understanding of the effects of culture on online behavior. This said, we would like to ask the following questions: Does ethics really matter to e-consumers, regardless of their cultural origins, and if so, to what extent? If not, is ethics also ignored in other Internet cultures when price and quality of product are attractive?

The study of e-consumers' ethical attitudes in cross digital cultures is in its diapers. We propose our methodology which unpack the ethical dimensions of business in online shopping transactions in cross digital cultures. Hence, a study of the impact of ethics in cross digital cultures is needed and scarce in the study of the global villagers' attitudes in e-consumption. It is needed since the variance of ethics in differing cultures seems to be quite great. We mentioned earlier that the set of findings of our earlier study may be read as

unique to the norms of Israeli society and culture but is it so or perhaps it is a universal phenomenon. We did not find a research on this issue.

The present study here aims to explore these venues. The results of such a study can benefit e-vendors and entrepreneurs alike in the different cultures by offering a way which addresses the needs of the e-consumers in the global village. These needs are met by determining the mixture of commercial and ethical factors suited to their sites. Such research probes whether or not the importance attribute to ethical factors in a hypothetical environment in various cultures is similarly reflected in their real-world actions.

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USER-DRIVEN BUSINESS MODEL INNOVATION – NEW FORMATS & METHODS IN BUSINESS MODELING AND INTERACTION DESIGN, AND THE CASE OF MAGITACT

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ABSTRACT

The primary goal of economic activity is the creation of value, and business models describe how to create and capture such value. An informed and systematic variation and extension of fundamental business aspects such as value proposition, user experience and partnering not only helps to focus new business, attract investors, and bring new products to the market, but also feeds back on the original concepts and design. We present a human-centered process and action framework, and user-driven innovation methods for modeling new business in IT and telecommunications. The approach and potential results are exemplified through the MagiTact project. The case shows how workshops with lead users and domain experts lead to new business models for touchless near field communication and inspired technological advancement of the original ideas. Finally we explore the dynamic interplay between user-centered idea generation, business modeling and technological development in innovation projects.

KEYWORDS

Business Modeling, Process Framework, Innovation Management, Interaction Design, Human-centered design, Touchless Near Field Communication.

1. INTRODUCTION: BEYOND TECHNOLOGY & MARKET

The traditional dichotomy between technology-based and market-driven respectively customer-driven innovation is currently being replaced with a systemic view on a multitude of innovation constituents within a business ecosystem (Teece 2009). Business Model Innovation has developed towards a prime technique of innovation management, complementing other forms of (technological, product, process, disruptive, user-driven, grounded) innovation. The idea is a systematic variation and extension of fundamental business aspects such as value proposition, user experience, partnering, and delivery of solutions. In the last decade the trend has been pushed through variety of new business models enabled through the internet.

This paper briefly describes conceptual cornerstones of business modeling and introduces a framework for the user-driven generation and elaboration of business models in IT and telecommunications. We present a rough process framework, a set of three distinctive, i.e. project-, workshop- and game-based, formats and experiences with several user-centered methods of modeling aspects of new business in technology oriented companies and small entrepreneurial teams. This framework not only modifies a well-known mapping tool (Osterwalder & Pigneur 2010) and enriches ideation through user-driven methodology (Steinhoff & Breuer 2009), but also takes initial steps into the iterative experimentation that is needed to study emergent markets and enact in them. Business model innovation in that perspective is not a matter of ideation but of iterative experimentation (Thomke 2002) with increasing degrees of fidelity, costs and time in order to generate usefully approximate information and evaluate concepts. In fact, not only information is generated here, but technological requirements are elaborated upon and implemented as we will see in a case study – just like the vision of a personal computer was a business model long before the suitable technology existed.

Analyzing the case of MagiTact, a set of applications for touchless near field communication, we reflect upon the dynamic interplay between user-centered idea generation and technological development in innovation projects. Within an ideation workshop with lead users, and a business modeling workshop with domain experts, business models and promising new application fields resulted. The case yields insights into

potentials, limits and challenges for the successful cooperation between user-centered, business-oriented and technical work streams in innovation projects.

2. RELATED WORKS AND CONCEPTUAL BACKGROUND

Business applies various means to deliver services and products but its ends rely on the values that even daily operations provide to customers and society: The primary goal of economic activity is the creation of value. Our framework combines a strong user focus with a value-oriented business modeling approach in the IT and telecommunication industry. Since Porter (1980) described the value chain of activities for a firm operating in a specific industry, information technology and web-based applications fuelled the creation of new business models. Beyond product and (internal) process innovation new business models emerged and became a new toehold for innovation strategy. Meanwhile software development methodology was increasingly challenged by the risen impact of user requirements and web based business models (IconProcess was one of the answers to this challenge). Interactive value creation places formerly peripheral activities – the design of interfaces to customers into the center of attention. Customers and users extend the producers knowledge, competences and resources – becoming a strategic factor for the creation of value. Operational efficiency became a necessary but insufficient competitive advantage (Reichwald & Piller 2009).

Within a research and consulting unit for “User-Driven Innovation” we leverage heterogeneous sources of knowledge to sense and seize opportunities for new business and fill the gaps in ongoing innovation projects. Informed decisions, which innovation topics to pursue, and which business opportunities to exploit, increase focus and reliability of investment decisions. Starting with the detection of new search fields for innovation through to the observation of users in their living environment and the joint effort of different disciplines in creative workshops, new business potentials are being identified and comparatively processed. A fast realization, check, and revision of tangible prototypes and new methods of user research permit an optimization of the most promising approaches and a reliable assessment of their market potentials. Trying to mature from a technology driven innovator to a creator of human-centered solutions we contributed individual components of future business models. One example: In order to support the crucial phase of starting-up the device and developing first using usage routines in a profitable way, easy-to-implement measures of the product packaging and introductory team exercises for users were developed (Breuer et al. 2009). Within corporate research and innovation as well as entrepreneurial initiatives we observed and responded to a growing demand to go beyond the generation and evaluation of new products ideas into modeling business ecosystems. One of these requests came from a group of researchers working on new technologies and interaction paradigms for touchless near field communication.

Business models lay out an organizational architecture within a business ecosystem. According to Chesbrough & Rosenbloom (2002) the function of a business model is to articulate the value proposition, select the appropriate technologies and features, identify targeted market segments, define the structure of the value chain, and estimate the cost structure and profit potential. In the last 20 years, associated with the rise of the internet and its potential to disrupt traditional business models, business modeling has gained attention in the corporate practice and academic literature (e.g. Staehler 2001). A variety of constituents, conceptual frameworks and how-to approaches have been proposed (e.g. Bouwman et al. 2008). The new complexity calls for simplified frameworks and easily accessible plans for action. We adapted such a reference model that assembled previous findings into the visual mapping tool of a “canvas” (Osterwalder & Pigneur 2010). This reference model was modified in several ways: Most distinctively it was redesigned from a user-centered and stakeholder-driven point of view that also serves as a consistent anchor for modeling entrepreneurs and engaged business leaders. On the one hand the mapping tool was driven to the extreme of simplification lowering entry barriers for young entrepreneurs and engaged business leaders: A game-like do-it-yourself starter kit is the result (see playground in figure 1). On the other hand the reference model was enriched through user-centered methodology and extended into a flexible process framework focusing on the demands of user-driven innovation projects in the information and communication technology industry.

Both approaches support small teams in thinking about new business in a structured way, and enable first hand experiences in the attempt to create or renew business models. Still, unlike some of the “how-to-model” literature we do not suggest that in depth user research, market study or organizational development of dynamic capabilities may be neglected. On the contrary inquiry into each of the building blocks (e.g. Breuer

& al. 2009) and their interaction within a business ecosystem are indispensable. Last but not least only repetitive, applied “experimentation” overcomes the barriers and engages in the potential that alternative business model ideas hint to and create and capture the value that new models promise.

3. MODELING NEW BUSINESS IN IT & TELECOMMUNICATIONS

In order to support research and innovation projects and entrepreneurial initiatives trying to develop new and suitable business models three formats were developed:

- **Business Model Game:** A self-explanatory, game-like do-it-yourself starter kit supports small teams in thinking about new business in a structured way. It enables first hand experiences in the attempt to create or renew business models providing a value- and user-centered playground, instruction and challenger cards, and a brief quick start guide to the basics of business modelling methodology and moderation. Its user-centered layout provides a consistent anchor and easy access even for novices.

- **Instant Business Modeling:** Instant business modeling is a moderated workshop format. Half day sessions with basic templates enable a rapid turnaround of results. Out of scope is an in depth elaboration of business models, its building blocks and their interaction. Just like in the last gaming format the focus is on knowledge sharing rather than creative development of innovative business models.

- **Full Scale Business Modeling Project:** The full scale business modeling project covers a five step process including an initial domain research, a user and a modeling workshop, a model test, model specification and finally illustration and storytelling, making it easy to communicate the business model. A toolbox of user-driven methods allows exploring and refining each dimensions of a model by generate ideas and provoking valid assessments from users and experts.

3.1 Business Modeling Process Framework

The business model process framework consists of five steps that are taken in an iterative fashion:

1. **Domain Research:** Domain Research includes trend & business model research, industry benchmarks, & blue ocean analysis (Kim & Mauborgne 1997) to create ideas and capture new demand in new uncontested market space. Goal of an initial domain research is to understand and current trends in the business ecosystem. We gather domain relevant trends, customer insights, and competitive market analysis (to inspire learning from other brands and blue ocean analysis) through desk research and expert interviews. Related business models can inspire the following activities

2. **Ideation & Deep Dives:** Ideation workshops generate and differentiate new business ideas with users, experts and stakeholders in two steps. First, using a range of creativity methods potential usage scenarios are developed together with lead users, and prioritized by means of innovation market research or management decision. Second, once usage scenarios and rough value propositions exist, we use a mapping tool and creative exercises to identify future customers and the value created for and with them. Supported by lead users, customer touchpoints (Rogers 2003), an intended user experience, and a viable revenue model are elaborated upon. Finally domain experts participate in the definition of solutions and costs including (dynamic) cost structure and dynamic capabilities, and key partner relations.

3. **Illustration and storytelling** consolidate and communicate the model to stakeholders. Starting from the needs and closing with the solution stories convey the big picture, make the models tangible, and perform a fictional reality check. Storytelling prepares entrepreneurs or business owners to acquire support from additional stakeholders and investors. Beyond simple elevator pitches we developed a range of visualization formats in order support the understanding of innovative business models and to enable valid evaluations. Visual storyboards on medium level of abstraction illustrate usage scenarios & interaction flows. Videos demonstrate motion sequences and prototype interaction. For the promotion of “information cards” technology we created a small comic of the early days of the internet providing context and contrast to show the potential of the innovation and its open business ecosystem.

4. **Stakeholder Reviews:** The initial model or single critical aspects are reviewed from multiple points of view involving lead users and/or domain experts from related fields, or potential customers, partners and/or investors. Various formative evaluation methods apply an increasing fidelity of business model prototypes and granularity for stress tests, ranging from simple challenger questions and stand up role playing games (to

enact a business model and use the actors and audience experiences as feedback channels) to the analysis of hypothetical future scenarios, to comprehensive user clinics and test markets applying customer analytics.

5. Model specification and experimentation: Operationalization sketches out a business processes model and its evolution. Quantification of activities with price tags feeds into a business plan. Through iterative remodeling and live experimentation an actual business may be developed. In order to refine the model we are working on a simple notation to visualize flows and relations. This graphical notation builds on known modeling languages. Boardofinnovation.com proposes six players and ten objects to exchange, IconProcess.com defines workflows, activities, (primary & supporting) roles, artifacts, and their relations. Different roles, artifacts and activities are visualized as icons - their elementary transactions are shown. An overview highlights distinguishing features, simplifies streamlining and recombination.

The proof of the pudding is in the eating. Experiments (Thomke 2002) and feedback loops should be integrated from early on paving the road to new business. "Emergent opportunities typically lack the deep wealth of data that are used to justify corporate actions in the mainstream business" (Chesbrough 2010). Early feedback from potential customers, partners and stakeholders is one approach to obtain such data. A complementary approach has been called effectuation (Sarasvathy 1996), not analyzing an environment but taking action to create information and reveal latent opportunities.

3.2 A Customer-Centered Mapping Tool and Methods

User driven innovation methods (Steinhoff & Breuer 2009) provide a consistent customer focus transform the mapping of prevalent ideas into trigger for the value driven generation of innovative business models. Thus, they work against the natural tendency to map conventional ideas and old business models onto new technologies and solutions, and help to explore and elaborate upon innovative business models providing real value. We start with the future customers and the value created for and with them, two sides of the initial coin. The second steps addresses customer needs and value creation by means of customer touchpoints and user experience (comprising not only channels and relationships but also holistic aspects including product expectations and emotional bonds) and revenue structure. Finally solutions and operational costs are covered including (dynamic) cost structure and dynamic capabilities of the company, and key partner relations.

1. The value proposition addresses the use value that an innovation satisfies. The notion of value has a long history in philosophy, sociology, psychology before taking over the business world. From a customer perspective we focus on the usage or use value and its resulting benefits, and the exchange value representing the sacrifice a customer is willing to make. The usage value not only contains the functional utility, or what something can do, but also more personal values such as self-expression or social influence. Through these business is linked to the existential needs and motivations for different groups of people, and thereby the existential reason for the whole endeavour, the job to be done. The initial value proposition is often based on expected benefits of a new technology or configuration, but the initial guess is rarely the best to establish strong links between value and proposition (Rorrich & Lierna 2011). Deep dive methods include the Basic Driver Analysis, Futures Workshops and Attribute Value Maps.

2. Customer segments refer to archetypical personas or target groups of people. Beyond the usual demographic, attitudinal or psychographic segments of people one may also start from individuals or stereotypical personas (Cooper 1998) as chances are good that if one customer is served perfectly the offer is likely to fit for others as well. Value proposition and segments highly depend on one another; the most interesting target segment for a seamless aid for elderly may be their mid-aged sons and daughters wanting to be caring kids.

3. Customer Touchpoints: Users encounter new products and services along seven touchpoints. Spreading the word to get the proposition known customers become aware of an opportunity, inform themselves about tradeoffs, acquire what they choose, start-up new devices, applications and services, and they use, change, and drop or renew them (Rogers 2003; Breuer et al. 2009). Investigating touchpoints we intend to stress the customers' perspective and interactive value creation more than a distribution of industrial good through marketing and delivery channels such as postal or online delivery, or live events. Touchpoint analysis and customer journey are proven tools for deep dives. While touchpoints deal with the product entering and living in the world of customers, complementary distribution channels may be addressed: the companies view how to get there. Beyond classical delivery channels online and mobile mediation, and intermediaries such as agents, retailers, and wholesale need to be considered.

4. Revenue Models: They describe how value is realized by the firm; including pricing models such as fixed and variable pricing (to the value) on an individual or subscription base (see Popp 2011). Here as with the other fields on the value driven side of the map blue ocean analysis (Kim & Mauborgne 1997), informed by previous domain research into industry benchmarks may lead to new approaches.

5. Capabilities include resources & skills, activities & processes. Various taxonomies of organizational resources are available. Since intellectual capital and intangible assets play a major role not only in the recent literature but also in information and technology intellectual performance drivers (Marr, Schiuma & Neely 2004) are likely to play a pivotal role (and may be used to dive deeper into the topic). In addition to hard and soft skills needed with the teams on a steady or temporary basis activities and processes may be addressed here. Learning from other brands, companies, and business model patterns critical capabilities may be identified.

6. Partnering: Thinking about value networks and potential assets and input that may be outsourced partner relations come into play. New win-win situations with potential suppliers and business partners need to be invented. Co-innovation may be required with new alliances. In the MagiTact project we successfully worked with stakeholder maps in order to sketch out potential partnering networks.

7. Cost structure: Summing up the cost-drivers of the model initial costs and their development are considered. Operational expenditure (OPEX) for ongoing expenses such as legal or software licensing fees, advertising and supplies, insurance and utilities, and capital expenditure (CAPEX) such as investments in infrastructure and acquisitions of equipment need to be considered and might provide chances for saving.

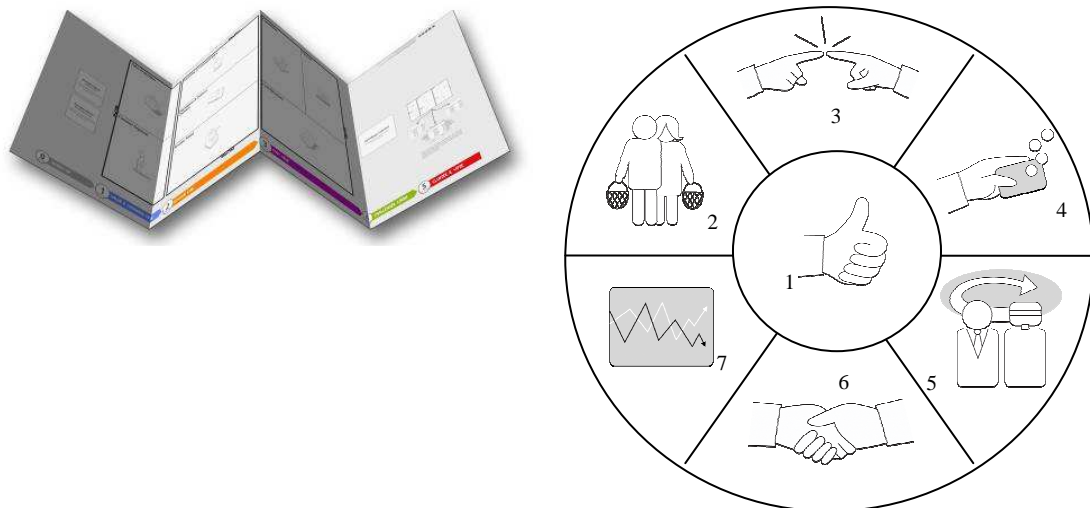


Figure 1. User-centered mapping tools for ideation with value and personas as key and starting turning points. The wheel (right) fosters thinking in relations and may be used on a table. The playground (below) may be used on a wall (below). Minimum required fields are: value proposition (1), customer segments (2), customer touchpoints (3), revenue model (4), capabilities (5), partnering (6) and cost structure (7).

4. THE CASE OF MAGITACT

The user-driven business modeling framework was developed through a number of business modeling projects conducted since the beginning of 2010. They addressed new business potentials around information card technologies, new voice logging products, identity management, and touchless nearfield communication. Due to its uncontested market space the latter project provides an outstanding case to demonstrate key aspects and methods of our approach. In order to understand the base line and challenges we briefly describe the MagiTact technology before going into the business modeling case.

4.1 Touchless Gesture Based Interaction using an Embedded Compass

To overcome the limited size of the interaction space in small mobile devices, Around Device Interaction (ADI) techniques have been introduced. They extend the interaction space beyond the physical boundary of the mobile devices. As most vision-based ADI methods suffer from the lighting conditions and environments changes we propose a touch less gesture-based interaction framework based on magnetic field. Magnetometer, originally embedded for the navigation purposes, measures the strength and direction of the magnetic field. It can sense slight changes of the device orientation with respect to the Earth's magnetic field. Such magnetic field can be deformed due to the movement of any local magnet in the vicinity of the device. If a user takes a properly shaped magnet in hand and makes 3D gestures in the space around the device, the movement of magnet changes temporal pattern of magnetic field sensed by the embedded magnetometer. These temporal patterns can be used to establish a touch less interaction framework, independent from lightning variations and obstructing materials. This property is useful especially when the device is held by hand or is in a pocket or bag. Interpreting signals at the output of the magnetometer is far less complex than applying computer vision techniques. Integrating the cheap, tiny magnetic sensor does not impose major change in hardware and physical specifications of even small mobile devices.

We have investigated the application of our proposed magnetic based interaction to infer simple user gestures by monitoring the movements of the magnet held in the user's hand (Ketabdar, Yüksel, & Roshandel, 2010). We have designed and implemented several applications based on the proposed magnetic interaction framework for mobile devices as proof of concept and in order to show the wide range of potential applications. The applications are ranged from general gestural interaction with computing devices to text (digit) entry, 3D signature (3D Magnetic authentication solution), and entertainment applications.

4.2 Modeling New Business for Touchless Nearfield Communication

The MagiTact Business Modeling project started in 2010 with an innovative technology and interaction paradigm looking for a promising business model. Only rough ideas existed on how to use the touchless nearfield technology, and the project team defined as its goal the generation and evaluation of new use case scenarios and business models for touchless near field communication (NFC). In order to come up with promising usage scenarios, value propositions and business models, we started with an extensive desk research and an ideation workshop with lead users. Within the desk research we reviewed recent developments on touchless NFC devices, applications, and contexts. Results showed that the few studies regarding 3D gesture control focus on technological aspects, but also demonstrate the usefulness of gesture-based device control especially in the context of consumer electronics. Within the ideation workshop more than 60 ideas were generated including 10 top rated ideas. Three ideas were prioritized to be evaluated by customers in an online study and to set the basis for a business modeling workshop.

- **Silent Reply:** With the help of a gesture you signal a caller that you are busy or do not want to be disturbed. You may indicate in how many minutes the call will be returned.
- **Swipe a dime:** A safe authentication of payments is a unique gesture. Two devices are needed: One communicates the amount to transfer, the other one issues the transfer after the swipe.
- **Smart controlled home:** MagiTact allows you to control almost everything in your home via gesture-based interaction e.g. switching on and off lights or moving the vacuum cleaner.

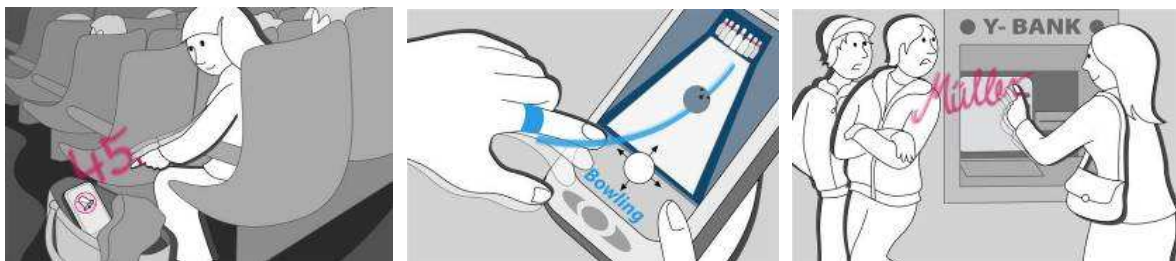


Figure 2. Illustrations for silent reply, gaming & payment from the usage scenarios as basis for business modeling

Deep dive methods included attribute-value mapping for the value proposition and stakeholder mapping to explore value networks and identify critical partner relations. Exemplary cornerstones include:

Silent Reply market introduction may be based on three steps:

- ‘Light Version’ for free to try MagiTact technology & ‘My favored magnet Competition’ in addition.
- Multifunctional ‘Premium Edition’ & additional magnetic devices in collaboration with partners.
- Software Development Kit for licensing.

Gaming:

- Game for free to demonstrate the features; distributed through special interest magazines.
- Software Development Kit for a developer contest to create new games and to acquire first licensees.
- Revenue arises from licenses to game developer firms.

Invisible Signature:

- Focus on B2B (vendors, banks and developers), but based on providing unique value to end users
- Preconditions: market preparation, customer education.
- Revenue arises from licenses to system providers, transactions or fixed fees for small and medium enterprises and subscription fees for end customers.

4.3 Interaction between Business Modeling and Technological Development

For the technical team, the main influence from the user driven business modeling workshops was to get a deeper understanding of the entertainment potentials of the MagiTact technology – multiple ways to entertain customers and to market the product could easily be identified and discussed. Additional reasons to believe in the entertainment potentials were found in the data drawn from the domain research and experts in the business modeling workshop. Still, deepening the understanding of the target group it was also worked out that initially focused gaming or even niche markets need to be addressed to generate a timely return on required investments and capital expenditures and thus a market proof of concept. Within the entertainment field both gaming and mobile music synthesis applications provoked several usage ideas and business potentials. Based on the feedback and experience in the workshops the team pursued the entertainment aspect as a business case with three major outcomes: First, the team was offered to setup a spin off based on MagiTact results for gaming and music synthesis. The final market approach is still being discussed. Second, the invisible signature concept and its rough B2B business model was handed over to other teams working on future payment and authentication systems. Finally we developed a new tailored series of entertainment cases, mainly in the form of what we call as “AirGuitar” (as iPhone application and as real instrument) and “AirDrum”, along with other similar cases. The AirGuitar, AirDrum and other Air Instruments (Ketabdar & al. 2011). The work on AirGuitar has received full positive feedback in scientific forums and well as business cases, and also covered by media.

5. CONCLUSIONS

Experiences from the MagiTact case and more than a dozen other modeling activities showed that the proposed framework is easy to handle and understand for developers and entrepreneurs not coming from a business background. Focusing on developing a viable business model we learned that it also helps to create a common ground or shared understanding of the fundamental assumptions within teams regarding the purpose and usage scenarios of technological developments and new service ideas. It may be applied to a wide range of ideas, concepts or technologies trying to evolve into valuable markets. Its flexibility allows to either dive deep into single aspects (as typically needed with respect to the value proposition and value network), or to analyze the interaction of elements and take the first steps into real options and markets. However, while the entrepreneurs we worked with, but also most of the related literature happily engage in the creative development of new models, one issue that has been widely neglected in the resolving of conflicts that naturally result from the implications of new models – within the entrepreneurial team or the larger corporation and its related and competing business streams. Regarding such internal issues and the proof of concepts on the marketplace only repetitive, applied experimentation overcomes the barriers and engages in the potential initial, alternative business model hint to.

Only live entrepreneurial engagement may capture the value new models promise. Future research should address the development of refined tools and benchmark measure for experimenting with and driving real markets and analyze entrepreneurial patterns and turning points during these first steps. “A mediocre technology pursued with a great business model may be more valuable than a great technology exploited via a mediocre business model” (Chesbrough 2010). At the Laboratories we have the chance to start with great technologies, and end with superior models. The success of this endeavor depends on iterative experimentation and cumulative learning that cannot be delegated or externalized.

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PLAYERS OF ONLINE GAME: AN EXPLORATORY STUDY FROM THE PERSPECTIVE OF LEISURE CONSTRAINTS

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ABSTRACT

There are many studies on the behavior of online game players. However, there has been little research from the perspective of leisure constraints. Some studies on the Hierarchical Leisure Constraints Theory have suggested the possible existence of intertwining relationship between constraints (the leisure constraint dimensionality issue). Hence, this study applied the concept of leisure constraints to study the behavior of online game players and to contribute to our understanding of the dimensionality issue of leisure constraint research. Using the Decision Making Trial and Evaluation Laboratory (DEMATEL) method, this study showed that the importance of leisure constraints is dependent on the social and time-consuming nature of online games. Applying the terminologies of DEMATEL method, lack of time constraint as well as lack of computer and other facilities constraint are two strong net causer constraints. Lack of interest constraint is a major receiver constraint and is influenced by many other leisure constraints. The results suggest that leisure constraints may vary with leisure activities. The study also showed that leisure constraints may interact, sometime bi-directionally, with one another, hence providing further evidence on the intertwining relationship between constraints.

KEYWORDS

Online game, Leisure activity, Leisure constraints, DEMATEL.

1. INTRODUCTION

Online game is now a global popular entertainment activity. ABI Research estimated the global revenue of online gaming to be more than US\$20 billion in 2012 (Liang, 2010). Online game is the most popular online entertainment application in Taiwan (Liu and Chou, 2008). According to Taiwan's Market Intelligence & Consulting Institute, Taiwan online game industry is expected to reach US\$470 million in 2011 (MIC, 2010).

There are many studies on the behavior of online game players. Perceptual antecedents such as ease of use, entertainment, enjoyment and e-lifestyle were used to explain the behavior of online game players (Kim et al., 2002; Gao, 2004; Wu et al., 2008). Lu and Wang (2008) looked at the issue of game addiction. There are also studies (such as Ha et al., 2007 and Chen, 2010) which looked at how demographics of players (such as age and gender) influence attitude, intention and loyalty to online game.

However, to the best of our knowledge, there has been little research on looking at the behavior of online game players from the perspective of leisure constraints. A lack of research from this perspective is surprising. Playing online game is a leisure activity in the eyes of many players. The concept of leisure constraints, a sub-field of leisure studies, has been applied to many leisure activities such as physical exercise (Currie, 2004), park visitation (Burns and Graefe, 2007), travel (Nyaupane & Andereck, 2008) and skiing (Gilbert and Hudson, 2000). The research involves investigating "factors that are assumed by researchers and/or perceived or experienced by individuals to limit the formation of leisure preferences and/or to inhibit or prohibit participation and enjoyment in leisure" (Jackson, 2000, pp. 62). According to the Hierarchical Leisure Constraints Theory (Crawford and Godbey, 1987; Crawford et al., 1991), these constraints can be classified as structural, intrapersonal and interpersonal constraints. They are experienced hierarchically and could be incorporated within an individual's decision-making process. People may overcome leisure

constraints through the process of constraint negotiation (Shaw et al., 1991). This study differs from previous studies on online game by using leisure constraints concept to study behavior of online game players.

The Hierarchical Leisure Constraints Theory is not without criticisms and concerns (Jackson, 2000). In a recent paper written by Godbey et al. (2010) to assess the status of Hierarchical Leisure Constraints Theory, the paper noted results from other studies that “the (structural, intrapersonal and interpersonal constraints) dimensionality issue, however, is far more complex than it appears at first glance. For one, observations of the interactions' among factors on the three levels have given rise to the question as to whether the three dimensions of constraints can be viewed as distinct categories” (pp. 113). Quoting more studies by other parties, the paper further observed that “these arguments seem to suggest an intertwining relationship between the three dimensions” (pp. 114). In response, the authors suggested that for this dimensionality issue “it is important to keep in mind that conceptually distinct constructs can be correlated (much as factors may be correlated in a factor analytic solution). In fact, it is implausible to contend that there are any relevant variables (or factors) connected with social life that would be entirely unrelated” (pp. 114) and “high internal consistency reliabilities should not be blindly pursued at the cost of content validity” (pp. 114). This exploratory paper hopes to contribute to this dimensionality issue by looking at the possible existence of intertwining relationship between the three leisure constraint dimensions in the context of online games.

The following two research questions for this exploratory study are therefore proposed: In the context of online game, how do players view the various leisure constraints, in isolation and in totality? How do the results contribute to our further understanding on the dimensionality issue of leisure constraints? Since this study suggests the possibility of existence of intertwining relationship between leisure constraints, to the extent of having bi-directional relationship, recursive model will not be suitable for this study. Decision Making Trial and Evaluation Laboratory (DEMATEL) method (Hung et al., 2006; Tzeng et al., 2007) is used instead. DEMATEL can discover the cause and effect relations between factors and allow one to visualize its structural model. Hence, it is an appropriate tool to construct cause-effect non-recursive model to show any existence of intertwining, reciprocal causal relationship between the leisure constraints.

2. LITERATURE REVIEW

Online game is a type of game where a person can play with the computer or with a handful to many people at the same time through the Internet (Kim et al., 2002) and brings the synthetic worlds out of the subculture of computer (Arakji and Lang, 2008). Playing online game requires some basic computer skills. Perceived ease of use encourages playing of online game (Gao, 2004). Players also get more skillful when they play online games for a long time. Expertise provides players a sense of control. According to Chen (2010), past online game playing frequency positively predicts future game playing intention. Players may need to pay a subscription fee for playing the games. For free-to-play games, players may instead purchase virtual game items (Park and Lee, 2011). There is also a social element in online games. Online games offer online social spaces and create miniature virtual societies where players “create individual factions, guilds, and teams based on shared beliefs, goals, preferences, or other factors” (Lo, S.K., 2008, pp. 1949). Players with pleasant social interaction with other people are likely to continue playing online games (Choi and Kim, 2004).

Playing online game is a leisure activity. Wang et al. (2008) found significant relationships between physiological and aesthetic dimensions of leisure satisfaction and life satisfaction in playing online games. Lee (2009) argued that online games are entertainment but not task-oriented technologies. Ha et al. (2007) mentioned that games provide entertainment, enjoyment and relaxation. Perceived playfulness influences online game addiction (Lu and Wang, 2008; Hsu and Lu, 2007). Enjoyment in playing online games impacts intention (Wu et al., 2008) and according to Lee (2009), flow experience plays a more important role than enjoyment on player's intention. Perceived entertainment contributes to user's attitude and intention to play online game again (Gao, 2004). Players can be highly attached or addicted to online games (Chen, 2010; Lu & Wang, 2008). Online games may also help players to gain a sense of accomplishment (Wang et al., 2008).

According to the Hierarchical Leisure Constraints Theory, there are three levels (dimensions) of leisure constraints: intrapersonal, interpersonal and structural. Intrapersonal constraints are related to an individual psychological states which shape leisure preferences (Alexandris et al., 2011), such as lack of skill and interest (Kimm, 2009; Chang et al., 2011; Stanis et al., 2009). Interpersonal constraints arise out of social interaction, such as lack of companionship or endorsement from family (Alexandris et al., 2011). Structural

constraints are external to the individual factors, such as lack of equipment, time, transportation and money (Alexandris et al., 2011; Son et al., 2009; Jun et al., 2008). According to the model, intrapersonal constraints are the most proximal and powerful determinants of leisure participation while structural constraints are the most distal and least powerful constraints. The model further suggests that eventual leisure behavior is dependent upon successful negotiation of these constraint levels in a sequential manner: intrapersonal, interpersonal, and structural constraints (Jackson et al., 1993). A series of studies have provided a reasonably stable and replicable set of constraints dimensions (Jackson, 2000). The three-dimensional construct structure was also validated (Raymore et al., 1993; Nyaupane et al., 2004). However, a study by Gilbert and Hudson (2000) showed that in the case of skiing, “interpersonal constraints either do not intervene between the other two types of constraint or they do not exist” (Walker et al., 2007, pp. 919). Studies by Gilbert and Hudson (2000), and Scott and Munson (1994) noted possible interactions between these three types of constraints.

3. RESEARCH METHOD - DEMATEL

Developed by the Battelle Memorial Institute of Geneva, DEMATEL is used to analyze the management problems of complex and inter-related relationship. It converts the relationship between causes and effects of factors into an intelligible structural model of the system. The steps of DEMATEL method are as follows:

Step 1: Find the average matrix. Suppose there are n factors and there are H respondents in this study, each respondent is asked to state the degree he or she believes a factor i affects factor j through a score from 0 to 4, with 0 as ‘no influence’ and 4 as ‘very high influence’. We will get H answer matrix where each answer matrix is an $n \times n$ matrix X^k with $1 \leq k \leq H$. The initial direct relation matrix A is obtained as below:

$$a_{ij} = \frac{1}{H} \sum_{k=1}^H x_{ij}^k \quad (1)$$

Step 2: Calculate the normalized initial direct-relation matrix D . The matrix D is obtained by normalizing initial direct relation matrix A : $D = A/s$ where

$$s = \max \left(\max_{1 \leq i \leq n} \sum_{j=1}^n a_{ij}, \max_{1 \leq j \leq n} \sum_{i=1}^n a_{ij} \right) \quad (2)$$

Step 3: Calculate the total relation matrix T . A continuous decrease of the indirect effects of problem along the powers of matrix D , e.g. $D^2, D^3, \dots, D^\infty$ guarantees convergent solutions to the matrix inversion similar to an absorbing Markov chain matrix. The total relation matrix T is an $n \times n$ matrix and is defined as:

$$T = D + D^2 + \dots + D^m = D(I - D)^{-1} \quad (3)$$

as $m \rightarrow \infty$ and I is an $n \times n$ identity matrix. The sum of rows r and the sum of columns c of the total relation matrix T is obtained as in (4). The sum $r_i + c_i$ gives an index representing the total effects both given and received by factor i . The difference $r_i - c_i$ shows the net effect factor i contributes to the problem. If the difference $r_i - c_i$ is positive, factor i is a net causer, and when $r_i - c_i$ is negative, factor i is a net receiver.

$$r = [r_i]_{n \times 1} = \left(\sum_{j=1}^n t_{ij} \right)_{n \times 1} \quad c = [c_j]_{1 \times n} = \left(\sum_{i=1}^n t_{ij} \right)_{1 \times n} \quad (4)$$

Step 4: Set the threshold value and draw the influence map.

This research conducted literature review and interviewed experts and online game players to find out suitable leisure constraints for analysis. Finally, nine leisure constraints were identified and chosen for DEMATEL analysis. Such an approach is common in leisure constraints-related study where each research

group identifies “the categories of constraints specific to certain research context and/or customizing the instrument development to its own needs” (Godbey et al., 2010, pp. 115). The final list of leisure constraints considered in this study comprises three intrapersonal constraints: lack of interest (Intra1), lack of skills (Intra2) and lack of accomplishment (Intra3); two interpersonal constraints: lack of companionship (Inter1) and lack of endorsement (Inter2); and lastly four structural constraints: lack of time (Struc1), lack of money (Struc2), lack of information (Struc3), as well as lack of computer and other facilities (Struc4).

4. ANALYSIS AND DISCUSSION

Survey method was used to solicit the opinion of online game users in three areas. Firstly, they were asked to indicate whether these leisure constraints have prevent them or reduce their intensity in playing online game through a score ranging from 1 to 5 with 1 indicating ‘little’ and 5 indicating ‘very’. This portion of the survey comprises 9 questions, one for each leisure constraint. Secondly, each respondent was asked to state the degree he or she believed a leisure constraint i affects another leisure constraint j through a score ranging from 0 to 4 with 0 indicating ‘no influence’ and 4 indicating ‘very high influence’. This DEMATEL portion of the survey comprises 72 questions. The third part of the survey queried respondents on 3 demographic-related (gender, age and educational level) questions.

Time-consuming face-to-face interviews instead of online survey were used to guide respondents to improve the accuracy and reliability of the returns. The key reason for such an approach is DEMATEL survey is not easy to understand, tedious and mind-boggling. Getting inputs from respondents was challenging and need initial guidance to navigate through the survey. The survey lasted for 2 month starting from Oct 2011. Convenience sampling with snowballing technique were employed to solicit for inputs. A total of 122 valid returns were received, 97 (79.5%) of them were male and 102 (83.6%) were in the main age group of 20-30 year old. In addition, 117 (95.9%) of them received college and university education.

4.1 Impact of Leisure Constraints

As a whole, most of the leisure constraints do not reduce their intensity in playing online game severely since the highest mean is only 3.48 (Table 1).

Table 1. Impact of leisure constraints

| Leisure Constraints | Mean | S.D. | Ranking |
|---|------|------|---------|
| <u>Intrapersonal</u> | 2.89 | 1.06 | |
| Intra1: Lack of interest | 3.26 | 1.10 | 3 |
| Intra2: Lack of skills | 2.60 | 1.06 | 8 |
| Intra3: Lack of accomplishment | 2.81 | 0.91 | 6 |
| <u>Interpersonal</u> | 3.18 | 1.09 | |
| Inter1: Lack of companionship | 3.30 | 0.97 | 2 |
| Inter2: Lack of endorsement | 3.06 | 1.19 | 4 |
| <u>Structural</u> | 2.92 | 1.13 | |
| Struc1: Lack of time | 3.48 | 1.06 | 1 |
| Struc2: Lack of money | 2.80 | 0.97 | 7 |
| Struc3: Lack of information | 2.41 | 0.96 | 9 |
| Struc4: Lack of computer and other facilities | 2.98 | 1.26 | 5 |

Lack of time (3.48) constraint has the highest mean. Together with lack of computer and other facilities constraint (2.98), they are the only two structural constraints in the category of top five constraints. Lack of companionship (3.30), an interpersonal constraint, has the next highest mean, follows by lack of interest (3.26), an intrapersonal constraint. Both interpersonal leisure constraints are in the category of top five constraints while the only intrapersonal constraint, lack of interest, is in the category of top five constraints.

4.2 Influence Maps

For better clarify, the obtained influence map is shown as three separate maps. These maps, when viewed together represent the overall influence map obtained through DEMATEL analysis. They focus on the relationship of lack of companionship (Figure 1), lack of skills (Figure 2a) and lack of interest focus constraints (Figure 2b) with other constraints respectively. These three constraints are chosen because they appeared to be the key centers where relationships originate or converged. Dotted lines represent uni-directional relationship and the solid lines represent bi-directional relationship. Many constraints are related to others except for two standalone constraints: lack of endorsement (Inter2) and lack of money (Struc2) constraints.

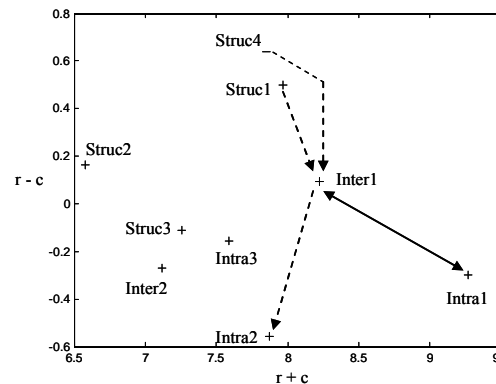


Figure 1. Influence map with lack of companionship constraint as the subject of focus

As shown in Figure 1, two structural constraints, lack of time (Struc1) as well as lack of computer and other facilities (Struc4) can influence perception of lack of companionship (Inter1) constraint. In turn, perception of lack of companionship can influence lack of skills (Intra2). Lack of companionship can influence lack of interest (Intra1) and vice versa (i.e. existence of bi-directional influence). As a whole, lack of companionship constraint is a weak net causer constraint.

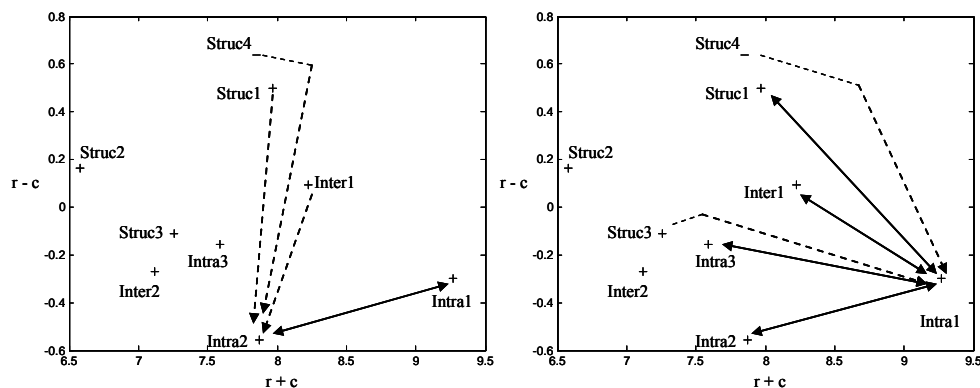


Figure 2. Influence map with (a) lack of skills (b) lack of interest constraints as the subject of focus.

As shown in Figure 2(a), the same two structural constraints, lack of time (Struc1) and lack of computer and other facilities (Struc4) that influence lack of companionship (Inter1) constraint, also influence lack of skills (Intra2) constraint. Lack of companionship constraint can also influence lack of skills constraints. Lack of skills can influence lack of interest (Intra1) and vice versa (i.e. bi-directional influence). As a whole, lack of companionship constraint is a strong net receiver constraint. Similar to lack of skills (Intra2) constraint, lack of interest (Intra1) is also a strong net receiver constraint but is slightly weaker because of its many bi-directional relationships with lack of time (Struc1), lack of companionship (Inter1), lack of skills and lack of

accomplishment (Intra3) constraints. As shown in Figure 2(b), two structural constraints, lack of information (Struc3) and lack of computer and other facilities (Struc4) influence perception of lack of interest constraint.

4.3 Discussion

Interpersonal constraints (3.18) are more prevalent in online game, follows by structural (2.92) and intrapersonal (2.89) constraints. Lack of time (3.48) and companionship (3.30) are the top two leisure constraints. This result is in line with many leisure constraint studies where lack of time often emerges as a highly common constraint. It also reflects the nature of online game as a social and maybe time consuming leisure activity, even to the point of addiction.

Unlike many leisure constraint studies where lack of money often appears as a top leisure constraint, it is not so for online game. Lack of money and skills have the least impact in this study. This outcome is partially contributed by the profile of respondents. Most of them are students; hence they often have the basic computer skills to engage in online games. Many of them also view online game as a relatively inexpensive leisure activity when compared to other activities such as traveling to touristic destinations or having a sumptuous meal at the restaurant. Some of the online games can be played for no cost.

According to the influence maps, lack of time (Struc1) as well as computer and other facilities (Struc4) are two strong net causer constraints. While having a direct influence on lack of skills constraint (Intra2), a closer look at Figure 1 and 2(b) further shows that these two structural constraints also exert their indirect influence on lack of skills constraint via the lack of interest (Intra1) and companionship (Inter1) constraints. Respondents feel that existence of these two structural constraints can contribute to lack of skills constraint since they don't have the appropriate equipment and time to practice. Furthermore, lack of engagement will lead to other players forsaking them and gradually causing players' loss of interest in online game. A managerial implication is while game developers may have less influence on the lack of time as well as computer and other facilities constraints, they must do everything within their means to lower these constraints since they are two top net causer constraints. The developers can alleviate these constraints by designing games which are less time-consuming and do not need special equipment.

Lack of interest (Intra1) constraint is a major top receiver constraint and is an outcome of many constraints. While lack of information (Struc3) as well as computer and other facilities (Struc4) contribute to lack of interest, another structural constraint, lack of time (Struc1) also contribute to lack of interest. Interestingly, lack of interest also contributes to perception of lack of time, hence justifying the often-heard argument that lack of time may just be a possible excuse for lack of interest. Lack of interest also has bi-directional relationship with lack of companionship (Inter1), skills (Intra2) and accomplishment (Intra3). The outcomes thus re-confirm game developers' need to provide games which do not need special or sophisticated equipments to boost market share. The developers can also boost the interest of the players. Games which need fewer co-players will definitely help as it can lead to more interest, which in turn make players feel that lack of companionship is not so much of a constraint. Providing information does help but marginally since players do not generally feel that lack of information is an important constraint.

This study adds to the existing theoretical knowledge of the concept of leisure constraints and the leisure constraint dimensionality issue. The results also suggest that DEMATEL method is a suitable tool to investigate and understand them by providing a mental map of the online game players which can be visualized. Using the context of online game, the DEMATEL results concur with the remark by Jackson and Scott (1999) that a common core of constraints tends to emerge. Hultsman (1995) has noted that constraints do not act alone; they may overlap in the mind of consumers. This study further shows that the overlap can be in the form of uni- and bi-relationship between the constraints. Besides interacting with one another within the same dimension, constraints may also interact with constraints from other dimensions. Hence, the three dimensions of constraints may not be viewed as distinct categories and this study supports the argument by Gilbert and Hudson (2000) as well as Scott & Munson (1994) of possible interactions between constraints. Davies and Prentice (1995) have argued that lack of interest is likely to be a rationalization of constraints. This study provides evidence for this remark.

As with any research, there are limitations to this study. Sample size is a limitation. The reason is DEMATEL survey is not easy to fill up and this study had to put a lot of effort to encourage participation. Despite the limitation, this study still provides useful contribution to the study of leisure constraints and leisure constraint dimensionality issue. It is suggested that larger sample size and a more diversified group of

respondents be used in future study. Earlier studies, such as Nyaupane et al. (2002) have shown that leisure constraints vary across leisure activities. Future research can include other types of leisure activities to obtain more generalized results. In-depth qualitative interviews with people engaging in leisure activities can also be conducted in the future to understand how they link various leisure constraints.

5. CONCLUSION

This study may be one of the few studies that apply the concept of leisure constraints to study the behavior of online game players. Using the Decision Making Trial and Evaluation Laboratory (DEMATEL) method and from the perspective of leisure constraints, this study showed that the importance of leisure constraints is dependent on the social and time-consuming nature of online games. Lack of time constraint as well as computer and other facilities constraint are two strong net causer constraints. Lack of interest constraint is a major receiver constraint and is influenced by many other leisure constraints. The results suggest that constraints may vary with leisure activities. The exploratory study showed that constraints may interact, sometime bi-directionally, with one another, hence providing further evidence on the intertwining relationship between leisure constraints. While this exploratory study provides some useful insights on leisure constraint dimensionality issue and shows the inter-linkage visually, more research should be pursued for this leisure constraint dimensionality issue. Two good starting points will be to extend this study to other leisure activities to generate more generalizable results and to engage in in-depth qualitative interviews with people engaging in leisure activities to understand how they link various leisure constraints mentally. These interviews will complement this quantitative study.

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IT SERVICE MANAGEMENT IN SMES: PREREQUISITE TO BENEFIT FROM RELIABLE AND FLEXIBLE INFORMATION SYSTEMS IN THE CLOUD

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ABSTRACT

Information processing is of high relevance for all industrial sectors and company sizes. Reliable and flexible Information Systems based on new Information Technologies and IT Services are needed to compete in today's Information Society. The currently observed trend back to more centralized IT delivery models, as currently discussed under the acronym "cloud computing", that supports a flexible and effective exchange and processing of information, is in its core principles nothing new and from a global perspective not even a challenge for the companies. But the use of cloud computing demands a high standardization of the existing IT and processes, which has to happen prior to the process towards the centralized IT service provisioning out of the cloud. It can be observed that there is a big difference considering the maturity of different company types with respect to the level of process and IT standardization. Whereas the large companies have a relatively structured IT and clearly defined processes, SMEs have not yet thoroughly reached that level. IT Service Management (ITSM) as concept to structure and standardize IT infrastructure and services can be seen as necessary prerequisite for SMEs to enter the world of cloud computing. Acknowledging the fact that cloud computing has not yet fully reached all industrial sectors and not all rather technological open issues have been solved (governance, security,...), there is a certain risk that SMEs, which are of high economic importance as they account for about 99% of enterprises and 60%-70% of employment, are not yet ready for standardization. One reason for this is that available ITSM frameworks, which would guide these organizations in structuring their IT, do not sufficiently address the specific requirements in terms of flexibility and complexity and thus seem to be much too heavy to be realistically adopted by SMEs. Empirical studies, conducted by the EU funded project INNOTRAIN IT, have clearly shown that there is still a big gap between knowledge on ITSM frameworks and their application in Central European SMEs. Therefore, within INNOTRAIN IT, a specific IT Service Management method derived from well-known ITSM frameworks (ITIL, COBIT, VAL-IT et c.) and adopted to the specific needs of SMEs has been developed. This method supports SMEs in standardizing their processes and IT to benefit from innovative information systems offered in the cloud.

KEYWORDS

Cloud Computing, Standardization, IT Service Management, SMEs, Innovation, Change management

1. INTRODUCTION

IT can be seen as a driver for global changes in society, not only on a private level (see Google, Facebook & Co.) but also on a business level. The intelligent use of Information Systems based on new information technologies has become a critical success factor for companies to enhance their competitiveness. Further, it can be clearly stated, that almost all companies use IT as a supporting concept to implement core business processes more effectively. This leads to a situation where companies become more and more dependent on information and their IT. Dynamic competition conditions, raising cost pressure and increasing customer needs force companies to continuously adapt their business – and that means their IT, too. [1]

In many sectors new information technologies initiate essential transformations and innovations. Information has taken the role of a core competence, especially in the service industry, and is an integral part of many products and services. Further, IT is no longer defined only by hardware and software, but as an essential supporting infrastructure for implementing core processes in a most efficient manner.

The reaction to specific demands of internal and external customers – like it was defined by Michael Porter in the context of strategic management as the so called "Market-based View" in the early 80s [2] – is not sufficient anymore. This leads to a situation where IT decision-makers have to proactively identify and

anticipate IT trends and map them to the core business processes of their organizations in a way that overall value creation and information process is optimized, which is mostly achieved by minimizing overall operational cost. This customer/process perspective is the key driving element of IT Service Management (ITSM), a discipline which has a niche existence in the current discussion w.r.t cloud computing. According to the ITSM philosophy the value created for internal and external customers is crucial for design, implementation and operation of IT services. Thus, IT can no longer only be seen from a functional perspective but serves as a strategic asset. IT decision-makers have to understand themselves as internal service provider with a direct impact on the added-value of the company. New information technologies should be understood as an integrated part of processes. ITSM helps companies to structure themselves, to standardize processes and to adapt the IT to the business processes in an optimal way. By this, financial and personnel resources can be saved that in turn can be invested in the development of process and product innovations. Furthermore, existing products and services can be innovated by the adding specific IT services.

Many SMEs have not yet realized their severe dependency on information and a standardized internal IT. Less than 10% of the nearly 200 SMEs that participated in an online survey of INNOTRAIN IT use ITSM though about 40% mentioned that they are aware of ITSM frameworks. This missing awareness regarding methods and frameworks to structure processes and IT can bring an SME into a certain risk situation. Technology can be relatively easy replaced, compared to non-documented and in-transparent IT processes. Thus, there is a strong need for SMEs to re-structure their internal IT service provisioning process pertinent to the importance of information and IT in their premises. Nevertheless these SMEs do face the challenge that most sectors are increasingly global and large companies dominate and give structure of value chains and operations. Especially SMEs addressing the global market have to be flexible, innovative and must provide an internal cost and information structure which allows them to prevail on the highly competitive market.

The rest of the paper is structured as following: Chapter 2 deals with the current role of IT in SMEs. Chapter 3 summarizes existing concepts and methods how to structure the IT and processes. Chapter 4 discusses why these available concepts and de-facto standards are not sufficiently applicable to the needs of SMEs. Chapter 5 presents the INNOTRAIN IT concept, both, a methodological framework for deploying structured IT Service Management processes derived from existing de-facto standards as well as a customized training concept fully adapted to SMEs needs. The paper finishes with a summary and conclusion given in chapter 6.

2. THE ROLE OF IT IN SMES

Usually, SMEs are slower in the adoption of new information technologies than larger enterprises in case IT is not considered as core business, but just as a tool to more efficiently implement core business processes. Whereas large companies have adopted the consistent use of information systems e.g. mobile applications, payment systems or cloud computing implementing the core processes, smaller companies of course use also IT but not in a strategic way. Most SMEs have not yet realized that the structured management and optimization of the IT is crucial for their competitiveness and innovation ability and thus their business success. Further, also in SMEs core processes are implemented in IT and thus, the reliable support of the core processes and the reliability of the IT infrastructure of these companies are fundamental. Any IT system deficiency can be life-threatening. Caused by the fact that e.g. automotive industry has adopted the just in time production principle, the importance of IT is continuously growing. In some of these organizations there is a situation reached, where a 36 hour failure of the IT system will lead to insolvency since neither products can be delivered nor billed.

Since IT has been in most organizations a “historically growing” service which smoothly gained importance, the perception of the IT with respect to the overall relevance of information for the organization is not adequate. As a consequence, SMEs management tends to avoid investments and changes in business models. Benefits must outweigh investment and maintenance costs. Further, barriers are the lack of IT skills and qualified personnel as well as high costs and little trust in the security and reliability of IT systems [4]. SMEs are often not aware of the business impact IT can offer them as well as the risk a failure could cause.

Usually, only a few employees are responsible for the administration of the IT infrastructure in SMEs – often not even qualified IT experts. IT is seen from a functional perspective and is considered within the organization as a pure cost factor with a focus on providing hardware and software only. Since the IT

delivery in SMEs is shouldered by a few persons operating along non standardized and not documented overall IT processes, these few administrators became a bottleneck of the overall IT service and thus, a significant risk for the whole organization.

Whereas the current arguments have been rather technical, a further, less technical, but rather psychological aspect has to be added to the discussion. Standardization can be identified a key requirement to dive into a mass production system, which allows exploitation of economy of scale effects and thus leads to a cost reduction, which in turn increases the competitiveness in a global market. Whereas this positive effect is widely accepted, standardization has also a second, from a psychological perspective less convincing aspects, which is that of transparency. Transparency is usually achieved by a systematic documentation, which in turn severely reduces the level of dependability since a replacement of a highly skilled technician by another one could be managed. Since transparency usually results in a higher level of control, standardization automatically leads to a situation where IT administrator will be from a sociological point of view downgraded to a less exposed position within the organization. Since this is not always in the interest of people and any kind of further automation is potentially jeopardizing the jobs of IT administrators it is almost understandable that the introduction of ITSM is not only a technical challenge.

3. STATE OF THE ART – IT SERVICE MANAGEMENT FRAMEWORKS

IT Service Management is of high relevance for many companies – otherwise there would not exist so many different frameworks. There exist various internationally recognized standards, frameworks and tools providing guidelines and best practices how to structure and optimize IT processes, e.g. ITIL (IT Infrastructure Library) [3], COBIT (Control Objectives for Information and Related Technology) [6], VAL-IT (Value of IT) [7] and BSI Standards [8]. They can be divided in to strategic, tactical, operational frameworks and standards. The different frameworks can be seen as “cookbooks”, including recipes for building and coordinating the IT activities in line with the business activities. Their use depends on the industry, legal requirements or the company size. As it would exceed the scope of this paper to describe all existing ITSM frameworks in detail the following paragraphs will focus on the best known and most relevant – from the authors’ perspective – frameworks.

The strategic framework VAL-IT, maintained by the independent IT Governance Institute, is an extension of COBIT, which is described in the next section. VAL-IT serves as a pragmatic organizing framework that enables the creation of business value from IT-enabled investments. It supports the executive management in optimizing the realization of value from IT investments – that means it helps companies to understand if they make the right investments by providing specific questions that have to be answered by the IT and the business decision-makers.

The tactical framework COBIT (Control Objectives for Information and Related Technology) deals with IT governance and information systems audit and provides definition and measurement tools for assessing IT related organizational control objectives. The tasks of IT are spread into processes and control objectives and the framework is often used in the context of IT compliance. COBIT is designed to provide effectiveness and efficiency while mitigating the risks connected with the use of IT based solutions and is fully process-oriented and measurement driven. The COBIT structure provides a definition and measurement tools for assessing IT related organizational control objectives and is structured in to several layers. On its highest level, COBIT constitutes a three-dimensional structure consisting of:

- (1) Business requirements (information criteria): effectiveness, efficiency, confidentiality, integrity, availability, compliance and reliability,
- (2) IT resources: applications, information, infrastructure, people and
- (3) IT processes (structured into domains, processes and people.

In the early 80s the operational framework IT Infrastructure Library (ITIL) [3] has been developed by the UK Office of Government Commerce, a UK non-profit organization. ITIL has been continuously enhanced and can be considered as framework supporting the process of standardization on the IT Service Operation level. ITIL has the status of a de-facto standard as it is used by the majority of companies implementing IT Service Management. It describes Best Practices in IT Service Management and focuses on the definition and the continuous improvement of the quality of IT services [5]. ITIL describes the overall organizational process of IT Service management grouped into 5 core processes, which in turn are composed by several sub-

processes which allow an IT responsible to define a strategy, to design a service portfolio out of the strategy, to transfer this design into operation and to operate the designed solution. Further a continuous service improvement is foreseen. ITIL is in its version 3 available and has reached a complexity, which makes the library for the rather small organizations less and less attractive.

ITILite [9] is an adapted version of ITIL V3 dealing with a full or partial ITIL implementation. ITILite is aimed at encouraging organizations to adopt ITIL V3 by selecting and implementing key ITIL V3 components.

The TM Forum (TMF) [10] has developed several standards – such as eTOM or SID – that provide blueprints for effective business and service operations. The Business Process Framework eTOM provides guidelines and standard process flows for the key business processes of service providers. The Information Framework (SID) offers a common information model, reducing complexity and allowing for the definition of standardized integration points.

Companies do face the challenge to understand the diversity of existing ITSM frameworks and to select the appropriate one. Furthermore, most frameworks show a high level of formalism and complexity. For this, an adopt and adapt approach – meaning to own a framework and make it suitable for the specific requirements and situations of the company – could make absolutely sense.

4. CHALLENGES DEPLOYING IT SERVICE MANAGEMENT IN SMES

Scientific publications about IT Service Management in SMEs are hard to find. Of course, different authors dealt with the adoption of information technology in SMEs in general, but the specific benefit and approach of standardization and strategic IT and business alignment has not yet been explored in detail. Reason of this might be the fact that the discipline of IT Service Management collects rather best practices on a very generic level without having methods and concepts available to justify the defined best practices both, qualitatively as well as quantitatively.

In discussions with SMEs it became obvious that there is a big gap between large and smaller companies regarding the knowledge about ITSM and its implementation. The above mentioned frameworks are known in half of the companies [11] but they are only used by less than 10%. IT Service Management is seen as a topic for larger companies. Based on literature review, classical survey, detailed case studies, interviews and discussion rounds the following barriers were identified hindering SMEs firstly to deal with IT Service Management and secondly to start to implement and continuously practice IT Service Management [12]:

- Missing IT Awareness
- Complexity of Existing Frameworks
- Lack of Skills
- Work Overload and Lack of Resources
- Missing training modules for SMEs

The complexity of the existing ITSM frameworks can be seen as the core barrier with a direct impact on the other recognized barriers. Therefore it will be discussed in more detail in the following paragraph.

All described ITSM frameworks are very powerful but they are all missing one important topic for SMEs: the philosophy and the implementation of ITSM. The existing frameworks describe what companies should do to optimize their IT investments, to check the IT governance and to define and manage IT services effectively but they do not describe why and how companies should implement ITSM. The relation between standardized and documented IT and processes and the use of ITSM should be mentioned, that the notion “implement ITSM” is a rather imprecise one since the level of patency as well as the level of detail in each specific sub-discipline are key questions. Further, it can be seen as a great barrier that most frameworks show a high level of formalism and complexity. IT decision-makers fear that such frameworks produce an enormous administrative and documentary overhead, comparable to the effort they face regarding compliance issues.

To make these frameworks suitable for the specific requirements and situations of the SMEs is absolutely necessary. It can be clearly stated that it is necessary to raise awareness for the potentials of ITSM, to qualify SMEs to use ITSM and to adapt the existing frameworks. By this, SMEs will be enabled to standardize their IT and processes and to enter Information Systems offered in the cloud.

5. THE INNOTRAIN IT APPROACH

The INNOTRAIN IT approach addresses the above mentioned barriers hindering SMEs to use IT Service Management by focusing on two principles: Awareness and simplification. The approach can be divided into five steps.

5.1 Step 1: Research and Analysis including Systematization of existing ITSM Frameworks

As existing literature does not provide enough data to analyze the current situation of the use of ITSM in SMEs, own research activities had to be conducted. The research model is based on three pillars: existing literature, empirical study with about 200 participants and more than 20 case studies. The research activities were conducted in six European countries, namely Austria, Czech Republic, Germany, Hungary, Poland and Slovakia.

Based on the findings of the analysis of the existing ITSM literature an electronic survey was set up in the mother tongue of all participating countries. With about 200 participating companies an average feedback rate of 4% was achieved. For the data analysis different methods were used including descriptive, quantitative statistics as well as multivariate statistics like a regression analysis.

The main survey results are the following [11]:

- There is still a big gap between the knowledge on ITSM and its application in European SMEs. About 40% are aware of existing frameworks like ITIL and COBIT but less than 10% are already using these methods. This clearly shows that SMEs are not ready yet to benefit from new and innovative information systems and technologies offered in the cloud due to the lack of structured and strategic planning and management of their IT.

- The introduction and effective use of ITSM can lead to an increase of productivity of 20-40%
- Saved financial and personnel resources due to the implementation of ITSM are often not invested in the development of process and product innovations.

- There exist differences regarding the ITSM adoption of SMEs in the six participating regions.

As mentioned before additionally to the online survey more than 20 case studies were created analyzing the challenges and success factors of implementing ITSM in SMEs. The cases include the current situation, the problem and the specific solution and give answers to the 'how' and 'why' questions in a real-life context from the perspective of the company. They serve as Best Practice examples and references for SMEs in other regions and industries.

The above described research regarding the status quo of ITSM adoption in SMEs was accompanied by a systematic analysis of the existing ITSM frameworks, methods and standards based on the following research questions: What frameworks, methods and standards do exist? How can they be categorized? Are they applicable for SMEs? What elements are relevant for SMEs (cf. chapter 3)?

5.2 Step 3: Simplified ITSM Method and Modeling Tool

The short description of some of the most ITSM tools in chapter 3 shows that it makes no sense to insist on a single framework. On the contrary, it is more useful to define a creative integration of two or more frameworks and to use the advantages of the different frameworks. Such a best of breed approach is already often used in IT (for system architecture) and is therefore well known. The following facts can be stated:

- The creation of a new framework does not make much sense because of the huge amount of existing and already introduced frameworks.

- The simplification of one or more frameworks for specific needs could be an option to reduce the complexity of existing frameworks and to eliminate such barriers.

- It is possible to combine different frameworks, but then an implementation guide and a kind of catalogue of the different frameworks and their patterns is required.

- The vocabulary of different frameworks must be considered – some terms are similar between frameworks, other terms have different meanings.

• Standards like ISO 20000 can be a valid source for information, but certification is too much effort for most SMEs. For service providers certification might be a good instrument to show the quality of their own service.

Based on the results of the systematization a specific simplified ITSM method was developed that includes all necessary steps to implement and operate ITSM tailored to the identified needs of SMEs.

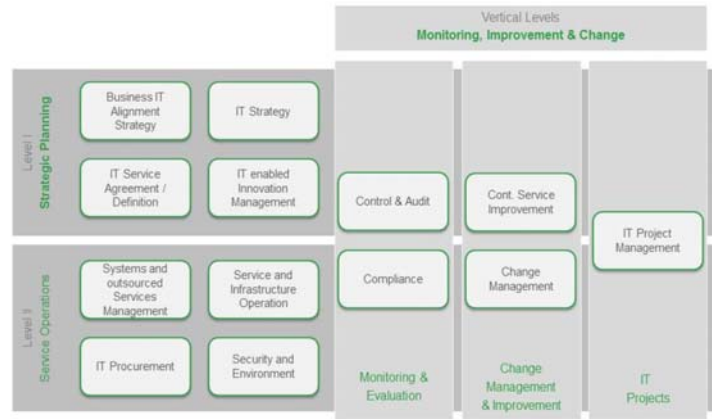


Figure 1. Simplified ITSM method

It is important to state, that the INNOTRAIN IT method does not represent a new framework but a kind of navigator for SMEs. It explains ITSM in a simple and neutral way, clarifies the philosophy of ITSM and includes a guideline how to start implementing ITSM. The method consists of three parts: Strategic Planning, Service Operations and Monitoring & Controlling. It deals with topics like the definition of an IT strategy and of IT services, data security, IT project management, etc. Of course, the method is upwards compatible to ITIL and COBIT to guarantee flexibility for SMEs to migrate to a larger framework when their companies grow. [12] A clear understanding of the internal processes is necessary for the analysis and standardization and thus the optimization of the IT infrastructure and services. Therefore, the INNOTRAIN IT method is supported by a specific modeling tool. This tool is based on the existing modeling tool ADOit. Its structure and functions were reduced and adapted to the relevant processes in SMEs. The modeling tool offers the possibility to document and link business and IT process and allows a transparency regarding dependencies, costs and duration of IT and business processes.

5.3 Step 4: ITSM Trainings for SMEs

As it is stated in the paper "ICT, E-Business and SMEs" of the OECD (Organisation for Economic Co-operation and Development) lack of ICT skills are widespread barriers for the effective uptake of new information technologies. Providing ICT skills is regarded as a major task and responsibility of the government.

IT Service Management is of course a complex topic, even for larger enterprises. Most SMEs do not have access to IT expert knowledge, IT topics and terms are like a foreign language for them. Smaller and medium-sized businesses need a specific guidance to orient them in the "IT-jungle". There already exist ITSM trainings, especially for the framework ITIL. Based on own experiences it can be clearly stated, that these trainings are not applicable for SMEs. The focus of these trainings is to memorize a high amount of IT definitions in a short period of time. There is no space to talk about the practical implementation of ITSM frameworks and methods. Another barrier is the time factor: for most SMEs it is not possible to spend 3-4 days for training.

SMEs need specific trainings that focus on the practical use of ITSM. It is necessary to show understandable practical examples, to interact and to discuss the presented topics as SMEs are not used to learn theory. Further, SMEs trust most in experiences of other SMEs of the same size or industry.

The INNOTRAIN IT approach includes a specific ITSM training concept with a modular structure based on experience-based learning. In face-to-face-trainings the basic concept and philosophy of ITSM is toughed.

The aim is to make SMEs aware of the importance of a reliable IT for their business, no matter whether they are from the production sector, the service sector or the crafts sector. The main focus is on the provision of basic ITSM knowledge that means relevant IT processes and structures every company should implement to guarantee an effective IT. The trainings further impart the close relation between using ITSM and benefiting from new and innovative IT services offered in the cloud.

To stabilize the gained knowledge an online training platform is offered. The participants get access to detailed information regarding the ITSM method, reference processes and best practice examples, self-assessments and e-Learning modules.

5.4 Step 5: Change Management and Innovation Management

Implementing ITSM means changing tasks, processes and organizational structures and that has to be done very carefully. In discussion with SMEs it becomes clear that the technical change of existing IT infrastructure is not the problem. The biggest challenge is to involve the affected people. The human factor can be seen as the most critical success factor of the adaption and optimization of IT solutions and services.

This topic is not yet addressed in existing ITSM frameworks or seminars. Therefore a special training module was developed, showing SMEs how to organizationally implement ITSM and how to deal with emotions and resistance.

The long-term aim of the INNOTRAIN IT approach is to convince SMEs to invest saved financial and personnel resources due to the implementation of ITSM in the development of innovation. SMEs should not only be satisfied with the cost savings. A structured innovation management is needed to further develop existing business models, to open up new attractive markets and to secure the competitiveness.

6. CONCLUSION

The role of ITSM within the current cloud discussion is twofold. First, any kind of outsourcing/outtasking requires the precise definition of the internal structure, which is finally the key factor influencing the overall success of the outsourcing task. This is an aspect, which is from a formal perspective not cloud-specific, but highly relevant within the cloud discussion. Further, it enforces and triggers a kind of standardization process in the area of IT operations in a way that economy of scale effects can also be offered. This in turn requires a high level of standardization in several aspects. ITSM can be considered as currently very promising concept for achieving the required level of standardization in the area of IT operations. The key questions following these generic lines lie in the “how” and “to what extent” questions, which are partly addressed within INNOTRAIN IT in a way that especially SMEs are supported.

The statements in this paper show that there is strong need for SMEs to start thinking about the topic ITSM on the one hand and the development of SME adequate tools, methods and training concepts on the other hand. The simplified ITSM method and modeling tool in combination with training concept provide valuable methods and tools that can be applied easily by most SMEs and should enable them to foster innovation and gain competitive advantages.

The INNOTRAIN IT approach has done a first step and will serve as a basis for further developments in this field. Nevertheless specific service and cloud computing concepts for the small enterprises are still missing. The existing ITSM solutions and services are – though they are meant to address SMEs – often still too complex and too powerful. To offer SMEs an access to the world of IT services and cloud computing the IT service providers should review their portfolio and a close discussion of IT suppliers and small and medium IT users has to be enforced.

ACKNOWLEDGEMENT

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A NEW PERSONALIZED APPROACH IN AFFILIATE MARKETING

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ABSTRACT

Affiliate Marketing is the process of generating revenue by making referrals online and has become the most popular and cost-effective technique to market product in a fast and effective manner. In this paper we propose a personalized concept in affiliate marketing by observing the interdependent relationship between a merchant (an advertiser) and an affiliate (a publisher) and performing implicit clustering on the basis of high similarity index between affiliates (advertisers) associated with their publisher. We achieve this by observing the common characteristics between the source and the destination referrals and comparing the most effective attributes of the user profiles. On the basis of similarity between the parent and child referral we perform an implicit clustering process and calculate conditional probability from similarity between the parent and child referral in each cluster to give the best recommendation to the future coming referral. To conduct this experiment we develop a simulation using a randomization algorithm in which we showed the simulation of 1 to 100 users registered on an affiliate site and after that we check the commonalities between these users by randomly linking attributes with each user and building parent-child affiliate relationship to calculate the probability from the similarity index and on the basis of results a proposed recommendation to the future coming referrals is given in an affiliate network.

KEYWORDS

Affiliate Marketing, Web Personalization, Publisher, Advertiser

1. INTRODUCTION

Affiliate Marketing has become very popular and cost-effective technique to market products in a fast and effective manner. There are different ways of earning online which primarily includes product-based earning and service-based earning. Apart from these one more way of earning online is through affiliate marketing (Brown, 2009). Affiliate Marketing is the process of generating revenue by making referrals online and its impact on ecommerce strategies (Duffy, 2005). There are various models in affiliate marketing being used on the internet such as percentage of sales model, pay per lead model, flat referral rate model, pay per email model, cost per view model and cost per click model (Bandyopadhyay, Wolfe and Kini, 2009) each with their own way of generating revenue online. Affiliate Marketing is an approach in which a company (a publisher) hires an affiliate (an advertiser) by signing a contract to feature a link on its affiliated site. The basic objective is to sell products by generating traffic to the publisher's site and in this way the affiliates can get commission for each sale produced if the backlink comes from his/her site. (Del Franco & Miller, 2003; Goff, 2006; Goldschmidt, Junghagen, & Harris, 2003; Haig, 2001; Tweny, 1999). On the other hand the concept of web personalization is becoming more pervasive allowing a user to see his/her personalized choice of data very easily on the internet (Mulvenna, Anand and Buchner, 2000). The key concept of web personalization is achieved by three major types of filtration techniques, namely Collaborative Filtration Technique (Konstan, A. J., Miller, N. B., Maltz, D., 1997; Shardanand & P. Maes 1995), Content Based Filtration Technique (Joachim, 1997) and Decision Rule-Based Filtration Technique such as Broadvision (www.broadvision.com). In this paper we have used the concept of Web Personalization (Lieberman & Letizia, 1995) to improve affiliate marketing by performing clustering of data on the basis of user profiles stored in the web logs.

2. LITERATURE REVIEW

One of the pioneer companies that proposed the concept of affiliate marketing is Amazon headed by Jeff Bezos, to introduce this dynamic concept of n-tier referral marketing on the web. Since then the concept of affiliate marketing has gained popularity. Many online merchants have adopted this technique of marketing to generate more revenue and to do more business online (Dysart 2002; Fox 2000; Oberndorf 1999). The basic pricing concepts of affiliate marketing in which the affiliates (publisher) are hired by an advertiser (a merchant) on a commission basis have been implemented in more than one way by more than one company on the internet. The most frequent pricing models of affiliate marketing used in the internet are the cost per click model and cost per sale model (Libai, 2003). Many individuals on the internet have generated a lot of money through affiliate marketing (Chia, 2008) and more recently the term affiliate network's has emerged as affiliate marketing has been so much misused that the reliability level from both the publisher and advertiser was becoming significantly reduced (Samosseiko, 2009). The four major affiliate networks established over time, namely 1) LinkShare 2) Commission Junction 3) Performics and 4) Be Free have been trying to make this concept more professional and efficient by inviting the publisher (affiliate) and advertiser (Merchant) to register together on the same platform so that they can best benefit from each other's capabilities. These organisations are trying to make affiliate marketing more organized and systematic compared to previous methods of disorganized and bogus approaches to affiliate marketing (Samosseiko, 2009).

The concept of web personalization has evolved by taking into account the user's navigation through a website and this goal was first achieved by using a client-side agent that recorded the user's behaviour and providing useful recommendations to the users (Lieberman & Letizia, 1995). Many researchers have contributed to enhancing this concept (Albanese, Picariello, Sansone & Sansone, 2004; Sah, Hall and d De Roure, 2010). Several clustering algorithms have been proposed for web personalization (Wei, Sen, Yuan & Lian-Chang, 2009) to perform grouping of data on the basis of web usage data and web user's logs.

Web usage mining is also another intelligent method for understanding the behaviour of the web user and recording it on both the server and client-side and then using various data mining techniques to extract useful information from the overall web data (Srivastava, Cooley, Deshpande & Tan, 2000). It has always been a way of performing intelligent marketing on the internet on the basis of web usage data and web logs (Buchner, Anand, Mulvenna & Hughes, 1998).

3. DESCRIPTION

The concept of affiliate marketing is to some extent formulized with the help of popular affiliate networks but still there is a significant gap between a publisher and an advertiser that need to be reduced to increase the decision-making ratio between the publisher and an advertiser to help both sides. The advertiser should be able to select the best publisher to market his/her product and to generate maximum revenue for him and the publisher as well. In order to reduce this gap we have conducted an experiment in which we have designed a small simulation in C# showing the first step towards intelligent working of affiliate networking sites by comparing the user profile information of an advertiser and the publisher shown in Figure 5. and Figure 6. The randomization function (Sestoft, 2006) is used to generate a random list of users and then to randomly function to dynamically allocate these users to the equally generated clusters w.r.t to the total number of the registered users as shown in Figure 1. The reason for choosing randomization function is to check the relationship between an advertiser and a publisher in a random fashion so that we can test the effectiveness of commonalities that normally exist between these two actors in all possible ways. Before providing the detailed description the basic steps that are involved in this experiment are mentioned below.

- 1) Random users with random associated attributes are generated
- 2) Random relationships as a publisher->advertiser (vice versa) between the users are created.
- 3) Similarity index with respect to the common attributes between the random relationships are generated.
- 4) On the basis of similarity index, the probability of similarity is calculated for each random relationship.
- 5) The probability of similarity for each incoming referral with all the registered users (publisher or advertiser) are calculated to recommend the best-fit user (publisher or advertiser).

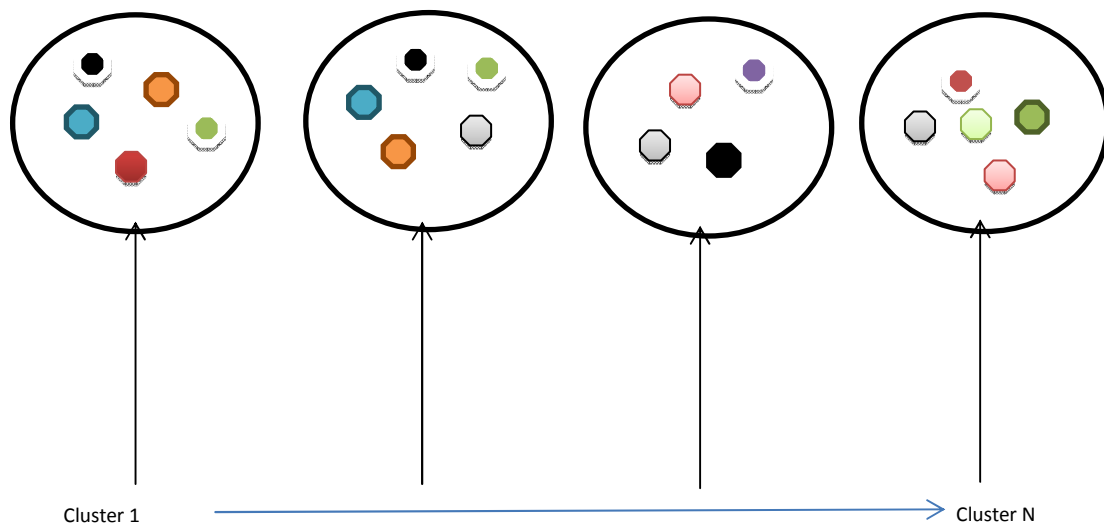


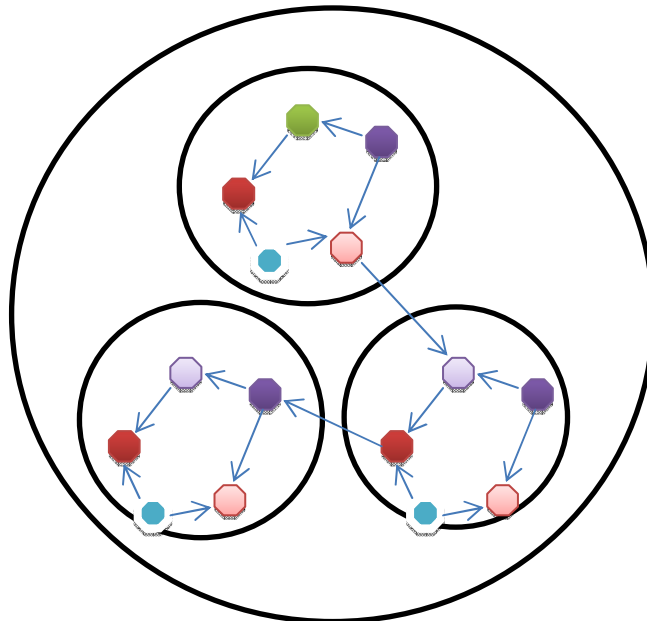
Figure 1. Random Clustering of Users

Three parameters are taken as an input into the system which includes 1) No. of registered users 2) Maximum referrals for one user and 3) Total no. of Proposed Clusters. Let $X_1 \dots X_n$ be the total number of registered users and $C_1 \dots C_n$ be the total number of clusters then $C_1 \rightarrow C_n = \text{rand}(X_1 \dots X_n)$ and k is the total no. of proposed clusters.

$$\sum_{k=1}^N \text{count}(X)/k \leftrightarrow \text{count}(X)/k = 0$$

$$\sum_{k=1}^N \text{count}(X)/k + 1 \leftrightarrow \text{count}(X)/k < 0$$

Will be the total number of clusters. The system assumes some of the users are publisher and some of them are advertisers and randomly generates parent \rightarrow child relationships among all the users as an advertiser \rightarrow publisher relationship as shown in Figure 2.

Figure 2. Advertiser \rightarrow Publisher Relationship

Let $A_1 \rightarrow A_n$ be the advertisers and $P_1 \rightarrow P_n$ be the publishers then

$$A_n \rightarrow P_n = \sum_{c=1}^N \text{rand}(U_1 \rightarrow U_n)$$

Every user in a cluster has an associated number of attributes, which he/she will provide while subscribing to an affiliate network. Some of the attributes like name and title will not portray the nature of the user. In order to understand the nature of the user more impactful attributes are taken that will provide an insight about the nature of the user after further research. These attributes were selected by analyzing many of the affiliate networks here in the UK and taking the most common and effective attributes that we thought would play a vital role in our research. For this purpose of the experiment we restrict each attribute to five values:-

- 1) Profession (Music, Entertainment, Sports, Teaching, Engineer, Business)
- 2) Interest (Reading, Listening, Playing, Writing, Internet, Disco)
- 3) Marketing Method (Email, Linkout, Network, Radio, TV, Banner)
- 4) Geographic Locations(USA, Canada, Europe, Australia, UK, Asia)
- 5) Secret Questions(Anniversary, Father's M.Name, Favorite Movie, Favourite Pet's Name, Favourite Sport's Name, Spouse Middle Name)
- 6) Language(Urdu, English, French, Spanish, Italian, Danish)
- 7) Sold in Past(No Product, Sports, Food, Jewelry, Shoes, Garments)
- 8) Marketing Preference(Email, HTML, Plain Text, Phone, Mail, Mobile)
- 9) Advertiser(US Network, UK Network, Canada Network, EU Network, Asia Network, Africa Network)
- 10) Nature of Website(Food Website, Music Website, Entertainment Website, Fiction Website, Books Website)

Each user will definitely have at least one value for each of the attributes mentioned above registered with the affiliate network as shown in Figure 3.

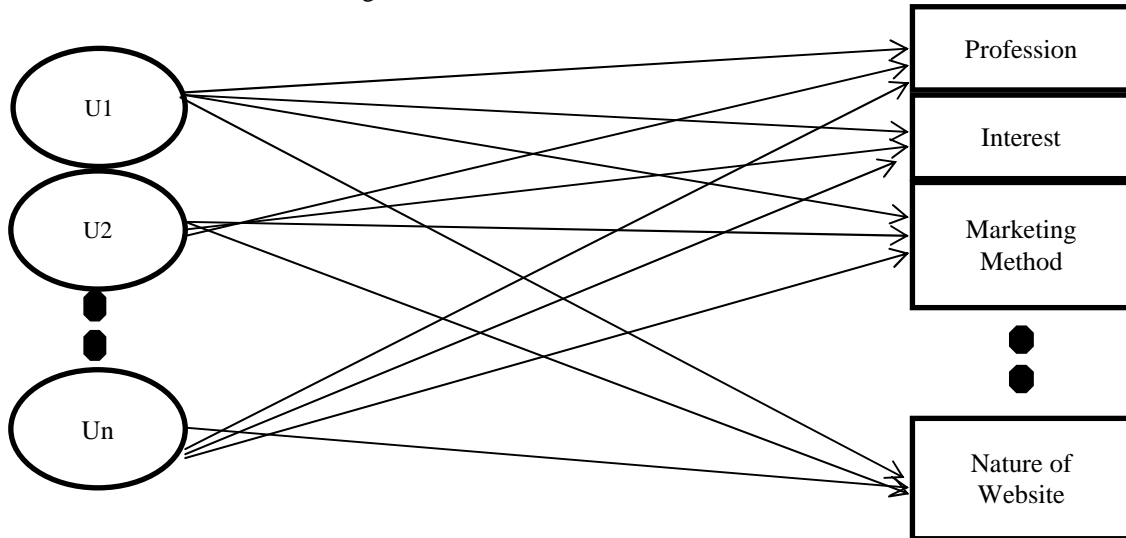


Figure 3. User Characteristics Association

The similarity index between the randomly generated Advertiser \rightarrow Publisher relationships on the basis of commonalities with respect to the above mentioned ten attributes are graphically shown in Figure 4.



Figure 4. Graph for Similarity Index

The above result shows that the commonalities between Advertiser→Publisher relationship lies most frequently between 2 to 6 whereas the similarity index below 2 is very low as is the similarity index above 6. Due to the existence of a similarity index between the currently registered users acting as publisher and advertiser the high commonality shows the greater compatibility between these two actors and will support the following statement

“THE HIGHER THE COMPATIBILITY BETWEEN THE PUBLISHER AND THE ADVERTISER THE GREATER WOULD BE THE CHANCES FOR SUCCESS” (Wu, 2011)

This similarity index will be used to recommend the relationship for the most preferred publisher with the advertiser where the probability from similarity (Blok, Medin and Osherson, 2002) is higher for the upcoming publishers and advertisers.

$$Prob(Advertiser/Publisher) = P(Advertiser)^{\alpha}$$

$$\text{Where } \alpha = [1 - sim(Advert., Pub.)/1 + sim(Advert., Pub.)]^{1-P(Pub.)}$$

On deriving the conditional probability on the basis of similarity index a recommendation can be made to customers (Publishers) to make those referrals (Affiliates) where the probability of similarity is greater and definitely where the compatibility level between them will be higher which will result in the maximum sale of the publisher's product or service and in this way increasing the chances of success.

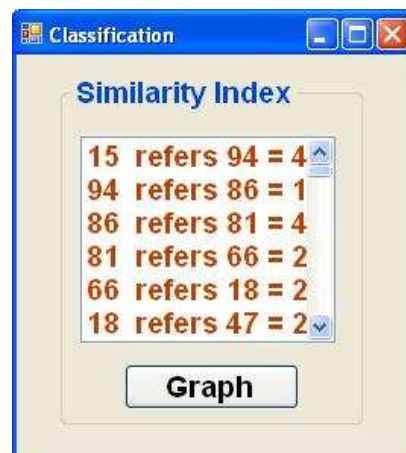


Figure 5. Snapshot 1

Randomization

Exit No. of Users: 100 Press For Randomization

Maximum Referrals for one User: 4

Total Proposed Clusters: 2

| Profession | Interest | Marketing Method | Geographic Locations | Secret Questions |
|------------|-------------|------------------|----------------------|--------------------------|
| Music 0 | Reading 0 | Email 0 | USA 0 | Anniversary 0 |
| Entern. 1 | Listening 1 | Linkout 1 | Canada 1 | Father's M. Name 1 |
| Sports 2 | Playing 2 | Network 2 | Europe 2 | Favourite Movie 2 |
| Teaching 3 | Writing 3 | Radio 3 | Australia 3 | Favourite Pet's Name 3 |
| Engineer 4 | Internet 4 | TV 4 | UK 4 | Favourite Sport's Name 4 |
| Business 5 | Disco 5 | Banner 5 | Asia 5 | Spouse Middle Name 5 |

| Language | Sold in Past | Marketing Preference | Advertiser | Nature of Website |
|-----------|--------------|----------------------|------------|-------------------|
| Urdu 0 | No Product 0 | Email 0 | US 0 | Food 0 |
| English 1 | Sports 1 | HTML 1 | UK 1 | Music 1 |
| French 2 | Food 2 | Plain Text | Canada 2 | Enter. 2 |
| Spanish 3 | Jewellery 3 | Phone 3 | EU 3 | Friction 3 |
| Italian 4 | Shoes 4 | Mail 4 | Asia 4 | Electron 4 |
| Danish 5 | Garments 5 | Mobile 5 | Africa 5 | Books 5 |

Similarity Index

Randomization

List of Random Users:

User15
User94
User86
User81
User66
User18
User47
User71
User79
User63
User84

No. of Clusters:

Cluster 1
User15
User94
User86
User81
User66
User18
User47
User71
User79
User63

Random Referrals:

15 refers 94
94 refers 86
86 refers 81
81 refers 66
66 refers 18
18 refers 47
47 refers 71
71 refers 79
79 refers 63
63 refers 84
84 refers 27

Combination

| | | | | | | | | | | |
|--------|---|---|---|---|---|---|---|---|---|---|
| User15 | 4 | 3 | 4 | 3 | 4 | 1 | 3 | 1 | 2 | 3 |
| User94 | 3 | 3 | 1 | 3 | 4 | 2 | 2 | 1 | 1 | 3 |
| User86 | 4 | 1 | 4 | 3 | 4 | 3 | 4 | 2 | 2 | 2 |
| User81 | 4 | 1 | 4 | 4 | 2 | 4 | 2 | 2 | 2 | 1 |
| User66 | 4 | 3 | 3 | 3 | 3 | 2 | 3 | 3 | 3 | 1 |

Figure 6. Snapshot 2

4. CONCLUSION

The above described experiment shows that the higher the probability of similarity between the Publisher and Advertiser the greater would be the chances of success and this is one contribution towards the intelligent approach in reducing the gap between an advertiser and the publisher. User profiles play a very important role in understanding the nature of the actor and by observing the behavioural relationship between the publisher and advertiser through their stored attributes we have devised a way to give personalized recommendations to the future users who will register themselves as an advertiser or a publisher in these affiliate networks.

In future, intelligent AI and searching algorithms will be used to further reduce the gap between the publisher and an advertiser through which a solution will be reached where the publisher will be recommended the best-fit advertiser and the advertiser will be recommended the best-fit publisher. Live data from affiliate marketing companies will be used to evaluate the algorithms.

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NATIONAL INTERNET OR A CENSORED PUBLIC CLOUD?

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ABSTRACT

Information and Communication Technology (ICT) has changed the landscape of communication among citizens and the way organizations communicate and conduct business. It has also assisted the public sector more effective and efficient ways to deliver services to citizens in form of e-government settings as well as the construction and formation of smart cities. In short, ICTs dramatically changed all aspects of today's human life and lifestyles. The recent notion of cloud computing is claimed to offer promising opportunities for service delivery to organizations and communities in sharing the computing power, storage and network infrastructure in a more effective and efficient manner. Cloud computing involves also many other issues and concerns, including the security concerns associated with the use of shared resources, the embedded control and monitoring systems, the physical storage location and management as well as the tools and services that otherwise may offer governments in non-democratic countries the ability to impose a more restrictive Internet access.

This study critically investigates the recent controversial national Internet introduced by Iran. It argues that the national Internet, in essence, is a public controlled cloud to restrict citizens' access to free information available on the Net and therefore should be viewed as an intensified Internet content and filtering method, exercised by elites in power.

KEYWORDS

Actor Network Theory, Cloud Computing, Halal Internet, Web 2.0, Virtualization

1. INTRODUCTION

Since 1995, the birth of the Internet in the Islamic Middle East region, the number of Internet users has grown drastically. According to ITU (2009) data set, the total number of Internet users in Iran was estimated slightly above 26,000, this value has increased to the remarkable value of 23 million at the end of 2008 and continued to grow to 36.5 million users at the end of 1995, according to WorldStats (2011). In this context Iran had the fastest growing Internet users in the Middle East. As a consequence, Iran was witness to a major increase in the number of Farsi blogs and citizens' participation in various social networking and content sharing sites such as Facebook, Twitter and YouTube.

Hundreds of thousands of bloggers, internet users, mainly the younger generation, have created a magnificent interconnected webs of digital communities for various forums and group discussions, including citizen-to-citizen interaction, participate in communication discourse, demanding a better and fair social and political life. Currently there are more than 65,000 active bloggers (Kelly and Etling, 2008) making the Farsi blogosphere the largest in the Middle East. In addition, the number of Iranians active in social networking sites such as Facebook exceeded 17 million users (The Guardian, 2012). In other words the Iranian digital community has become an integral part of the so-called 'the networked society' in 'the information age' (Castells, 2000a, 2000b). In this context the digital community of Iran was very effective in sharing information and knowledge and disseminating opinions suggestions, comments, ideas and thoughts about the matters of concerns, otherwise unavailable in traditional media. From the social science perspectives the digital community of Iran was a successful example in the Middle East of promoting communication discourse and providing a voice to voiceless, by distinguishing itself from the hegemonistic and ideological perspectives of the dominant power, offered by the traditional media. Some of the grassroots journalists became also the opinion makers, organizers and mobilizers of major events initiated online, with the ultimate goal of changing the hostile and oppressive physical structures of Iran. This is aligned with what van Dijk's

(1997) named “virtuality”, a phenomenon that will help the physical social life in a fruitful and optimistic ways. The active enrollment of the Iranian digital community to disseminate information through new media, engaging in public discourse, and mobilizing public action and street demonstrations, aftermath disputed 2009 presidential election is well documented and reported by many international news agencies as well as scholarly researches.

However, the intensity of Internet content filtering has also increased proportionally with the increased number of Internet users and online activities according to the reports published by Freedom House (2010), Reporters Without Borders (RWB, 2010) and the OpenNet Initiative (ONI, 2009).

The aim of this study is to critically investigate the intention of national Internet introduced by some of the governments in the Middle East, particularly in Iran, to better understand the underlying ideological connection between the private Internet and the imposed restrictions on freedom of expression.

The rest of paper is organized as follows: section 2 discusses the media structure of Iran; section 3 presents the theoretical basis of this study; section 4 reviews the planned private Internet in Iran and finally section 5 concludes the paper.

2. IRAN’S MEDIA AND POLITICAL STRUCTURES

Iran is the largest populated country in the Persian Gulf region. Table 1 shows demographic data with regards to its population, life expectancy (LE), adult literacy rate (ALE), GDP per capita in US dollars, the level of human development (HDI) and the existence of gender inequality (GI). It also shows the country’s global ranking scores with regards to its media freedom (MF) among 175 nations as well as its level of political and economic corruption (CPI) in comparison with 166 other nations. Among the developing countries Iran has a promising number of Internet and mobile users but unfortunately its Internet connectivity is the least developed when it comes to upload and download speed. For example, Iran’s global rankings in Internet speed is placed at 161st among 166 economies according to Netindex (2011).

Table 1. Demographic Data

| Country | Land (mil. Sq. km) | Population (mil.) | LE | ALR | GDPP (US\$) | GI | HDI rank | MF rank | CPI rank | Internet speed rank | Internet | Mobile |
|---------|--------------------|-------------------|------|------|-------------|------|----------|---------|----------|---------------------|----------|--------|
| Iran | 1.648 | 74.2 | 71.9 | 82.3 | 4682 | High | 70 | 175 | 146 | 161 | 34.6 | 58.7 |

Source: ITU (2010), RWB (2010), UNDP (2010), Transparency International (2010).

Note: the Internet and mobile cell phone values are per 100 inhabitants

Independent media (print, broadcast and online) does not exist in Iran. Media is under heavy surveillance through a complex set of political, legal and economic structures to ensure that all publications, whether prints, broadcastings or online are aligned with the guidelines dictated by the office of the Supreme Leader and/or they are functioning in accordance to the Shari’a laws and the state’s political agendas. Iran’s media is controlled and monitored by a complex set of agencies, including, but not limited to government, the judiciary system, the powerful Guardian Council, the military, the parliament, and the clerical institutes.

In addition to above agencies, there are many other institutes that directly or indirectly influence the shape of media, including the powerful conservative clerical association of Fatwa authorities, that have the ability to oppose any critical media (print, broadcast or online) deemed to undermine the Islamic Ideology of the state. Finally, the selected members of each of the above agencies, constitute the Supreme National Security Council which is responsible for implementing security policies related to intelligence, socio-political and economic matters, including areas related to media and culture. Under the ultimate command of the Supreme National Security Council the Internet Filtering Committee has been setup. This filtering and censorship body is responsible for setting up guidelines and framework policies for filtering of sites deemed to be a threat to Iran’s national security and elites in power.

2.1 The State of Media Freedom in Iran

As a consequence, Iran was able to successfully implement one of the world’s most repressed press freedom structures according to UNDP’s Human Development Report. In its 2010 report, UNDP (2010) ranked Iran in the bottom of the list concerning respect for media freedom, following Eritrea, North Korea and

Turkmenistan. In addition, the global study of media freedom conducted by Freedom House reveals important information about Iran. Freedom House rates each country's level of press freedom based on the scores obtained from three major categories namely the legal, political and economic environments. The legal environment, according to Freedom House, is concerned with issues such as the constitutional support for freedom of expression, the degree of independency of the juridical system, penal code, security laws and information related legislation. The political environment evaluates the degree of adherence of each country to media freedom in the form of the governmental and the powerful elite's interferences in media publications. This interference may take place in different capacities and forms, such as imposing licensing restrictions on critical newspapers, or in form of legislation that mandates ISPs and Internet café owners to monitor Internet traffic and report suspicious activities deemed to be 'illegal' as well as blocking critical websites and/or initiating cyber-attacks on critical websites and news agencies. The economic environment deals with the economical pressures and sanctions imposed on independent media (if any). It deals also with the level of governmental control on print materials. A rating score of 0-30 is assigned to the legal entrainment category, while the scores of 0-40 and 0-30 are assigned to political and economic environments respectively. A total score obtained from these groups is used to rate each country's respect for freedom of the press. A score of zero indicates the highest respect for media freedom (including the Internet), while value 100 indicates the lowest respect.

Table 2 reports the level of media freedom in each category from year 2002 to 2010. As indicated Iran is not only placed in the category of "Not Free" media nations but also the country has scored the lowest ranking when it comes to its media legal environment score. In addition Iran has been ranked at 175th place among 178 nations by another independent institute "The Reporters Without Borders" in year 2010 (RWB, 2010).

Table 2. Media Freedom in Iran

| Iran Press Freedom | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|-----------------------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Legal Environment | 26 | 25 | 27 | 28 | 28 | 29 | 29 | 29 | 30 |
| Political Environment | 29 | 32 | 32 | 33 | 36 | 34 | 34 | 34 | 36 |
| Economic Environment | 20 | 19 | 20 | 19 | 20 | 21 | 22 | 22 | 23 |
| Total Score | 75 | 76 | 79 | 80 | 84 | 84 | 85 | 85 | 89 |
| Status | Not Free | Not Free | Not Free | Not Free | Not Free | Not Free | Not Free | Not Free | Not Free |

Source: Freedom House (2010)

Table 3 shows Freedom House's report in regards to a neighboring country, Kuwait. As shown Kuwait's media freedom scores are higher compared to the scores given to Iran. In addition, the media divide gap between these two countries has increased from 26 points in year 2002 to 34 points in year 2010.

Table 3. Media Freedom in Kuwait

| Kuwait Press Freedom | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|-----------------------|------|------|------|------|------|------|------|------|------|
| Legal Environment | 22 | 19 | 19 | 20 | 20 | 19 | 18 | 18 | 18 |
| Political Environment | 19 | 22 | 22 | 22 | 20 | 21 | 21 | 21 | 21 |
| Economic Environment | 8 | 13 | 16 | 16 | 16 | 16 | 15 | 16 | 18 |
| Total Score | 49 | 54 | 57 | 58 | 56 | 56 | 54 | 55 | 55 |
| Status | PF | PF | PF | PF | PF | PF | PF | PF | PF |

Source: Freedom House (2010), PF=Partly Free

Regarding ICT media, particularly the Internet Iran is among the countries that adopted one of the most sophisticated Internet content censorship apparatus according to OpenNet Initiative (ONI, 2005, 2009). The extensive Internet content filtering was adopted during the increased popularity of the Internet among the younger generation. The imposed censorship is under the pretext of defending the Islamic values, national security and the immoral content of the Internet aimed to impose Western ideology into the Islamic society (ONI, 2005, 2009).

3. THE ACTOR NETWORK THEORY

The underlying theoretical framework of this study is the Actor-Network Theory (Callon, 1986; Callon et al., 1986; Latour, 1999). According to Latour (1999) Actor-Network Theory (ANT) aims at accounting for the very essence of societies and natures; however, it does not wish to add social networks to social theory; rather it rebuilds social theory out of networks. ICT media with its various applications, equipments, tools, processes, protocols, rules and policies is considered an essential part of today's actor-network structures. Latour (1999) argues that ANT makes use of some of the simplest properties of network of communities integrated to an actor that does some work; the addition of such an ontological ingredient deeply modifies it. In this context, social networks is an integral part of ANT allowing us to better understand the human behavior in the use of technology-mediated social settings (Kling et al., 2003) impacting groups, communities, institutions, organizations, states and nations, in one or another way.

The Iranian digital community can be understood better through the lens of ANT in which an interconnected webs of communities participating in public discourse demanding changes in the physical world for a better and fair social and political life. The main actors of this structure include not only grassroots journalists, individuals, NGOs, pressure groups and political parties, but also the government and its various agencies. However like many other communities the central notion of discourse is that of power, and more specifically the social power of groups or institutions (van Dijk, 2001). Essentially, social groups have (more or less) power if they are able to (more or less) control the acts and minds of (members of) other groups; which in turn constitutes a power base of (privileged access to) scarce social resources (van Dijk, 2001).

The cat and mouse game between the digital community and the censorship and filtering agency of Iran has been intensified by government's announcement of setting up its own private Internet system, in order to cut off the digital community of Iran from the rest of the world. In the following section the main idea of a "public cloud" will be discussed.

4. PRIVATE INTERNET OR A CENSORED PUBLIC CLOUD

During the popular unrest aftermath 2009 presidential election, thousands of pictures, video clips and text messages from Iran disseminated in social networking, video sharing sites and blogs, indicating the fact that the digital community of Iran, in particular the grassroots journalist had successfully bypassed Iran's sophisticated filtering system. They were able to not only to share the events occurring in Iran with the rest of the World, but also participate in communication discourse with peers organized around the social networking sites.

The recent announcement of Iran's telecom officials in implementing their own national Internet the so-called *Halal* Internet "aimed at Muslims on an ethical and moral level" (Rhoads and Fassihi, 2012) is in fact an acknowledgement of the inefficiency of government's imposed filtering and censorship mechanisms aimed to block citizens' access to free information. The introduction of Halal Internet indicates the Islamic ideological perspective of elites in power, to allow only a single view of Internet under the pretext of protecting the Islamic values from the influence of "Western culture" (see Shirazi and Greenaway, 2009 for more details). In fact these arguments are used as a pretext for implementing a particular narrow Shi'a Islamic private Internet for the sake of government's political agendas by imposing Internet filtering at the over 36 million users.

In essence the Halal Internet is a nationwide peer-to-peer network established between ISPs and the centralized monitoring system as depicted in Fig 4.1. At the heart of this network there is a controlled monitoring and alarming system, such as the Nokia-Siemens' monitoring system which allows for real-time network topology and status map, inventory collection and reporting, traffic monitoring, IP packet capturing and real-time alerts and notifications among other features. In other words a censored public cloud.

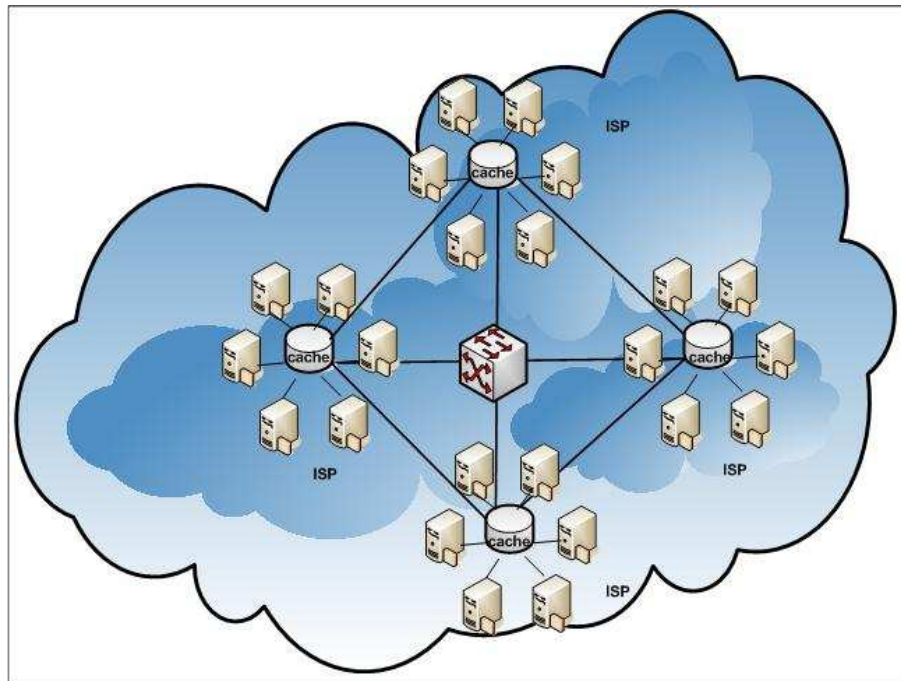


Figure 1. A peer-to-peer implementation of public cloud

4.1 Public Cloud

According to National Institute of Technology and Standards (NIST) cloud computing “is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., network, service, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider” (cf. Josyula et al., 2012:9). Despite the fact that cloud computing is a buzzword after Web 2.0 technology but the concept is rooted to earlier relevant technologies such as Grid Computing (Foster et al., 2008), distributed computing architecture (Zhang and Zang, 2009) such as the Peer-to-Peer (P2P) architecture. Essentially, cloud computing is a Service Oriented Architecture (SOA), multi-platform structure, integrated with web 2.0 technology (user interface) that provides layers of abstraction in form of virtualization. Three main components of a cloud system are: a) Software as a Service (SaaS); b) Platform as a Service (PaaS); and c) Infrastructure as a Service (IaaS). While SaaS is a layer of cloud linked to user application running on provider’s server, the latter two layers are referred to as the network operating system(s), databases, tools and services integrated with the underlying hardware and network infrastructure. The key point in this arrangement is the use of global Internet infrastructure and its various platforms and applications to efficiently and effectively manage the needs of organizations and communities, in a cost effective, scalable, ubiquitous and on-demand manner.

Iran’s *Halal* network is a national public cloud established by the infrastructure provider (e.g, government and the military) around licensed Internet Service Providers (ISPs) as well as other community clouds (e.g., government, organizations and business clouds). ISPs and other subsystems are connected with each other through the IaaS layer in a hybrid fashion. At the center of each peer network there will be a monitoring system for controlling sub-network’s traffic. These monitoring sub-systems are then controlled by a centralized monitoring system as depicted in Fig 4.1. The government announcement of rolling out the Microsoft Windows Operating System and replacing it with its own version of operating system (Rhoads and Fassihi, 2012) is a move for controlling the middle layer of cloud (e.g., PaaS). As such other services such as e-mail servers and other services can be monitored and controlled accordingly. In this context, the introduction of *Halal* social network as a means of replacing the global social networking sites such as Facebook and Twitter can be understood as an ideological move toward a more controlled and restrictive social network.

It is not clear whether this censored public cloud will succeed in future, however, this arrangement will impact a citizen's access to free information negatively. But Internet development is a dynamic process in which it will invent and reinvent new tools and services that static arrangements such as *Halal* Network cannot compete with. For example, it is not clear how Iran's national cloud will be able to cut off citizens access from the global Internet permanently when it comes to the use of advanced technologies such as Internet access by the means of satellite.

5. CONCLUSION

ICTs changed the nature of interaction among individuals, civil society, democratic institutes and business activities. In particular, many individuals and protest movements were organized by utilizing ICTs in their campaigns. As we have seen in recent popular unrests in Middle East and North Africa, ICTs provide the means for building the capacity to participate in democratic discourse, and mobilize masses for radical social change in constitutional and legal arrangements.

Since the Introduction of Internet in Iran in 1995, the digital community of Iran was able to effectively use the new technology for not only as a means of communication and interaction among people, but also to organize social-political events. Despite governmental censorship and filtering of Internet content, including the block of millions of blogs and websites, the digital community of Iran was able to use advanced anti-filtering tools and utilities, as well as proxies, to bypass the imposed restrictions on the Net and participate in discourse with digital societies across the globe.

The recent move by the government of Iran, to setup its own private Internet, is viewed as another attempt to block users' access to free information available on the Internet. We can understand the extent to which the ideological lens underpins the justification for introducing *Halal* Internet. However, it is not clear how the Iranian authorities will succeed in their move to implement such a plan, because the Internet technology is a dynamic process, which evolves by itself constantly, and stopping such a process is an impossible task. For example, it is not clear how this wired, peer-to-peer public cloud will prevent users' access to global network by other means of communication channels, such those provided by the satellite systems.

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CULTURAL ADAPTATION AND ARAB E-COMMERCE: AN EXPLORATORY STUDY

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ABSTRACT

This study aims at exploring the cultural adaptation of Arab e-commerce websites based on Hofstede's cultural dimensions and related guidelines developed by usability researchers for localization of websites. The results of studying a selection of fifty e-commerce websites of Arab countries show that the sites studied do not significantly reflect characteristics pertaining to a higher context culture. Additionally, the site designs do not demonstrate conformance to Arab cultural dimensions identified in Hofstede's model. The study, which is among the first to explore the e-commerce theme specific to Arab countries, is particularly relevant given the recent developments in the region and consequent implications to globalization and e-commerce. Besides providing useful guidelines for developing localized web interfaces, the study gives insights to global companies intending to establish their commercial presence in Arab countries.

KEYWORDS

Arab culture, usability, e-commerce, metaphor, cultural marker

1. INTRODUCTION

In recent years, information and communication technologies (ICT) have penetrated all corners of the globe. In particular, the Internet has enabled the delivery of new products and services at a global scale. With this trend in globalization, cross-cultural issues in information systems have become important for researchers. Organizations are increasingly concerned about the cultural adaptation of websites and online services. Web interface design and usability issues are crucial factors in the measurement of global information systems success. Kang & Corbitt (2001) note that the use of metaphors, visual design factors such as color, layout, and style, and types of images employed on many country-specific e-commerce websites seem to be more adapted to the culture of the origin of the design and not to the target audience. In many cases, organizations attempting to make a global presence, simply translate their original websites into the corresponding language of a country where their products are intended to be sold, paying little attention to localization guidelines (Corbitt & Thanasankit 2001).

Culture and information presentation (layout, graphics, color, etc.) are considered important determinants of website usability, particularly for e-commerce. Several studies (Dormann & Chisalita, 2002; Marcus & Gould, 2000; Robbins & Stylianou, 2002) have tried to explain cultural differences in website design. All these studies are based on the work of Geert Hofstede (Hofstede, 1991, 2001, 2002), who argued that world cultures vary along five consistent dimensions - power distance (PD), individualism vs. collectivism (IC), femininity vs. masculinity (MAS), uncertainty avoidance (UA), and long- vs. short-term orientation. Khashman and Large (2010) examined the design characteristics of web interfaces from Arab countries using Hofstede's cultural dimensions. Their results of applying content analysis methods to a sample of 15 government web portals suggest that Hofstede's model of culture does not seem to be reflected in the Arabic sites studied. Marcus and Hamoodi (2009) studied university websites from 3 different Arab countries, on the same grounds as that of the Khashman and Large (2010) study. Their study concluded that the Arabic websites studied partially exhibits characteristics of Hofstede's model. Prior research has examined e-commerce websites from US, Japan, Greece, China, India and many other countries (Singh et al. 2003, Chai & Pavlou 2004, Callahan 2005, Stroehle 2008, Ahmed & Mouratidis 2008) in a multicultural context. Also,

studies on Arabic website design have mainly focused either on the differences that exist between Arab and Western countries (Al-Badi & Mayhew 2004, Al-Badi 2009) or on domains other than e-commerce (Khashman & Large 2009, Marcus & Hamoodi 2009). There seems to be a dearth of studies specifically focused on the cultural issues related to e-commerce websites of Arab countries. Marcus and Hamoodi (2009) call for further research in e-commerce, travel and government sites. Our study addresses this need.

The primary research question for this study relates to how well Arab e-commerce website interfaces portray Arab culture in their design and the related implications to site designers. The selection of this single genre for the study (Barber & Badre, 1998), in this case, e-commerce, is particularly motivated by recent developments in the region that have highlighted the importance of the Internet and the resulting implications to globalization. We further narrowed the scope of the study by limiting the analysis to graphical and structural elements only, since conducting deep linguistic analysis would require a high level of proficiency in Arabic language and a consequent need to involve language experts.

In the following sections we present our exploratory study of randomly selected e-commerce websites of businesses based in Arab countries. The results show that a majority of the sites studied have given very little attention to localization in their site design. The next section details the choice of our websites and methodology. This is followed by a discussion of the results. We conclude with future directions for this research.

2. HOFSTEDE'S CULTURAL DIMENSIONS

Hofstede (2001) examined data gathered between 1967 and 1982 from 50 countries and 3 regions of the world and formulated five dimensions by which he argued all cultures could be evaluated. These dimensions are: power distance (PD), individualism vs. collectivism (IC), femininity vs. masculinity (MAS), uncertainty avoidance (UA), and long- vs. short-term orientation. Hofstede's dimensions may be characterized as follows: *Power distance* is the extent to which the less powerful members of organizations expect and accept unequal distribution of power; *Individualistic societies* value personal achievement while *collectivistic* ones emphasize the benefits of working in a social group; Cultures with a high *masculine* index maintain traditional distinctions between gender roles and perceptions, whereas *feminine* cultures tend to dissolve gender differences. *Uncertainty avoidance* measures the degree to which people tend to stay away from uncertain situations. *Long term orientation* stands for the fostering of virtues oriented towards future rewards, in particular, perseverance and thrift. Its opposite pole, *short term orientation*, stands for the fostering of virtues related to the past and present, in particular, respect for tradition and preservation of 'face' and fulfilling social obligations (Hofstede, 2001). These dimensions are not distinct; they overlap and correlate with each other to a certain degree.

Marcus and Gould (2000) characterized website interfaces using Hofstede's dimensions. They argued that website features may be characterized against each dimension as follows: (1) High power distance corresponds to features relating to status appeals, referent power and hierarchy; (2) high collectivism maximizes users motivation based on group achievement, includes privacy policies, and prominence is given to leaders who portray tradition and history; (3) masculinity in interfaces can be reflected through traditional gender roles and age differences between users, navigation is oriented to exploration and control, and graphics and animation are used for utilitarian purposes, while feminine interfaces would have blurred gender roles and tasks are accomplished through mutual cooperation; (4) uncertainty avoidance is portrayed in interfaces through simple design with limited choices and a restricted amount of data; and (5) long term orientation requires users to exhibit patience to achieve goals.

3. RESEARCH QUESTION

As stated earlier, the question that guided our study pertains to the examination of whether or not e-commerce websites of Arab countries accurately portray Arab culture in their interface design. Following other similar research studies, we used Hofstede's model to guide our analysis. Prior research demonstrates that Hofstede's model captures cultural aspects well and hence has been used extensively by many studies pertaining to website design to understand cultural similarities and differences (Dormann & Chisalita, 2002;

Marcus & Gould, 2000; Robbins & Stylianou, 2002; Rajkumar, 2003; Khashman & Larger, 2010; Singh et al. 2003; Marcus & Hamoodi, 2009; Al-Badi & Mayhew, 2004; Khashman & Large, 2009; Cyr et al. 2005; Callahan, 2005). We have also chosen Hofstede model as no other model has been so extensively replicated and validated (Zahedi et al. 2006). Additionally, we also assumed that by limiting our study to a sample of bilingual (Arabic and English) sites randomly chosen from an exhaustive search of Arab e-commerce websites, it is plausible that a great number of these sites have indeed considered Arab culture as an important determinant of success and hence Arab culture is likely to be reflected in their designs.

Table 1. Website characteristics in relation to Hofstede's dimensions of culture (adapted from Reinecke et al. 2010 and Singh et al. 2003)

| Hofstede's Dimension | High | Low |
|-----------------------|--|--|
| Power distance | Guided navigation with many navigational cues | Non-linear navigation preferred |
| | Most information not found in the first sight | Most information found in the first sight |
| | Hierarchy in information presentation (Proper titles, messages etc.) | Less structured data |
| | Simple menus | Complicated menus |
| Collectivism | Presence of social responsibility policy | Good privacy statement |
| | Traditional or family theme | Independence theme |
| | Use of monotonous colors | Colorful interfaces |
| | Loyalty programs | Importance to product uniqueness |
| Masculinity | Navigation towards exploration and control | Non-linear navigation |
| | Product images in use by individuals | Attractive product images rather than explanatory |
| | Clear gender roles, presence of male images rather than female images | Unclear gender roles without proper depiction of clear men and women roles |
| Uncertainty avoidance | Simple interfaces | Complex interfaces |
| | Linear navigation paths of the products | Non-linear navigation (everything on the same page) |
| | Spatial organization of the screen can be complex but clearly arranged | Maximal content and choices in functionality |
| Long term orientation | High information density, most information at first sight, menus should have only few levels | Low information density |
| | Less structured data | Hierarchy in the information presentation |

4. METHODOLOGY

To address the research question stated above, we first examined the available literature to understand the use of Hofstede's cultural dimensions in the interpretation of differences in graphical design. A list of adaptation rules compiled by Reinecke et al. (2010) and a framework proposed by Singh et al. (2005) guided our further search. Reinecke et al. (2010) drew upon prior research work based on Hofstede's dimensions to develop their adaptation rules. The resulting framework is summarized in Table 1.

4.1 Sample Selection

Localized e-commerce websites are meant for use by local shoppers. Therefore, they are presumably attuned to local culture rather than targeted at the world-wide Internet community. For example, it is very unlikely that the "Abaya" used by Qatari women is bought in USA or as a matter of fact even in Egypt as designs are localized. For selecting our sample of websites, we chose six Arab countries - Qatar, Kuwait, Egypt, Oman, Dubai and Abu Dhabi. Country-specific e-commerce websites were randomly chosen using Google search with specific keywords such as online shopping, fashion, clothing, travel, and bookstores. The final sample for the study was selected based on two criteria – the selected site is bilingual, i.e., has both English and Arabic versions linked to each other, and the site facilitates online e-commerce transactions. Further, we ensured that the sample used for the study, although not exhaustive, was representative of five different types

of ecommerce domains -travel, food, retail, fashion, and bookstore. We randomly chose ten sites from each category.

5. ANALYSIS AND FINDINGS

The analysis of the website design focused on the functional, structural, visual, and graphical elements such as navigation schemes, menus, images, presence of search engines, site maps, color, gender in images, use of animation, etc. The term “cultural markers” as defined by Barber and Badre (1998), apply to these elements when certain attributes are most prevalent and preferred within a particular cultural group. The description and frequencies of occurrence of these cultural markers were counted and then aggregated based on Hofstede’s dimensions. Before the analysis took place, two judges were trained on websites not included in the final sample. Subsequently, the results of their classifying the cultural markers on the chosen sites were compared and an acceptable inter-judge agreement score of 73% was observed.

In the following discussion, we present preliminary results from the study conducted on the fifty chosen websites. We also compare our findings with the results of prior research studies of a similar nature. The results we obtained were mixed, in some cases the results were consistent with prior findings and in some cases not. Table 2 summarizes these results, portraying the adaptation rules suggested in the literature, conformance or non-conformance to these rules as evidenced in our study, and new adaptation rules we uncovered relevant to Hofstede’s cultural model.

Bilingual versions of the chosen sites certainly cater to both the expatriate and Arab population of the regions. Contradicting our assumption of designers considering culture as important part of the design we found that Arabic counterparts of the websites are poor imitation of the English counterparts; the design of the latter seems to have guided the overall design of the websites. Further, although the sites advertise products targeted at users in Arab countries, except for 3 sites, all the other website domains were hosted in the USA, UK and Europe further hinting at the possibility that even the original designers were likely from regions other than Arab countries.

The websites were analyzed for company logo presence (vs. non presence of company logos), simple menus (vs. complicated menus), ease of information access, presence of live chat, newsletter, links to local websites (vs. non presence), use of simple colors, use of human images (vs. nonuse of human images), gender in images (female vs. male), presence of privacy statement, best sellers, clear gender roles (vs. non presence), presence of navigational cues (vs. non presence of navigational cues) and presence of search function (vs. non presence of search function). As shown in Table 2, our study also added elements such as presence of female images, data and privacy statements, easy access to information and use of figurative language based on Reinecke et al. (2010) and Singh et al. (2005). At the same time with reference to the above mentioned literature (Reinecke et al. 2010; Singh et al. 2005) interface elements such as loyalty programs, social responsibility policy, proper titles that are highlighted in their framework are seen missing in the websites we studied.

Table 2. Summary of cultural adaptation rules for websites based on a synthesis of the literature

| Dimension | Rules suggested in literature | Conformance in studied websites | Non-conformance in studied websites | New rules suggested by our study |
|-----------------------|---------------------------------------|--------------------------------------|-------------------------------------|--------------------------------------|
| Power distance | Company hierarchy information | Company logo presence | Company hierarchy information | Easy access to product information |
| | Prominent persons pictures | Simple menus | Prominent person's pictures | |
| | Proper titles | Easy access to product information | Proper titles | |
| | Simple menus and high structured data | | High structured data | |
| Collectivism | Social responsibility policy | Live chat | Social responsibility policy | |
| | Clubs or chat rooms | Newsletter | Clubs or chat rooms | |
| | Newsletter | Links to local websites | Loyalty programs | |
| | Loyalty programs | Simple and pleasant colors | | |
| | Links to local websites | | | |
| Masculinity | Less imagery on the website | Use of image and figurative language | Less imagery on the website | Use of image and figurative language |
| | Guarantee policy | Guarantee policy | Presence of men's pictures | |
| | Presence of best sellers | Presence of best sellers | | Presence of female images |
| | Clear gender roles | Clear gender roles | | |
| | Presence of men's pictures | Presence of female images | | |
| Uncertainty avoidance | Customer service | Customer service | Local terminology | Data privacy statement |
| | Guided navigation | Guided navigation | | |
| | Local office contacts | Local office contacts | | |
| | Local terminology | | | |

The results of the chi-square test are presented in Table 3. We assumed an equal likelihood of occurrence of the elements in each category as we did not have prior knowledge about the state of cultural adaptation of the websites. The chi-square statistic exceeds the critical value for the chosen probability level and degrees of freedom for all of the elements thus rejecting our null hypothesis. The percentages column clearly indicates that considerable effort is required before the websites chosen for our study demonstrate conformance to Hofstede's cultural dimensions and other cultural adaptation rules suggested in the literature.

Power distance: A high power distance culture focuses on experts, certifications, official stamps and logos (Marcus & Gould 2000). A similar study by Singh and Pereira (2005) also made the same conclusions. Therefore, certification, awards and presence of official logos are seen as distinct identity depiction of high power distance culture in websites. Evidence of this aspect is clearly reflected in our study. Arab countries being high power distance scorers are characterized by the presence of official logos on websites. Wurtz (2005) has identified another characteristic of high power distance website with new pages opening in a new window. However, this characteristic was totally absent in our sample of websites. According to Marcus and Gould (2000), high power distance cultures influences high access to information with hierarchies. Our study identified websites with simple menus and easy access to the information of the product. Additionally, websites displayed awards they won, and secured payment certifications on their homepages to make the customers believe that buying through them is secure and risk free (Singh et al. 2005; Singh 2003; Wurtz 2005).

Table 3. Results of the chi-square test for the design elements

| Dimension | Element | X ² | % | df | P |
|-----------------------|---|----------------|--------|----|-------|
| Power distance | Company logo presence | 17.64 | 23% | 1 | 0.001 |
| | Simple menus | 17.64 | 23% | 1 | 0.001 |
| | Easy access to information | 6.76 | 6% | 1 | 0.01 |
| Collectivism | Live chat | 10.24 | 20.05% | 1 | 0.001 |
| | Newsletter | 7.01 | 19% | 1 | 0.01 |
| | Links to local websites | 5.76 | 6.5% | 1 | 0.01 |
| | Simple colors | 2.56 | 14% | 1 | 0.1 |
| Masculinity | Use of images | 1 | 12.5% | 1 | 0.001 |
| | Privacy statement, presence of best sellers | 1.9 | 16% | 1 | 0.1 |
| | Clear gender roles | 23 | 24.5% | 2 | 0.001 |
| | Presence of female images | 2.4 | 10.5% | 1 | 0.1 |
| Uncertainty avoidance | Customer service | 17.64 | 23% | 1 | 0.001 |
| | Guided navigation | 2.04 | 16% | 1 | 0.1 |
| | Local office contacts | 12.31 | 21% | 1 | 0.001 |
| Long-term orientation | Search engines | 16.84 | 22.5% | 1 | 0.001 |
| | Sitemaps | 10.24 | 20.05% | 1 | 0.001 |
| | FAQ | 15.98 | 21.9% | 1 | 0.001 |

Collectivist community: Arab countries are placed among the collectivist countries listed by Hofstede with a score of 58, which is considered high. We, therefore, expect Arab e-commerce sites to have community policy, family theme, products displayed by the individuals using them, newsletter and live chat presence and links to local websites (Marcus & Gould 2000; Reinecke et al. 2010; Singh et al. 2003). Additionally, Reinecke et al. (2010) in their work have identified that collectivist cultures use monotonous colors and high text to image ratio in the websites. In line with these findings from prior work, our results showed less evidence in some aspects of collectivist nature. Our study revealed presence of live chat, newsletter, link to local websites and use of simple and monotonous colors in their websites. We also found the products were being displayed primarily as in use by individuals and not displayed as products alone. We did not find community policies, family themes and high text to image ratio in our studied websites. In this regard we also found a few websites displaying product images alone with no textual description.

Masculinity: Masculine cultures value assertiveness, ambition, success and performance. To such cultures, traditional gender and age distinctions, navigation towards exploration and control by opening new windows for every option or link and use of image and animation are norms (Wurtz 2005; Khashman & Large 2009; Singh et al. 2003; Marcus & Gould 2000). Further Singh (2003)'s framework portrays presence of guarantee policy, best sellers and data privacy statements as a masculine feature. Arab countries are ranked as highly masculine by Hofstede. Therefore, it is expected that Arab websites would have more frequent images of men and animation. But in our study, we found that a great number of images used were that of women and animation was not prominent in the sites. Most of our sites did not open new pages for links thus not supporting navigation towards control and exploration. Images and figurative language were observed in our studied websites. Gender roles were clear with different pages for products targeted at men and women.

Uncertainty avoidance: Societies high on uncertainty avoidance tend to be more risk-averse, avoid ambiguous situations, and value security. Individuals in such cultures show preference for clear directions, instructions and rules (Gudykunst 1998). Hence we can claim that high uncertainty avoidance cultures are manifested in simplicity, clear use of metaphors, limited choices, and guided navigation and assurance to the user at every step of transactions (Singh et al. 2003; Marcus & Gould 2000).

Our study shows the use of metaphors and simple menus with low information density. Navigation is guided and navigational cues are present in the website page navigation. Further, there is presence of local office contacts, customer service emails, telephone numbers as well as help line numbers in the webpages.

Long-term orientation: Arab countries were not originally scored on this dimension as Hofstede formulated this at later stage in 1980 based on Chinese data. Regardless, the descriptive features of long-term oriented cultures may be applied to Arab countries. We identified the sample website interfaces as having search engines, FAQ, and site maps, thus accounting for long-term orientation characteristics.

6. CONCLUSION

Although the cultural background of consumers is an important determinant of interface design, current design practices of Arab e-commerce websites do not seem to account for cultural adaptation. Thus, the conclusions made from the exploratory study is that the essence of the Arab culture, as defined by Hofstede, seems to have not been depicted, in general, in the selected e-commerce websites. Consequently, further efforts are needed to encourage designers of the region to understand and assimilate the cultural aspects of e-commerce website design. These results also imply that e-commerce website design should be treated differently with regards to cultural markers. The results of this study also provide several pointers to improving the design of Arab e-commerce websites based on appropriate use of associated cultural markers.

This study has several limitations. First, the countries chosen for our study were not originally included in the seminal study that formed the basis of Hofstede's model. Second, our results might be influenced by the choice of the sub-genre of the e-commerce websites (Barber & Badre, 1998). Rather than quantitative and content analysis methods that are employed in this research, user centered research is much suitable for investigation of how people in these countries perceive the websites. User-centered studies would prove more useful to gain more insights into the design of Arab e-commerce websites.

The results, their implications, and the limitations discussed above direct the need for further research. As our pilot study did not investigate e-government sites, our first aim in future research is to include a wider spectrum of e-commerce domains (sub-genres). We also propose an empirical study to gain insights into how online buyers perceive Arabic e-commerce websites through a controlled experiment using eye tracking, verbal protocol analysis, and questionnaires in wider domain spectrum of commerce such as e-banking, e-tourism and e- government.

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ONLINE APPLICATIONS FOR USER INVOLVEMENT IN LIVING LAB INNOVATION PROCESSES: AN INITIAL FRAMEWORK

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ABSTRACT

The use of Living Labs is gaining importance as an approach to involve users in innovation and development, serving to make users active participants in the development of e-Society. However, Living Labs are currently not taking full advantage of online applications to support user involvement, even though such applications are gaining impact in other innovation fields. To support the uptake and future development of online applications for user involvement in Living Labs we propose a framework that classify and relate such applications to the Living Lab context. The framework serves to classify types of online applications for user involvement, and the high level Living Lab activities which these may support. The application types are classified according to different phases of the innovation and development process. The high level activities include short term user campaigns and maintaining long term user relationships. Three issues related to the framework are discussed; that is, (a) process phase as determinant of the relevance of online applications for user involvement, (b) integration of online and traditional approaches to user involvement, and (c) trade-offs when choosing online applications, are discussed. The framework is the result of a collaborative process involving seven Living Lab researchers from four Nordic Living Labs, and is meant to guide Living Lab representatives that are considering whether or how to utilize online applications for user involvement.

KEYWORDS

Living Lab, online user involvement, innovation.

1. INTRODUCTION

The use of Living Labs is a relatively new approach to the involvement of users in innovation and development processes (Schumacher & Niitamo, 2008). In the field of ICT development, Living Labs have been defined as environments for innovation and development where users are exposed to new ICT solutions in (semi)-realistic contexts, as part of medium- or long-term studies (Følstad, 2008a). Consequently, Living Labs are of high relevance to e-Society innovation and development. The Living Lab approach has received much interest the last few years. This is particularly seen in the growth of the European Network of Living Labs, now numbering more than two hundred Living Labs across Europe.

An emerging trend is to see the Living Lab as a way of tapping into the creative potential of users where users and user communities engage in co-creation activities, and new designs are returned on the basis of interchange between developers and users. With the increasingly participatory nature of the Internet - where users provide feedback, share, and co-create – *online applications for user involvement* are becoming ever more relevant to Living Lab innovation, including both what is typically referred to as social software (Shirky, 2003), social media (boyd, 2009), or social technologies (Hagen & Robertson, 2010) as well as non-social applications for user feedback such as applications for online questionnaire surveys, cultural probing and experience sampling, and remote usability evaluation.

Early work has been conducted on how online user involvement may be integrated in Living Lab innovation and development processes (Näkki & Antikainen, 2008; Følstad, 2008b; Følstad, 2009). However, applications for online user involvement are rapidly evolving, and it is challenging for Living Lab administrators to get an adequate overview of (a) existing tools and applications as well as (b) the high level

Living Lab activities that these may support. Further, Living Lab researchers need a framework on which to base future research on online applications for user involvement.

In this paper we present an initial framework for classifying and understanding online applications for user involvement in Living Labs. The framework is intended to support Living Lab administrators to get an overview of application types and high level activities supported by such applications, as well as Living Lab researchers in their study of the performance and characteristics of such applications in varying Living Lab contexts.

The framework was developed within the SocialLL project (<http://sociall.origo.no>) that runs from 2010-2012. As an introductory activity in the project, we saw the need to establish a framework to classify social software for co-creation purposes. In order not to be unnecessarily restrictive, and thereby possibly limiting the relevance of the framework, we scoped the process leading to the framework to include both social and non-social applications for online user involvement in innovation processes.

The structure of the paper is as follows: We first present existing background on online user involvement in development and innovation processes. Then we specify the objectives for the framework and describe the approach for its establishment. The framework is presented and discussed in two sections. In the first of these, online application types and high level Living Lab activities are treated. In the second section, we present three issues identified as important when applying the framework. Finally we discuss the limitations of our contribution and suggest future research.

2. BACKGROUND

The participatory nature of the internet has become increasingly visible during the last decade, in particular with the spread and uptake of services for user generated content and social networking. According to the traffic ranking service Alexa (<http://alexa.com>), five of the top ten trafficked web sites in the world, as of October 2011, were social media sites (Facebook, YouTube, Blogger, Wikipedia, Twitter).

Striking attributes of the participatory internet is the ease of connectivity and group formation (Shirky, 2009) and users' willingness to share openly and freely (Leadbeater, 2009), implying the internet to be a promising arena for user involvement in development and innovation processes. Indeed, within the general field of innovation management, innovating enterprises have already begun utilizing general purpose applications, such as blogs and social networks, as well as special purpose applications to involve users in innovation and development processes; examples of the latter being My Starbucks Idea (<http://mystarbucksidea.force.com/>) and Dell's IdeaStorm (<http://www.ideastorm.com/>) where users openly and collaboratively contribute and develop ideas for product and service innovation.

Also within the specific field of Living Labs, online user involvement has been employed to some limited degree. At the Finnish Open Web Lab (OWELA, <http://owela.vtt.fi>) an open source blog software (WordPress, <http://wordpress.org>) is utilized as an arena for idea generation and user feedback (Näkki & Antikainen, 2008). At the Norwegian RECORD online Living Lab (Følstad, 2008b), an open source media management software (OS Tube, <http://ostube.de>) serves as a platform for users to provide feedback on ideas and designs. Online questionnaire surveys have been used to capture Living Lab data on the users' context and needs (Lievens, Van den Broek & Pierson, 2006; Hess & Ogonowski, 2010). Experience sampling methods implemented as self report questionnaires automatically triggered during use of a given application have been suggested for a particular mobile Living Lab set up (De Moor et al., 2010). However, given the large number of existing Living Labs, it is surprising to find only these few reports of Living Lab studies with substantial utilization of applications for online user involvement (Følstad, 2008b).

3. OBJECTIVES FOR THE FRAMEWORK

The modest attention given to applications for online user involvement in the Living Lab literature, as well as the rapidly evolving offer of such applications, indicate that we need to improve our understanding of the various types of applications for online user involvement as well as our understanding of how they can be used. The main objectives for the framework were:

1. Identification of different types of applications for online user involvement in Living Labs

2. Identification of high level Living Lab activities to be supported by these application types

The framework should support discussions of issues such as how to integrate traditional and online approaches to user involvement in Living Labs, and trade-offs when choosing online applications for a given Living Lab purpose.

4. APPROACH

The framework was established through a collaborative identification and reflection process, with the active involvement of seven researchers in the SocialLL project. All of the researchers have participated in multiple Living Lab projects and hold deep knowledge in Living Lab innovation. Four of the researchers are affiliated with academic institutions, two with research institutes, and one with a SME consultancy. Three of the researchers have participated in the establishment of online platforms for user feedback in Living Labs.

The identification and reflection process was conducted in four steps. First, relevant applications were identified through a collaborative effort across eight weeks. Identified applications were presented to the researchers by adding comments to an open online discussion thread. Second, one of the researchers (the first author of this paper) compiled the identified applications in tentative groupings. Third, each researcher familiarized herself with the applications they did not know from beforehand on basis of general descriptive material and demonstrations available on the web-pages of the application providers. Fourth, the researchers met in a face to face workshop presenting their individual perceptions of the applications and discussed their potential categorizations and Living Lab utilizations.

The workshop lasted four hours and was structured as a series of intervals of individual note taking and discussion. For each application, the researchers took individual notes on potential uses, strengths, and weaknesses. Following individual note taking, the researchers engaged in plenary discussions to reach a common understanding on potential uses, strengths, and weaknesses. Consequently, the plenary discussions returned (a) a refined set of application types - presented in section 5.1, (b) high level Living Lab activities to be supported by the application types - presented in section 5.2, and issues of concern when applying the framework - presented in section 6.

The steps of the collaborative identification and reflection process are laid out in Figure 1.

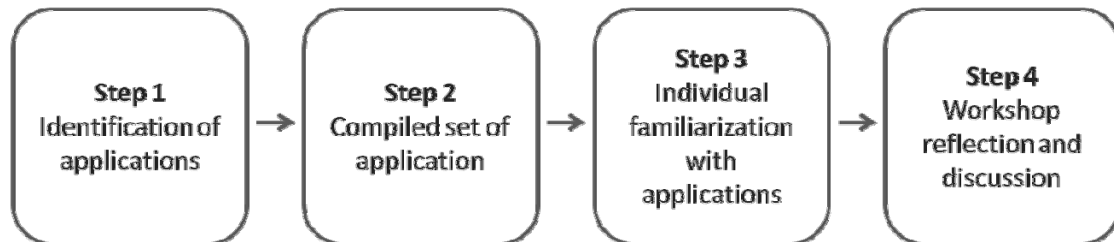


Figure 1. Overview of the four steps of the collaborative identification and reflection process.

5. TYPES OF APPLICATIONS AND HIGH LEVEL LIVING LAB ACTIVITIES

5.1 Application Types

A process-oriented classification of applications and application types were made during the first two steps of the collaborative identification and reflection process, and refined during the workshop. The innovation process phases are motivated from a classical sequential process model as described by Rothwell (1994). Table 1 presents the identified application types as well as their mapping relative to innovation phases.

Table 1. Types of applications for online user involvement of relevance for Living Lab innovation

| Innovation process phase | Application types | Example applications |
|---|--|---|
| Analysis and inspiration | Applications for cultural probing. Inspirational material in the form of text, images or videos are collected from participants as responses to tasks. May include social functionality enabling participants to rate, prioritize, comment, and discussing each others contributions. | Syncrowd (syncrowd.com) Piip (piipl.net) |
| Ideation | Idea capture and management. Users are invited to contribute suggestions or ideas, typically as text and possibly an image. Participants are encouraged to rate and comment each others contributions. Brand representatives may respond to contributions. Can be framed as general purpose idea portals (UserVoice and Get satisfaction), or as innovation challenges of limited scope (Induct software). | UserVoice (uservoice.com) Get satisfaction (getsatisfaction.com) Induct software (inductsoftware.com) |
| Early development | Feedback on early visualizations. Users are invited to contribute feedback on images/screen shots showing concepts, wireframes, or web pages lay out. Feedback is given as annotations or notes in the image, and may be contributed by user participants, clients and the design team. | Notable (notableapp.com) Notebox (noteboxapp.com) |
| Late development | Feedback on running websites. Users are invited to contribute feedback as comments in discussion threads located in panel adjacent to the website. Users can navigate in the website while having the commenting facility available. Unmoderated usability evaluation. Users are presented to the website and asked to do tasks, such as report on their understanding of the web page (Fivesecondtest), click on a particular location in the UI (Chalkmark), or use specific functionality and find specific content (Loop 11). Applications may include functionality for participants' reporting of task outcome or measurements for time spent on task. | Critique the site (critiquethesite.com) Fivesecondtest (fivesecondtest.com) Chalkmark (optimalworkshop.com) Loop 11 (loop11.com) |
| Multiple phases of the innovation process | Feedback management. Users are involved as long term participants in innovation or development projects, to contribute feedback on ideas, concepts and designs at different levels of sophistication. Questionnaire surveys. Typically these applications allow qualitative and quantitative data collection from a large number of respondents. Participants may be presented to images and video in addition to text-based questions. Group interaction is typically not supported, even though exceptions exist. Social content management. Application categories include blog platforms (such as WordPress), media platforms (such as VIMP), discussion thread solutions (Disqus), wiki services (such as Wikispaces) and social network platforms (such as Ning). Users may contribute by commenting, rating others, uploading images or videos, writing posts, or adding to content provided by others. Due to their general purpose character, applications for social content management may support co-creation in all phases of the innovation or development process. | Revelation (revelationglobal.com) Survey Monkey (surveymonkey.com) PollDaddy (polldaddy.com) WordPress (wordpress.com) VIMP (vimp.com) Disqus (disqus.com) Wikispaces (wikispaces.com) Ning (ning.com) |

5.2 High-level Living Lab Activities

Two high-level Living Lab activities, relevant across multiple process phases and supported by different types of online applications, were identified and detailed in the workshop. These are summarized below.

5.2.1 Short Term Campaigns

Short term campaigns are characterized as activities aimed at getting user input in a particular innovation phase, for example a cultural probing or an ideation activity. Such activities typically involve a large number of participants, and may share characteristics with a crowdsourcing (Brabham, 2008) approach to innovation. Large numbers of participants are held to improve the chances of getting valuable input. Also, large numbers of participants may improve the reliability and validity of findings, for example when using online applications for user feedback or remote usability testing.

Short term campaigns allow for the involvement of also moderately motivated participants. The duration of user participation is to be short and the level of participant commitment may be low. Applications for cultural probing, idea capturing and management, and questionnaire surveys are assumed to be particularly suitable for short term campaigns. The following characteristics were seen as particularly important:

Easy access: Easy access to the study is critical as participants cannot be expected to comply with access procedures requiring them to remember for example user names and passwords. Easy access may require direct access through a link (as is typical for online questionnaires) or ability to comment and vote without having to go through an extensive process to establish a user profile.

Simple interaction: The participants of short term campaigns cannot be expected to prioritize learning a complex application. Interaction mechanisms need to be intuitive and easy to use. All needed functionality need to be immediately visible and understandable. The user's options should be few and self explanatory.

Simple setup: In short term campaigns, the study administrator typically will need fast and simple set up and configuration for a particular study. Highly targeted applications typically require less modification for the individual study; the prize to pay for this being limited flexibility.

5.2.2 Maintaining Long Term Relationships

Maintaining long term relationships in many ways hold the opposite characteristics of short term campaigns. Living Lab studies often aim at involving a group of users across a longer period of time. In such studies, the users may participate in both traditional face to face user involvement activities as well as online participation; however, the applications to online user participation need to support a deep involvement and engagement in the user group. The number of users involved in long term relationship studies is typically low compared to that of short term campaigns. Also, the participating users need to be highly motivated.

Long term relationship studies allow for in-depth knowledge of the users and their experiences, and may be part of an ethnographically oriented (Hoving, 2003) or social construction approach (Pierson & Lievens, 2005) to innovation. Applications for feedback management and social content management were considered as particularly suited for supporting long term relationship building, but it was also considered that some applications for idea capturing and management could be used to support long term relationships. In particular, the following may be key criteria for supporting long term relationships in a Living Lab context:

Participation through user profile: The participants need to be identifiable to each other in the online environment; participants need to establish profiles prior to contributing. Profile set up should be easy and fast, but cannot be excluded as in the case of short term campaigns.

Interaction with participants: Fine grained interaction between researchers/moderators and participants, as well as among participants, needs to be supported. The applications need to be social, supporting comments on contributions and messages between participants and also study administrators. Due to the asynchronous nature of the interaction, notification mechanisms (such as e-mail notifications) are needed to alert participants to relevant new contributions.

Management of activities: The participants are likely to engage in several tasks or activities during their participation. In consequence, managing and guiding the participants through the different activities should be easy and efficient to the study administrator.

6. ISSUES RELATED TO THE FRAMEWORK

The collaboration and reflection process also served to identify issues related to the framework. In the following we present three issues relevant to Living Lab representatives considering implementing online applications for user involvement in the Living Lab.

6.1 Early Phase Rather Than Late Phase?

Online applications supporting early phase user participation were suggested to be more relevant than those supporting later phase participation; that is, the phases of analysis and inspiration, ideation and to a certain degree early development. For Living Lab innovation purposes, user involvement related to running applications was seen a stepping stone to suggest new products and services rather than to improve on the existing applications.

One important reason for focusing on the early phases of the innovation or development process is that co-creative activities with users is seen as more useful when it targets the utility of products and services, rather than the usability. Early phase activities target concepts for high level functionality, not detailed design. Similarly, late phase Living Lab studies involving running solutions typically target changes of user practices and new uses of the solutions, rather than the identification of usability problems in the context of the user.

This leaning towards early phase (or utility) rather than late phase (or usability) implies that online applications for user participation needs to support easy communication of ideas, concepts, and suggested uses, rather than detailed design and usability-oriented activities.

6.2 Integrating Online and Traditional Approaches to User Participation

On basis of the identified framework, reflections were made on how to successfully integrate online and traditional practices. In particular, the following is judged to be important: Clarity of purpose, needed resources, and relationship between online and face-to-face activities.

Clarity of purpose: As seen from the previous sections, applications for user participation may be used for a range of activities spanning the entire innovation process. In consequence, it will be critical for Living Labs taking up such applications to establish a clear understanding of the particular Living Labs activities they aim the applications to serve. Some applications are more flexible than others, but no current applications were found to cover the entire spectrum of possible activities. As Living Lab administrator, it may in the long run be useful to look for a set of applications to match your varying needs rather than trying to identify one multi-purpose application. Living Lab researchers comparing applications between cases need to be aware that the performance of a given applications will depend on the match between the application and the activities it is assumed to support in the given Living lab context.

Needed resources: User participation may be resource demanding with respect to study moderation; in particular when using social rather than individual applications. In order to be active and creative, participant engaged through social software will typically need feedback to stay motivated. In particular in early phases of studies involving social applications, it will be important to facilitate participant activity by responding to participant input and support discussions and exchanges between participants.

The relationship between online and face-to-face activities: Online applications for user participation may be seen as a vehicle for communication between participants of face-to-face activities when they are not together; in this respect serving as an augmentation of the participation already conducted by traditional methods. This is particularly so for social applications. However, there is no guarantee that the social applications will have this effect. First, the participants of face-to-face activities are likely to be few in numbers making it difficult to get the social exchange started in the online applications. Second, these participants may already be satisfied with the contributions they have made face to face and therefore be less motivated to participate online. In consequence, Living Lab administrators should consider whether it may be useful to involve other and/or larger numbers of participants in online and face-to-face activities in order to improve the chances for successful user participation through the online application.

6.3 Trade-offs when Choosing Online Applications

As is evident from the framework and the discussions above, choosing online applications for user participation imply trade-offs. This is not unique for this kind of applications; reaching a design application will always involve judgments on opposing forces (Van Duyne, Landay & Hong, 2007). The following trade-offs were addressed during the collaboration and reflection process.

Targeted vs. flexible: Some of the discussed applications are highly targeted, others may serve multiple purposes. Highly targeted applications, such as some of the applications for idea capture and management, include only the minimum of functionality needed to fulfill their purpose. Flexible applications, such as applications for feedback management, include a broader spectrum of functionality and may to a greater degree be configured to meet individual Living Lab requirements and to support multiple Living Lab activities, which in turn may reduce participant and administrator overhead as they do not have to learn to use several applications. The adaptability of a flexible application, however, comes with the price of increased

implementation overhead. Also, a targeted application may be able to serve the one particular activity which it is designed for better than a flexible application.

Deep involvement vs. short term participation: The two key Living Lab activities to be supported by online applications for user participation were held to be short term campaigns and long term relationship. The distinction between these two purposes implies important choices that are to be made with respect to whether the applications should support deep involvement or short term participation. Short term participation require easy access and simple interaction for participants, whereas long term relationship require the establishment of user profiles, rich functionality for interaction between study participants and support for managing user activities. The differences in requirements between applications for deep involvement and applications for short term participations imply that this trade-off should be critical for choice of application for a particular high-level activity.

Application as service vs. software on premises: A final trade-off to be mentioned is relating to the hosting of the application. Typically, applications for online user participation are set up as services, rather than software to run on a server controlled by the Living Lab; however, exceptions to the rule exist – such as general purpose applications for social content management such as blogs (i.a. WordPress) and media sharing (i.a. OS Tube). Applications as services will typically be easier to set up and configure. At the same time, the study administrator needs to rely on a third party for control of the user data which may compromise privacy regulations or client requirements. Also, applications as services may not be as configurable as software to be implemented on premises, limiting the administrators' possibilities to adapt to a given study context.

7. LIMITATIONS AND FUTURE WORK

The presented framework was established as a collaborative effort to provide an overview of application types and related Living Lab activities. We believe that the framework may serve as a basis for the development of future theory and empirical research, and that it also may support Living Lab administrators in understanding and relating to online applications for user participation. As the Living Lab objective of involving users in ICT innovation processing is highly compatible with the aim of e-Society, our framework can be a useful mean towards achieving the e-Society vision.

However, our results may possibly also be seen as contributing empirical knowledge on the needs and requirements for online applications to support Living Labs. As such, the results have important limitations. The collaborative reflection process on which the framework is based on only involved seven researchers from four Living Labs. Consequently, the identified needs and requirements cannot be seen as representing a comprehensive overview of such across Living Labs. Also, as relevant online applications were identified by the researchers participating in the study, there may well exist relevant applications that were not identified. This implies a limitation to the comprehensiveness of the identified application types.

Future research is needed to exploit the framework as basis for theory development and empirical studies on the implementation of online applications in Living Labs. In particular we foresee case studies on Living Lab innovation processes integrating online applications for user participation. Such cases will help us gain deeper insight in the potential benefits and challenges related to online applications in Living Lab innovation. As case studies extend our theoretical basis and allow the formation of hypotheses, experiments or quasi-experiments should be designed to compare different approaches to online user participation, in order to gain insight in their relative performance and fit for given Living Lab activities.

Online applications for user participation clearly will be beneficial for Living Lab innovation. We trust that the initial framework presented in this paper will motivate future research to improve our knowledge in this important field.

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COMMUNICATION TECHNOLOGY AS ENABLER FOR THE COMMUNICATION SPACE

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ABSTRACT

The Communication Space is a part of modern corporate communication and therefore relevant when planning the communication policy of a company. This paper illustrates the change in corporate communication initiated by the developments in Communication Technologies and thus the emergence of Communication Spaces. Communication Systems as part of Communication Spaces are then analyzed in detail, where the matching of fundamental technologies, devices and needs of participants is seen as the main challenge to obtain a powerful Communication System, which can be used effectively for corporate communication in the Communication Space. Communication Technologies as the basic element of Communication Systems are therefore seen as the Enabler for Communication Spaces.

KEYWORDS

Communication Space, Communication System, communication technology, corporate communication

1. INTRODUCTION

The Communication Space is a phenomenon, which is seen recently in the field of corporate communication. Corporate communication itself is an element of each successful corporation and is defined as all communication processes, which provide a contribution to the task definition and fulfillment of profit-oriented business entities and which especially impact the internal and external coordination of actions and clarification of interests between corporations and its stakeholders. (Zerfaß 2007, p 23) Corporate communication is therefore important for each company which converses with stakeholders.

Corporate communication is steadily in transition and subject of change by a number of environmental conditions. (Goodman & Hirsch 2010) During the last years it was especially influenced by the developments in new media and the improvements and shifts in communication technology. Hence corporations have to implicate technological issues into their marketing planning process.

These technological implications also affect the communication policy (promotion) as part of the marketing mix (Meffert et al. 2008, pp 632; Bruhn 2010) of corporations. Recently communication policy is touched by a phenomenon which is named Communication Space – as opposed to traditional communication channels (Grimm & Röhricht 2003). The Communication Space can be briefly described as the sum of all Communication Systems which are used and relevant for the specific aims and needs of the participant. Information can be injected into the Communication Space by using Information Units which build on the selected Communication Systems (Petrovic 2011). The emergence and profile of the described Communication Space is regulated by the development of the available communication technology.

The purpose of this paper is to describe the relevance of communication technologies as Enabler for Communication Systems and in the end Communication Spaces. To illustrate these relationships a model of a Communication System, which includes the needs of the participants, fundamental technologies and devices will be drawn as contribution of this paper.

2. CORPORATE COMMUNICATION AND COMMUNICATION SPACES

2.1 Corporate Communication in Transition

Corporate communication is strongly interconnected with social communication, which on the other hand relies on Communication Technologies. Communication Technologies have been alternated and renewed permanently throughout history and have therefore changed social communication. Each stage of development of social communication radically modified the way, corporations communicate - beginning from communication based on assembly (age of orality), continued by communication over distance with e.g. letters (age of literacy) until the introduction of electronic Communication Technologies with e.g. a telephone (age of electric mass media), which enabled electronically mediated communication. (McLuhan 1962; Schönhagen 2008) These three main stages of development can be enhanced by the age of digital interactive media or 'new media'. (Logan 2010) This last period in the progress of social communication, which is based on electronically mediated communication and especially on online and mobile Communication Technologies, is the focus of interest and has to be further analyzed.

Several technological and environmental factors that influenced and changed communication can be identified. (Goodman & Hirsch 2010, p 45; Kolo 2010, p 284) When corporations plant a message into the Communication Space they are nowadays mostly *location-independent*. It does not matter where the communication participant is at the moment. Mobile and online communication technology enables communication almost independent of different locations, e.g. the front of a TV screen. But also specified *location-based* communication is possible, which means customers are especially approached with a message if they enter a defined place or area. Corporate communication also got *time-independent*. The message can be placed into the Communication Space independent of the participants' availability. He accesses the information independently whenever he has the need to do so or when a certain alert or filter is activated in an e.g. RSS-feed (*automation*). The participant also chooses the device with which the message should be retrieved, which meets the criterion of *platform-independency*. The message itself is *multi-modal*, which means corporations cannot only choose between text or graphics or audio, but have the possibility to generate a message in various hybrid forms. A special criterion of modern corporate communication is that customers can influence the communication itself, by participating in the communication process and generating individual content (*user-generated*). This enables a fast and easy feedback for corporations. Wikis, Blogs, Social Media or Forums are possible ways to express an individual opinion and participate. And these forms are *transparent*, which means a published message is available for a large audience within seconds. Most of the communication content is also *searchable*, which makes the retrieval of specific information out of the Communication Space easier for participants. All mentioned factors are dependent on the available Communication Technologies, their established fundamental technologies and the devices of the participants. This illustrates that the change of corporate communication is driven mainly by the development of Communication Technologies, which enhances the traditional thinking in corporate communication policy. Marketing literature proposes that the planning and development of a certain communication strategy is the first step in communication. Subsequently specific media are chosen out of the given set of available communication instruments. The media taken into consideration are designed to transport the message afterwards. (Kotler 2011, pp 789) The illustrated criteria show that change in corporate communication is based on communication technology. Therefore changes in communication technology should influence the communication instruments taken into consideration and finally the corporate communication policy itself. This extension of the traditional thinking could include evolving capabilities of Communication Technologies into the planning process and improve corporate communication. (Petrovic 1995)

As example to depict these changes in corporate communication, one can think about the coverage of the Austrian television program ORF1, which has decreased from 61.7% in 1991 to 31.3% in 2010. (Mediasearch 2011) To go back even further, in 1964 80% of all US-Americans read a newspaper on a daily basis. Nowadays these figures declined to just around 40%. (Logan 2010, p 65) These examples indicate, that the increase of available Communication Technologies and media lead to the usage of even more different 'marketing technologies' and 'channels' to communicate. A so called "*Long Tail of Communication*" emerges. (Petrovic 2011) Corporate communication can not only focus any more on single channels to communicate the message – the Communication Space has to be taken into consideration.

2.2 The Communication Space

The change in corporate communication based on the developments of communication technology formed the Communication Space phenomenon. With the rise of electronic media in general, the theoretical models of a Mediated Communication Space (Krotz 1995) and an Electronically Mediated Collective Communication (Burkart & Hömberg 1998, pp 32-36) were developed. Build on this model for electronic media, as representatives of the third age of social communication, the Communication Space was developed as another model for the description of the communication process for corporations in the fourth age of social communication respectively new media. (Rössler 1998; Petrovic 2011)

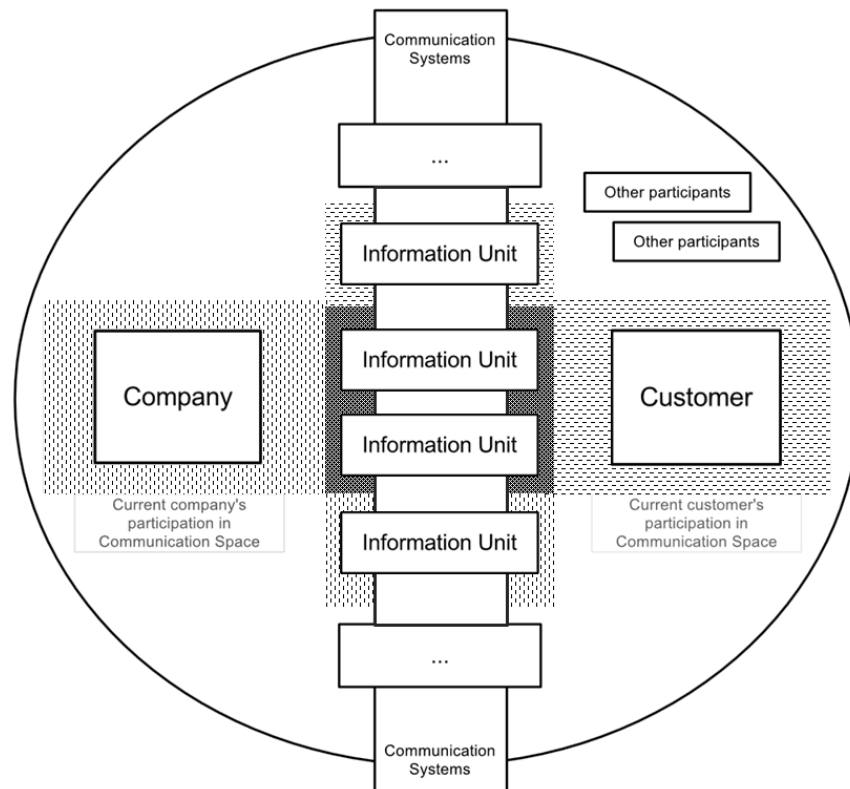


Figure 1. Model of the Communication Space

Figure 1. Model of the Communication Space, illustrates the model in detail. (following Petrovic 2011) The main statement of the *Communication Space* for corporate communication policy is that the target audience of the communication process moves from an individual receiver of a message to the Communication Space and his participants. Corporations should therefore aim to efficiently handle and effectively deal with the Communication Space as a whole. The Communication Space consists of companies and customers as participants of the Communication Space as well as of other participants, who could be customers, suppliers, other corporations but also uninvolved third parties. Communication Spaces do also have a various number of Information Units which use Communication Systems to transfer information between participants or to plant a message into the Communication Space.

Communication Spaces have *participants* as a fundamental element. On the one hand participants are *companies*, which use the Communication Space to communicate a message about their products or services or pursue any other aim of the corporate communication strategy. On the other hand there are *customers*, who use the Communication Space to satisfy their communication needs and participate in the Communication Space by providing or sharing content or by specifically using individual Information Units. Finally there are *other participants*, who are not part of the shared Communication Space of company and customer but could possibly be a part of one of their individual Communication Spaces. These participants could be other customers who give ratings about products on the Internet, suppliers of the company who build their own

brand image, other corporations who try to entice new customers or also uninvolved third parties who do not influence the relationship between company and customer at all.

Communication Spaces are based on *Communication Systems*. Communication Systems are strongly interrelated with Communication Technologies and include elements like established fundamental technologies and available devices. Examples of Communication Systems are Facebook, websites in general or applications. It is important to mention, that Communication Systems are not a specific website, application or Facebook page, but the general system behind these structures or the provided functionalities. Corporations choose which of the available Communication Systems they use, depending on their individual communication policy. (Petrovic 2011)

Inside the personal Communication Space, corporations are able to choose which and how many separate *Information Units* they deploy. Information Units are e.g. single applications, a company website but also a TV spot as classic medium to transport a message. Information Units are used to place messages into the Communication Space. Companies are able to design these Information Units around the potentials, which the underlying Communication System is providing, but must also be aware of the limitations of the Communication System. The participants choose which Information Units they would like to experience. They can also participate in the Information Unit, e.g. by providing user-generated content or sharing information. These participants are nevertheless bound by the potentials and limitations of the used Communication System.

Companies, customers and other participants create their own *individual Communication Space* by their choice out of the available Communication Systems and Information Units. The participants act within, participate at and experience their personal Communication Space. Companies and customers generate a *shared Communication Space* when they use the same Communication Systems and Information Units. Thereby, the Information Units which are provided by the company but not used by the customer, fall out of the shared Communication Space, but are maybe relevant for the communication with other customers.

3. THE COMPONENTS OF A COMMUNICATION SYSTEM

The provided Communication Space gives a new thinking about the actual possibilities in communication. The Communication System hereby acts as the major component between participants and Information Units. By the usage of these systems in combination with a communication aim, one or more Information Units can be created to place a message in the Communication Space.

Communication Systems and their development are strongly influenced by the utilized technologies. New developments in areas of technology impact Communication Systems and even create new such systems. As all of these new systems belong to the tertiary systems of communication some kind of device to retrieve the message has to be used by the recipient. (Beth & Pross 1976) The user has to interact through these devices to participate in the Communication Space. Besides these physical components, technical functionalities play a major role to establish a new Communication System too. The functionalities work as a fundamental component that supports the communication process, enhances the possibilities and enriches the Communication System for a specific purpose by satisfying communication needs. Both parts, the device as well as the fundamental technology, have a strong interrelation but do not always have to depend on each other. While some technologies like networking protocols are used within many different devices, others seem to have a more relating connection to a specific kind of device, like geolocation to smartphones. Devices as well as established fundamental technologies are both components within the area of communication technologies and both their developments have an impact on the Communication Space.

3.1 Devices as the Physical Part of Communication Technologies

Devices are the perceptible access point to information and therefore are often the only physical objects in the communication process. These objects had very different forms – starting from symbolic gestures to demonstrate power, religious figures on statues or coins, to smartphones and tablet computers recently. (Frevel 2003; Würdler 2009) After Gutenberg's letterpress in the 15th century, the start of broadcasting via radio and television, the so called Digital Revolution (Hiebel et al. 1998), starting in the last century, brought new possibilities of mass communication to a broad audience. What these latter forms of communication

have in common is their need for a device to receive the message, regardless if they require radio or television receivers or some kind of computer system. Schiller (2003) distinguishes communication devices into four categories: (1) stationary fixed and wired, (2) mobile and wired, (3) fixed and wireless, and (4) mobile and wireless. Especially mobile wireless communication got into focus in the last years.

Observations confirm that even if a device was initially created for a specific (communication) purpose it can capture other forms of communication too - in case of mobile phones the additional utilization of established fundamental technologies like network protocols to connect to the internet, or the integration of multimedia player for audio and video content. A device with its originally intentioned purpose can so be upgraded to further application areas. The possibilities for additional usages depend on the matching between technology and device. Another example are car navigation systems which were initially intended as supporting systems, but the display's attributes like the size of the screen or the already integrated speakers also fit multimedia intentions like playing music or even videos. Examples for devices in the communication process are radio and television sets, stationary and mobile computers, smartphones, tablet computers but also many other devices that take place in this process like navigation systems. Even company specific products that carry information and work in combination with another system can act as a Communication System in a wider range of view. Examples here can be the tracking device of the Nike+ system or near field communication (NFC) enabled carrier devices.

3.2 Established Fundamental Technologies as Enhancement for Communication

The historical development of fundamental technologies to well-established systems is a dynamic process of acceptance and distribution. Standardization is a crucial step for new technologies, which enables a wider spread and achieves compatibility to other systems. (Schmidt & Werle 1998).

Operating systems build the base for modern technology systems and provide the general functionalities of the underlying hardware. Acceptance, standardization and a wide spread are important enablers for operating systems and technologies in general, and lead to confidence for users to use them. In case of operating systems a well-versed workflow for all kind of operations is important to users whereas software developers benefit by reducing the amount of platforms to deploy their software to. Additionally open source code builds a stable and transparent basis for companies and developers to create further applications atop the provided code.

Like in operating systems, layers are important abstraction models in all areas of technologies too. Technologies are integrated in all different layers and supply other systems that work on top of them. QR codes are a modern way to interact between the real and the virtual world. By scanning a special tag from paper or other media the standardized system interprets the symbolic image and matches it to a predefined function. The system can so be used to promote a website's URL in print media without requiring the reader to enter the long URL but just scan a tag. The technology thereby utilizes many other technologies by combining photo or video capturing with the Internet protocol HTTP to redirect the user directly to a website. The QR code technology adds a protocol to interpret the tag and manages the linking between the scanned image and the corresponding subsystem, like opening a website or displaying contact details in case of virtual business cards. (Knuchel et al. 2010)

Usually technologies do not only enable the communication process between humans and computer (human-computer interaction) but also communication between different machines. The "Internet of Things" describes systems that interact between each other without the involvement of humans due to the use of standardized technologies e.g. near field communication (NFC). Examples for established fundamental technologies in the communication process are network protocols like TCP/IP or UDP, networking technologies like WIFI or 3/4G, operating systems, multimedia systems like movie, image and audio compressors, tagging technologies like the QR code, near field communication systems or geolocation systems to locate where the act of communication takes place.

3.3 Needs as Motives for Communication System Usage

After specifying the importance of devices as physical objects and the integrated technology layers, the participant's need is the trigger for using any of these communication technologies. Humans have motives for

using media and technologies, which can form manifold characteristics. Maslow showed with his pyramid how different human needs can be seen as in levels. (Maslow 1943) In the context of media and the consumption of media the most rational aspect is the *cognitive motive* to gather information or knowledge. The focus of the *affective motive* is to get entertained, while the interaction with other human beings is a *social motive*. The last motive of media consumption is a *self-expressing* one, which indicates that media is used to build an identity towards the utilization. (Schweiger 2007)

The traditional sender-receiver communication model mainly implicates the coverage of cognitive motives whereas the thinking in Communication Spaces allows integrating other motives too. The opportunities of connectivity thanks to Social Media, Weblogs and other systems, brought the customer closer to the sender and created new ways of interaction. Besides the usefulness of new technology also the ease-of-use shows high importance in the acceptance process, which can be determined by the Technology Acceptance Model (TAM). (Davis 1989).

4. THE MODEL OF THE COMMUNICATION SYSTEM

Instead of media channels, Communication Systems build the basis for the implementation of Information Units that hold the information or message. These units are built on already established Communication Systems where a target group is expected to participate. Innovative companies may even develop new Communication Systems to realize new ideas and deploy individual Information Units. The message creator as well as the customer participates in their own Communication Space by the utilization of different Communication Systems. When creator and target utilize the same Communication System the implemented Information Unit can connect both parties and therefore unfold a managed communication process.

The process implicates that generally the customer, as a user of a system, already participates in a Communication System and is also well versed in using it for his own personal purpose. This is generally linked to the person's *need* where the person tries to find satisfaction by using the specific system. The need is the trigger to participate in a Communication System and so has no direct relation to an Information Unit. The systems are not necessarily built for marketing purposes but for an interaction between participants – gradually possibilities for marketing and promotion activities may evolve.

Communication Systems require and use different *communication technologies*. The here presented model divides the term of technology into *physical devices* and *fundamental technologies*. As different devices are used in diverging contexts and environments, Communication Systems and their access varies by the characteristics of each device. This does not implicate an entire independence between devices and their integrated and used fundamental technologies, but explains that not all technologies combine well with every kind of device. While some rudimentary technologies like protocols for network operations empower devices to interpret data on a standardized level, others are associated with specific chances of use.

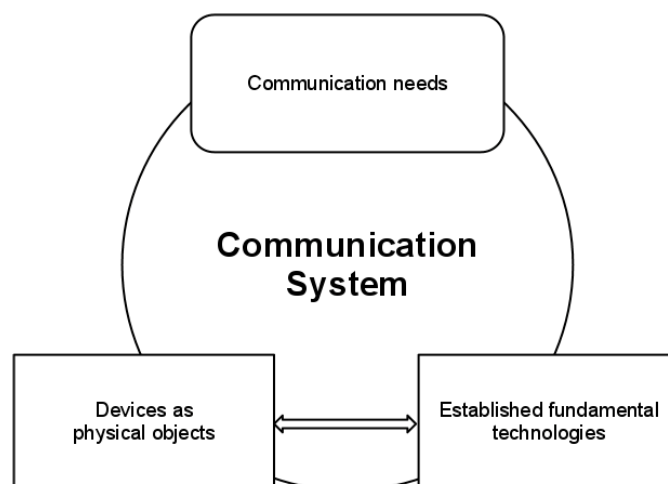


Figure 2. The interdependent factors of Communication Systems

As Figure 2 shows, a Communication System is described by the following three factors: the communication needs, the physical devices where the system is used on, and fundamental technologies the system is based on and also connects to. All three elements work in a connected environment, which are important parameters when thinking about developing an Information Unit based on a Communication System. Facebook or the location-based social networking website Foursquare are examples for different possibilities of Communication Systems due to varied combinations between used communication technologies. The concept of building a connection between people through their current location is realized by geolocation technologies like GPS or network triangulation. Thanks to the same latter technology this works on stationary computer systems too, but the mobility of smartphones keep people in permanent contact and allows to constantly check-in to different locations. Tagging via QR codes is another technology that is typically used in combination with smartphones but not stationary computers. Although both devices integrate the same fundamental technologies (video camera, network protocols) only the more context-specific opportunities of the usage by smartphones create a sufficient additional benefit.

5. CONCLUSION

The immense possibilities due to the usage of new communication technologies changed the way of corporate communication from a traditional sender-receiver model to the new model Communication Space. This Communication Space is based on Communication Systems that enable the transport of information between participants. The introduced model of Communication Systems explains how the needs of participants are satisfied by the utilization of communication technologies that consist of fundamental technologies and devices.

The employment of the model allows marketing strategists to specifically select appropriate Communication Systems as the developed factors characterize the system. Based on the model, Communication Systems cannot only be selected but also the implementation of Information Units will be supported. The development of Information Units is supported and new marketing possibilities are emphasized when the three factors that characterize a Communication System are kept in mind.

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INTERACTIVE SERVICE FOR TRANSCRIPT ANALYSIS AND VISUALIZATION

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ABSTRACT

Discussions on plenary sittings in the assemblies are recorded and usually published in a form of documents - transcripts. Those documents contain large amount of unstructured text from which is difficult to easily determine the topics of the discussion or to have a quick overview. For this reason, suffix-tree structures were investigated as a potential structure for transcript visualization. If content of transcripts is treated as data and properly structured then statistical analysis can be performed and a new perspective can be presented to the reader. We have developed a prototype visualization service with continuous integration with parliamentary website. Since this system serves as a document repository, we introduce a method for historical analysis and visualization for selected period of time. Currently the service operates on a corpus of over 20 years of transcript documents. New approach for interactivity between visualizations is introduced. This paper discusses the structure, algorithms and techniques for an interactive public service for analysis and visualization of transcripts from plenary sittings.

KEYWORDS

Transcript, Visualization, Suffix Tree, Word Tree, Word Cloud

1. INTRODUCTION

One of the main objectives of the modern parliaments is to make lawmaking processes as much transparent as possible. Global Center for ICT in Parliaments (2010) compiles annual report and defines directions for development in parliaments. One of the main recommendations of the latest report of Global center of ICT in parliament is improving transparency of the legislative processes by enhanced access to information. In this manner the Assembly of Republic of Macedonia publishes documents related to the work of the assembly and its committees (Inter-Parliamentary Union, 2009). Transcripts of plenary sittings are published and publicly available to the citizens.

This paper introduces a service that processes transcripts and provides new graphical representations of the data in those documents. We use two visualization techniques on single documents: word clouds and word trees (Andersson, Larsson and Swanson, 1999; Wattenberg and Viégas, 2008; Gambette and Véronis, 2009). The prototype service practically represents a tool for advanced statistical analysis of the transcript documents (Hearst, 1995). Considering that this tool is implemented as an online web service, citizens are able to perform own quick analysis and generate visualizations. Documents that are processed by the service are taken from the public website of the assembly through integration infrastructure. Once the visualization is generated it can be then published and used for further discussion (Heer, Viégas and Wattenberg, 2007; Danis, Viégas, Wattenberg and Kriss, 2008). Having on mind that this system also serves as a transcript repository, options for even more detailed historical analysis on the documents are available. In that sense we introduce the third visualization Word Distribution Chart. This representation is analyzing historical distribution on a given word or phrase for specific period of time.

The problem of visualization of unstructured data is known to the scientific community and in general it is solved with word suffix tree structures (Andersson, Larsson and Swanson, 1999; Alur, 2007; Gambette and Véronis, 2009). Inenaga and Takeda (2006) suggest improvements and optimizations on those structures. Currently exist a few different online services for visualization of text documents (Viégas, et al., 2007; Spoerri, 2007; Danis, Viégas, Wattenberg and Kriss, 2008). Usually those services require that user manually

submits the document. None of the existing services has implemented integration with some transcript source, in this case parliament website.

Our aim in this research is to describe the design of system that provides easy to understand interactive visualizations of the transcript contents. We focus on two goals: automatic retrieval and import of transcript documents and the interactive combination of some visualization methods. Statistical data that is contained in the transcript document will be transformed by this service and visually communicated with the user. Prototype service is already implemented and publicly available. This service provides valuable results to our primary users – citizens (Lathrop, Ruma and Steele, 2010), and: media, journalists and analysts as secondary users.

In Section 2 we will provide a brief overview of similar solutions and work of others. Section 3 outlines the core functional modules, their problem domain and solutions. Data structures, algorithms and interactivity are covered in Section 4. Section 5 discusses the advantages, disadvantages and future work.

2. RELATED WORK

At 2007 the newspaper New York Times introduced a webbased tool “Transcript Analyzer” that provided visual representation of text records of debates. This tool calculates total number of words for each speaker of the debate. If a speaker is selected then the tool highlights areas in the transcript document where selected speaker participated. Statistical information like total speaking time for participant and overall total speaking time information is presented. Unfortunately this tool is only available for selected transcript documents of some debates and it does not provide option for uploading document for analysis or integration with source of transcript documents.

Many Eyes (Viégas, et al., 2007) is another online visualization tool. Data is manually uploaded by the user and then visualizations can be generated. For instance in the text analysis category there are four visualization engines: Word Tree, Tag Cloud, Phrase Net and Word Cloud Generator. Many Eyes is not specialized for transcripts visualization and it doesn’t have module for automatic transcripts retrieval.

Processing is a programming language and tool for generating custom visualizations. The main idea behind this language is to get the non-programmer users to start with programming by using instant visual feedback. Beside the fact that it is very flexible language, still it is not intended for regular users that require instant results from some analysis.

All referenced systems operate on a data set that is provided by the user. The biggest advantage of our proposed service is that documents are automatically transferred from source location - parliamentary web site. This allows us to create local document repository and execute more complex statistical computations over subset of transcript documents instead of visualization of a single document.

3. MAIN SERVICE MODULES

We have organized the modules in our service around three main problems. First problem is data integration with the transcripts source. Second problem is indexing and storing documents on the visualization service environment, and the third problem is statistical analysis and visualization

3.1 Module for Transferring Transcript Documents

The main advantage of this solution is the continuous integration with actual source of the documents. That means automatic retrieval and transfer of transcript documents from location A to B. We define the two locations as: “source” meaning web site of the Parliament and “service” meaning location of the visualization service. All documents are published at source location and all visualizations are provided on service location. Figure 1 represents the communication steps between service modules and source system. Someone may argue the need for replication of the transcript documents on the two computing locations. The idea for local replication of transcript documents is based on following considerations:

- Visualization service is independently isolated from the parliament website. If for some reason parliament website goes offline, the service will continue running without interruptions
- Fast loading of documents. Analysis and visualizations are not limited to the speed of the interconnection link between two server locations. Documents are directly loaded from the local database, instead of the source location
- Performing historic analysis. Advanced analytical queries can be executed on a set of transcripts. One of the proposed visualization actually is providing word distribution analysis.

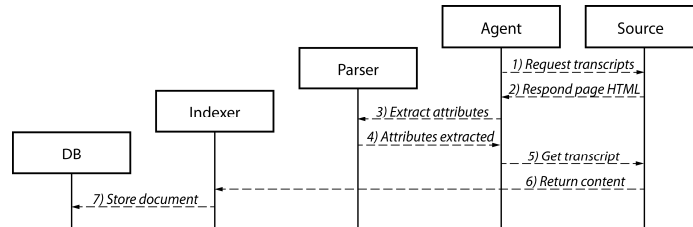


Figure 1. Communication flow in document transferring module.

Parser module is using regular expressions for attribute extraction operations. Software agent periodically checks source website for new published transcripts and then documents are transferred to the service location where they are preprocessed before storing to the local document repository.

3.2 Module for Indexing Transcript Documents

Index used in our approach is composed of transcript document contents and session attributes. Unlike the regular search engines where search results are ordered by relevancy, in this particular case we propose that search results are ordered chronologically. Chronological order is necessary because results are displayed on a chart diagram.

Transcript documents can be published on the source web sites in any of following file formats: Portable Document Format (PDF), Microsoft Word Binary Format (DOC) or Office Open XML (DOCX). As such document needs first to be converted into readable plain text format. The conversation process consists of filtering formatting information and extracting plain text content. Figure 2 shows this procedure.

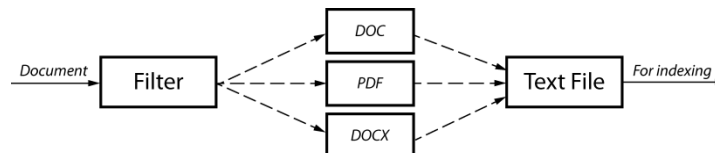


Figure 2. File conversion procedure.

Once the content is ready for indexing, first it is stored as text in the relational database and second it is indexed by full text search engine. Besides indexing transcript content, also attributes that were extracted by Parser module are included in the index. This is required for sorting the results and presenting contextual information in the search results.

3.3 Visualizations Generator Module

At this stage, our service supports three visualization types: Word Cloud, Word Tree and Word Distribution Chart. Word Cloud representation consists of list of words with different font size. Size of each word is proportional to the number of occurrences in the document. Word Clouds differ by colors and layout. Figure 3 is Word Cloud visualization generated from our service. Size and position of each word is calculated by the frequency of occurrences. Words with higher frequencies are bigger and more positioned to the center of the visualization and words with lower frequencies are smaller and located towards the edge of the visualization.



Figure 3. Word Cloud visualization from our service

We base this visualization on the following aesthetic principles:

- A1.** Words with higher frequencies are more noticeable
- A2.** Words with higher frequencies are positioned toward the center of the Word Cloud
- A3.** Favor symmetry and balance

Noticeability factor mentioned in A1 is solved with size of the text, higher the frequency larger the text. Another option for adjusting noticeability is to use an optical characteristic – opacity where words with higher frequencies have more translucent characteristics (are more visible) and words with lower frequencies have more transparent (are less visible) optical characteristics.

Word Cloud visualization communicates statistical information on the most frequently used words in the discussion. From here user can directly determine topic of the discussion. The disadvantage is that user is unaware of the context where the word is used. Next visualization - Word Tree solves this disadvantage by showing the context where and how specific word is used.

Word Tree visualization represents a structure of all the words that are followed by a given word or phrase. Tree structure is not observable in the transcript documents without previous computation and analysis. It is deduced from the document content and is different for each root word or phrase. Wattenberg and Viégas (2008) define it as a form of keyword-in-context (KWIC) structure. Word Tree visualizations in our service are generated on a single document level. User selects transcript document and root word or phrase and then service generates suffix tree structure and word tree visualization. Once the visualization is generated, user can browse the tree branches and analyze the words followed by each KWIC word. Figure 4 is an example of word tree visualization from real transcript document.

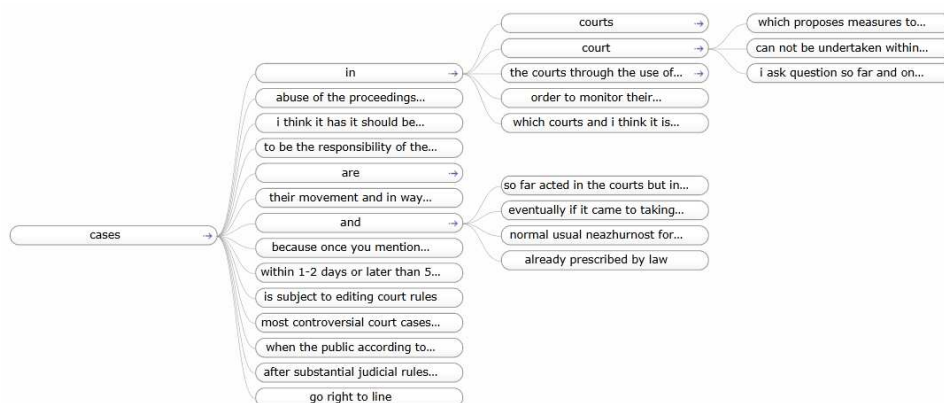


Figure 4. Sample Word Tree visualization.

The advantage of Word Tree view is that it instantly visually communicates the sentence structure for the given root word or context. This view can be further extended with aesthetic principle A1 defined in the

Word Cloud visualization. On the other side the biggest disadvantage is that user needs to know and enter the root word. Usually users are unaware of the topic of the discussion and they don't know the context word. In order to surpass this disadvantage we propose that entry in the word is a word from previously described Word Cloud visualization. In this combined system user first selects a word from word cloud and then that word is used as context for word tree visualization.

The main goal of Word Distribution Chart is to provide analysis on a set of transcript documents, for instance how a given word or phrase is used across transcripts for some period of time. Let's consider this simple scenario: A user wants to browse the discussions where act on "e-commerce" was discussed. Instead of going through each transcript document and evaluate, he can execute a new Word Distribution Chart search and in the results can clearly see where that subject was most argued. Figure 5 shows a sample result of this visualization.

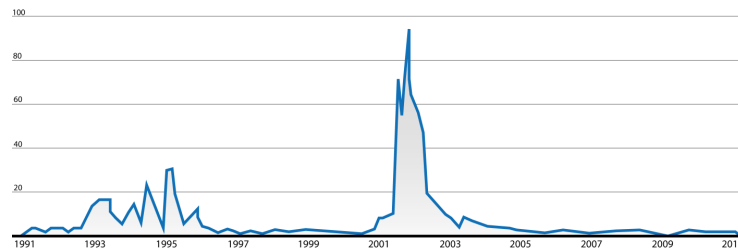


Figure 5. Word Distribution Chart

Generally search engines display results in a list that is arranged by relevance. The most relevant documents are shown on the top of the list followed by less relevant ones. In Word Distribution Chart we show search results in different arrangement they are chronologically positioned on the x-axis starting from the oldest document and to the latest. X-axis is representing discussion date and Y-axis is representing the number of occurrences or relevancy of the search results. We propose a further extension of this chart with functionality for comparative analysis. The idea is to analyze more than one word and their distribution in transcript documents. Figure 6 presents results from comparative word distribution chart.

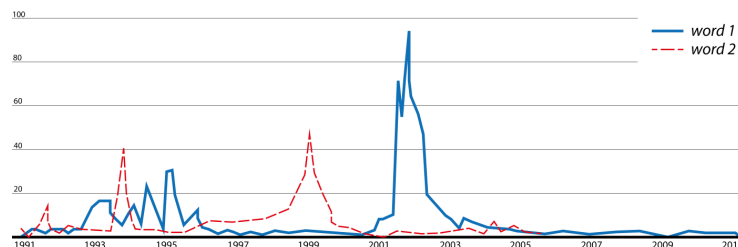


Figure 6. Comparative Word Distribution Chart

The interactivity approach that we used in Word Cloud and Word Tree visualizations can be applied for Word Distribution Chart. Instead of just static representation of search results, we use this view as an entry point for other two visualizations. By selecting a search result point user can drill down and use that point for Word Cloud and Word Tree visualizations.

4. IMPLEMENTATION CONSIDERATIONS

In a Word Cloud visualization two computational problems are considered: first one is to create sorted list of top n words from a set of M words; and second is to display those words on a two dimensional surface according to the aesthetic principles A1-A3. Algorithm is presented in Table 1.

Table 1. Algorithm for generating list of most frequent words in text

| Step | Action |
|------|---|
| 1 | Find all distinct words K from a set of words M ($K \subseteq M$) |
| 2 | Remove all irrelevant words (stop words) |
| 3 | For each distinct word k ($k \in K$) calculate and assign number of occurrences – frequency |
| 4 | Sort elements in K by frequency, in descending order |
| 5 | Create subset N of first n words from K ($n \leq K, N \subseteq K$) |

Second problem is to arrange all elements of set N on a two dimensional surface. According to first aesthetic criteria $A1$, words with higher frequencies should be more noticeable. For each element n from N , we assign numerical value $s(x)$ where $s(x)$ calculates size of the word on the surface. Size is proportional to the word frequency and is in a range $\min \leq s(x) \leq \max$. Having in mind that all elements in N are sorted by frequency in descending order, for each element n in N ($n \in N$) we apply the algorithm described in Table 2.

Table 2. Algorithm for word positioning

| Step | Action |
|------|---|
| 1 | Assign random x position |
| 2 | Place the word on the position x and move it on the y axis as close to the center as possible until center is reached or collision with other element is detected |
| 3 | Move the word on the x axis toward the center until element is centrally aligned or collision with other element is detected |

Aesthetic principle $A1$ is satisfied by using the size calculation function $s(x)$, additionally this can be combined with additional opacity function $o(x)$ so that words with higher frequencies are less transparent.

In Word Tree visualization we solve two problems, first one is creating suffix tree structure for the given transcript and keyword, and second is calculating positions of each tree node on the screen. Let's suppose that a transcript document is set S of sentences, and that k is a search keyword entered by the user. Sentences are delimited by set of delimiters D . In our case delimiter set D is composed of one element $D = \{“.”\}$.

Table 3. Algorithm for creating suffix tree structure

| Step | Action |
|------|--|
| 1 | Separate all sentences S by using delimiter characters from D |
| 2 | For each sentence s ($s \in S$) separate part of the sentence that comes after keyword k and create a subset of suffix sentences S_j |
| 3 | Create tree node n with keyword k and suffix sentences S_j |
| 4 | For each sentence in S_j use the first word in the sentence to create set of distinct words set K_2 |
| 5 | Add all elements of K_2 as child nodes to the node n |
| 6 | Use each element in K_2 as a keyword and recursively perform steps 2-6 |

After completing the procedure for creating the suffix tree structure, the result will be a structure of linked nodes with parent-child relations. Additionally each node can have frequency of occurrences assigned to it. By using linear function $s(x)$ we can calculate the size of the node. Next step is calculating the optimal position of each node in space. In our case we have routed tree that is treated as a directed graph where all edges are oriented away from the root node. Tree is oriented left to right. Simple tree layout algorithm is used to calculate the position of each node in space. When positions are calculated, nodes are drawn on the surface. We draw quadratic Bézier Curve between connected nodes.

Word Distribution Chart is defined with set of points P each with pair of coordinates x and y . X-axis represents time, and y-axis represents number of word occurrences or relevancy. Those are ranges of valid values are: $0 \leq x \leq x_{max}$, $0 \leq y \leq y_{max}$. We first define linear transposition function $t(x)$ that will transpose date value into numerical positive value, and another function $f(x)$ used for normalization of y values in a range $0 \leq y \leq y_{max}$.

It is highly possible that search keyword will be present only in small number of transcript documents and full-text search engine will return only subset of results R that have *relevancy* > 0 . This means that set R needs to be extended with additional elements that were not included in R . Those points will have x value

calculated from function $f(x)$ and y value will be zero. Table 4 represents the procedure for calculation and drawing of Word Distribution Chart visualization.

Table 4. Algorithm for constructing Word Distribution Chart

| Step | Action |
|------|--|
| 1 | Execute full-text search on the given keyword k |
| 2 | Extend search results R with excluded points |
| 3 | Sort points by their x coordinate in ascending order |
| 4 | For each point p_i ($1 \leq i \leq n-1$, where n is total number of points) draw a line between points and p_{i+1} |

In case of comparative Word Distribution Chart, set of keywords $K = \{k_1, k_2 \dots k_n\}$ is used, then for each keyword k ($k \in K$) execute steps 1-4. In this case different line color or style needs to be used for each keyword line.

In this prototype service we have focused on the interactivity concept between visualizations. Instead of just having static view of the analysis, it is more useful to have the functionality for drill down into different analysis and perspectives. Results of first visualization can be further used as an input to second type of visualization.

In the Word Tree visualization we are facing with a problem of limited visible screen area on one side, and large number of tree branches on the other side. Wattenberg and Viégas (2008) considered this problem and they proposed a method of “level in detail” for solving this problem. Here we propose that instead of automatically opening all tree branches, only first level beneath the root node will be expanded and all other branches will be collapsed. Having in mind that only visible screen area is limited, all other tree branches will be moved into the invisible part of the screen. By clicking on the tree nodes user can further browse and expand all child nodes and so on. Tree can be scrolled so that branches that were hidden can be moved to the visible area of the surface. By hovering on the currently focused node a new popup message with full context text is displayed as shown on Figure 7.

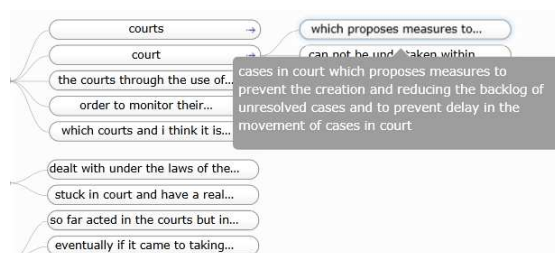


Figure 7. Preview of a full contextual sentence

In a Word Distribution Chart visualization user can select point from the chart and according to our idea use it as an input to other visualization. Since points on the chart represent single transcript document then selected document will be used for Word Cloud visualization.

Client unit currently is implemented as a *Silverlight* application that runs in a browser. An open source library called *GraphSharp* is used for the tree layout algorithms. *QuickGraph* library provides directed graph data structures and algorithms. A set of *IFilter* components are used for converting document formats into plain text. We use an open source full text search engine library named *Lucene*.

5. CONCLUSIONS

Continuous integration between the source of transcripts documents – parliamentary website and visualization service plays an important part in one complete visualizations and analysis platform. In addition to that interconnected visualizations provide drill down functionality and analysis from different perspectives. Furthermore, word distribution chart offers a chronological analysis to set of transcript documents. The architecture of our visualization service can make a contribution in the direction of constructing specialized automated visualizations platforms. On the other side our service deduces and

presents statistical results that are not directly available by manually reading documents. By changing the contents' source this service can be used for visualization of other types of contents instead of transcript documents. The main disadvantage of this solution is the lack of collaborative functionalities. Visualizations can be further extended with functionalities for saving views and debating on the view. The future work will mainly cover the development of additional visualizations and collaborative functionalities.

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THE OPINIONS OF SPANISH FIRMS ABOUT MOBILE SELLING. TYPES OF POTENTIAL M-VENDORS

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ABSTRACT

The mobile phone is now an option that firms are actively considering as a means of selling. In this study, we present the survey results from a sample of 125 firms, in Spain. We outline different characteristics associated with two types of firms (sceptical and receptive) on the basis of factors that either drive or inhibit this type of selling. Online buying has been extensively studied in the literature, but to the best of our knowledge, previous studies have neither analyzed mobile selling in Spain, nor proposed relevant strategies for firms to follow.

KEYWORDS

Mobile selling; enablers; inhibitors; profile; companies.

1. INTRODUCTION

Global penetration of mobile telephony is high and the mobile phone is now the most widely used electronic device worldwide. In 2010, the total number of mobile lines amounted to 76.1 per one hundred inhabitants (ITU). However, the number of lines for every one hundred inhabitants in Europe is much higher, reaching a figure of 120 (ITU). Hence, there are more telephone lines in Europe than there are inhabitants, which is a clear indicator of the importance of the mobile phone for the population. In addition, this data reflects the enormous market that the mobile phone creates and, therefore, the importance that mobile commerce can acquire with this type of device. The large growth in the number of mobile phone subscriptions, over 5 billion worldwide, should be highlighted, many of which have upgraded from 2G to 3G. It is currently estimated that 90% of the world population have access to mobile networks (ITU, 2011).

In the case of Spain, data hardly exists on mobile commerce, however, data may be found relating to the internet population (ONTSI, 2010). According to this study, 29.4% of internautes have acquired some type of service or product through their mobile devices. The type of purchaser is mainly young, with secondary studies and a low social and economic level. The products and/or services that are purchased are principally melodies and songs, followed by participation in various competitions. This trend continues to rise; whereas the number of products acquired, in 2009, was slightly below two (1.96 products/person), it surpassed two, in 2010, but only slightly (2.04 products/person). However, such growth has hardly achieved the real potential of this business channel, as it could still be much greater. Indeed, rather than growth, it suggests a slight stagnation of mobile commerce, in Spain. The report prepared by ONSI (2011), on the basis of the ITC business survey, points out that around 100% of large firms have computers, Internet connections and electronic mail. With regard to small firms, the report shows that 2 out of 3 had mobile phones and computers in 2010; the presence of these technologies is therefore clearly increasing in firms.

In this situation, business management has experienced changes derived from development, introduction and acceptance of new technologies. The mobile phone is acquiring ever greater relevance as a means of commerce. From the initial simple communication device, it has become a complex instrument capable of completing almost any transaction. Bearing in mind the special characteristics of the mobile phone, as opposed to other devices such as the television or the computer (mobility, interactivity, ubiquity, localization and personalization), it should begin to be seen as an appropriate instrument for firms to complement other types of commercial channels (Clarke, 2001, Heng-Sheng and Gururajan, 2005). Mobile commerce may be

considered an innovation in electronic commerce, and firms will therefore use it as an opportunity for growth. We could say that mobile commerce implies a move from a sales paradigm, in which the consumer enters the seller's environment, to one in which the seller enters the consumer's environment, at any time and place, by means of mobile devices (Shankar et al., 2010). We are going to focus on mobile selling (MS), which can be defined as the delivery of products and services through wireless technologies to facilitate electronic commerce, unrestricted by time or place (Liao et al., 1999). Previously, sales were done with other technological devices such as mailings, fixed phone lines or faxes.

The firm can enjoy a series of benefits arising from the particularities of MS, as it is a convenient, rapid, and fully interactive means of communication, which has great potential for segmentation and for promoting customer loyalty. Nevertheless, it represents an important challenge for firms, given that the development of this promising sales channel is still at an early stage. There are also a series of impediments or obstacles to its widespread use, such as inadequate standardization of payment methods. In a review of academic research into mobile business, Scornavacca et al. (2006) found it to be an emergent research area. Thus, the *objective* of this study is to outline the situation regarding MS, identify the motives and obstacles that directly or indirectly influence the adoption, by firms, of MS, and describe types of firms in accordance with their perceived motives and impediments. This is the first study of which we are aware in Spain on types of firms, drivers and impediments that affect MS.

2. MOTIVES FOR AND IMPEDIMENTS TO MOBILE SELLING

As Clarke (2001) affirms, mobile commerce is the ability to buy products anywhere, by means of a device with a wireless Internet connection. Thus, we can say that m-commerce (mobile commerce) is a particular branch of e-commerce (electronic commerce) (Heng-Sheng and Gururajan, 2005). There are studies that consider the adoption of e-commerce by firms (Bradshaw and Brash, 2001; Nguyen et al., 2003), and although studies on m-commerce are increasing, very few concern themselves with the firm (Liang et al., 2007; Shankar et al., 2010). Given the scarcity of such studies that focus on the firm, further understanding is needed of the internal processes of firms that lead to the acceptance of MS and the way they realign their resources to put them at the disposal of this new business channel (Salo et al., 2008). Accordingly, Salo et al. (2008) identified a series of complementary stages that are needed in the MS process for successful mobile marketing. These stages, such as design, content creation, authorization management, delivery, analysis and feedback, may likewise represent obstacles that prevent firms from adapting to this form of business. However, it can also entail an extra motivation for firms that, without having developed the necessary platforms for MS, do possess some sort of experience with these stages in the process.

Obtaining descriptions of a firm typology and a series of motives and impediments for and against mobile sales, acknowledged by firms when they enter the business of mobile commerce, is a complex task. Nevertheless, this is a key theme in the literature on mobile marketing (Liang and Wei, 2004; Shankar et al., 2010). The authors have found nothing similar to the present study in Spain. Shankar et al. (2010) identified a series of pros and cons that should be considered. Thus, the principal motives that drive firms to accept MS are its variety of applications, the price, the utility of the service, the creation and maintenance of networks, ease of use, trust and service security, and privacy of the sale. All these factors can be decisive for decision making by firms when developing mobile commerce platforms. However, they identify, in the same way, a series of impediments on adoption of this business channel. Economic barriers represent an essential impediment, given that firms may not recognize the potential volume of business that mobile commerce can generate. Likewise, other impediments that these authors identify as relevant for firms include limited knowledge and mistrust of the business environment. Resistance to the use of electronic platforms is construed by firms as slowing down their acceptance considerably. In the case of Spain, the principal factors behind the slow development of MS (ONTSI, 2010) are lack of innovation in the services on offer and inadequate standardization of payment procedures.

3. EMPIRICAL STUDY

Information was gathered through telephone surveys, in April 2011. Managers in their posts for at least one year were interviewed. They were required to have responsibility for the Internet services and electronic platforms of Spanish firms with an Internet presence. The selection was by quotas from a panel of firms taken from AC Nielsen, Spain. All of the firms in the sample had a website and were taken from different-sized sectors. We made sure that at least half of the firms had Internet sales, so that they would know how to better answer questions. A national valid sample of 125 firms with an Internet presence was obtained, the great majority well consolidated in their sector. Sampling ensured the representation of different sized firms from various sectors and with a similar profile to national firms included in the study by ONTSI (2010, 2011). The measurement of the key variables was on 5-point Likert scales, based on suggestions and ideas taken from the scant literature on this topic (Liang and Wei, 2004; Shankar et al., 2010) were used, in order to measure the motives and impediments for and against MS. Brainstorming sessions were also conducted with colleagues, firms, and consumers, given the novelty of the topic. The obstacles to and the motives for the acceptance of MS were measured with 12 and with 8 indicators, respectively.

A preliminary analysis of the data was completed, to detect data that could distort the results. No anomalies were found. Thus, firms with at least 30 years in the sector represented more than half of the sample (23%, up to 9 years, and 30% between 10 and 19 years). In each case, 10% of the sample had between 30 and 39 years or more than 50 years of activity. In contrast, the least numerous group, 8%, had been active for at least 40 and 49 years. In most cases, the interviewee occupied a relevant position in the firm: 21% were owners; 10% were commercial directors; 23% were another type of director; 18% were managers; another 18% were system technicians; and 10% were other sorts of employees in the firm.

The majority of them, when asked to define mobile marketing, construed it as marketing (55%), publicity (54%) or promotions (26%) through the mobile phone. Only a few defined it as Internet in the mobile or MS (26%). Respondents in those firms that had conducted mobile marketing campaigns were asked to describe their content. This revealed a series of actions such as selling through mobiles; reminders of promotions; the promotion of services and free products offered by the firm. They also spoke about information on product novelties as another way of conducting mobile marketing. This only reflects the incipient state of MS given that, as happened with online sales, marketing through these channels started with publicity and promotions. When MS were compared with online sales, the firms in the sample assessed a series of attributes. Expressed in average values at all times over 5, they considered that mobile sales were more rapid (3.3) and more useful (3.4), although it was perceived in a similar way to online sales as regards facility, security, profitability, closeness and interactivity. According to our sample, we could therefore identify these attributes with MS. If we consider degree of satisfaction, the firms that sell online expressed medium-to-high satisfaction of 4.05 over 5. On another point, those that had conducted publicity campaigns by mobile (above all personalized SMS) expressed average satisfaction at 3.8.

When considering the budget, less than 25% of their marketing budget was allocated to electronic platforms. Less than half of the firms in the sample had a marketing director or a director of information systems. With regard to products likely to be sold through mobiles, most of the sample considered that any product could be sold through this channel. However, some respondents from the industrial sector affirmed that it was not a suitable channel for their products. The great majority of firms that sold online said they were, at the very least, satisfied (63% satisfied and 22% very satisfied) and those that had implemented mobile marketing campaigns also highlighted their satisfaction (64% satisfied and 9% very satisfied).

4. PERSPECTIVE OF SPANISH FIRMS ON THE MOTIVES AND IMPEDIMENTS TO MOBILE SELLING

An exploratory factor analysis was completed to obtain types of motives and impediments for and against mobile sales. It shed light on two factors as the motives for MS (explained variance 69%) and 3 factors for the impediments to its acceptance (explained variance 54.48%) (Tables 1 and 2). The first motivating factor included the perceived advantages for firms, such as facility of use and learning, low cost, personalization of messages and the promotion of client loyalty, as well as the possibility of reaching new clients. The second factor encompassed the perceived advantages for the client: the variety of applications and MS as an

extension of online sales and utility, which in itself implies better client services. Only one respondent added a further reason to the list of those contemplated in this work: the improvement of mobile devices, but in reality, rather than a motive in favour of MS, it is currently perceived more as an obstacle. With respect to the obstacles, the first factor included unfamiliarity and mistrust of MS among the causes. This factor referred to economic barriers and to the scarcity of resources, the limited knowledge of workers, unfamiliarity with the environment among managers, poor experience with online sales, mistrust of the environment and resistance to the use of electronic platforms. The second refers to the few perceived advantages because of its similarity with Internet sales. Here, the factors included are assimilation of mobile commerce to online commerce, the fact that the potential clients are practically the same as those for online sales, and the role of online competitors, which have not yet adopted MS. The third and final factor to note was its scant perceived utility at present. On this point, reference is made to the absence of utility for the business itself, the lack of mobile users prepared to use this medium in their purchases and, finally, the few options built into mobile devices to make the sale. One respondent pointed out another obstacle: excessive invasion of the consumer privacy.

Table 1. Factor analysis of the motives for mobile sales

| Factor | MOTIVES FOR MOBILE SELLING | Factor loading |
|--|--|----------------|
| F1: Advantages for the firm ($\alpha=0.781$) | Facility of use and learning opportunity for workers | 0.876 |
| | Low cost for the firm | 0.706 |
| | Allows personalized messages | 0.694 |
| | Allows access to new clients | 0.692 |
| | Helps to promote client loyalty | 0.626 |
| F2: Advantages for the client ($\alpha=0.860$) | It is an extension of online sales | 0.856 |
| | Variety of applications for the client | 0.748 |
| | Utility that implies better service for the client | 0.596 |

Using these 5 factors, we used non-hierarchical (*K-means*) agglomerative *clustering* methods, in order to create consumer typologies. Our aim was to identify different profiles of firms in relation to the perceived motives and impediments for and against MS (table 3). The definitive solution chosen for this study was that of two conglomerates. Taking the most significant factors into account, we identified a majority group of firms (80% receptive to MS), which perceived advantages in MS for the firm, but which stated that they neither had sufficient knowledge nor confidence to implement it. They also perceived MS as similar to online sales. There was a minority group of firms (20% sceptical) as well, which perceived no motives for MS and considered it of little utility at present, because of the existing technological characteristics state of mobile phones, the scant availability of mobile shoppers and the lack of its perceived utility for certain businesses.

Table 2. Factor analysis of the obstacles to mobile sales

| Factor | OBSTACLES TO MOBILE SELLING | Factor loading |
|--|---|----------------|
| F1: Unfamiliarity ($\alpha=0.782$) | Economic barriers and scarce resources | 0.766 |
| | Limited knowledge among workers | 0.752 |
| | Unfamiliarity of the environment among managers | 0.698 |
| | Bad experiences with online sales | 0.678 |
| | Unfamiliarity with the environment | 0.612 |
| | Resistance to electronic platforms | 0.578 |
| F2: Similarity with online sales ($\alpha=0.704$) | Assimilate mobile and online commerce | 0.810 |
| | Some potential clients as for online sales | 0.750 |
| | Online competitors yet to adopt MS | 0.467 |
| F3: Little or no utility at present ($\alpha=0.698$) | Mobile devices still not prepared | 0.753 |
| | No utility to my business | 0.741 |
| | Few mobile users ready to buy with the mobile phone | 0.525 |

Table 3. Cluster analysis. Centres of the final conglomerates (groups) and ANOVA analysis

| | Groups of firms | | F | Sig. |
|--|-----------------|-----------|--------|-------|
| | Sceptical | Receptive | | |
| <i>Advantages for the firm</i> | -1.40725 | 0.32434 | 93.844 | 0.000 |
| <i>Advantages for the client</i> | -0.28649 | 0.04524 | 2.019 | 0.158 |
| <i>Unfamiliarity</i> | -0.52890 | 0.11636 | 7.939 | 0.006 |
| <i>Similarity with online sales</i> | -1.04896 | 0.23077 | 38.745 | 0.000 |
| <i>Little or no utility at present</i> | 0.85169 | -0.18737 | 23.011 | 0.000 |

We see that the firms we refer to as *receptive* are the larger-sized firms, principally from the services sector and the consumer sector. They have already acquired knowledge of mobile phone marketing strategies (many of them have already used this medium), however, the principal strategies that they use are still related to e-mailing. It may be seen that a high number of them also use social networks as a marketing strategy. Firms from this group are accustomed to being the first within their respective sectors to apply new information technology. They therefore try to keep up to date with new openings and operations. They also habitually experiment with these new technologies on which they provide, receive and/or obtain information. The budget for the majority of these firms (at around 60%) is an important factor when introducing MS. The group of firms, which we have called *sceptical*, are smaller-sized firms, on the whole, that belong to the industrial sector and are not very familiar with new marketing channels. None of them have used viral marketing strategies, neither do they have a web site, nor have they used publicity or MS. One of the most important differences that may be appreciated in this *sceptical* group with respect to the receptive firms relates to their budgets. The majority of these firms (around 65%) do not identify the budget as a condition to implement MS. This contradiction is probably due to lack of interest, uncertainty and the absence of proposals, at present, to adapt to the mobile phone as a sales channel. This means that these firms fail to discern any budgetary drawbacks, owing to their limited readiness to implement MS. Firms in this group are cautious about accepting new ideas and almost none are leaders at testing new information technology in their sector. It is striking that, at present, the sceptical firms allocate none of their marketing budget to actions such as viral marketing, publicity, or website design; actions that in the receptive firms do amount to a percentage of between 10 and 40% of the marketing budget. Table 4 summarizes the profile of both types of firms obtained in accordance with some essential variables for the characterization of the sample in this study and other relevant ones for which differences do exist between both types of firms.

5. FINAL CONSIDERATIONS

This study contributes to a gap in the academic literature in which there is an absence of studies similar to this one on mobile business and, more particularly, sales through the mobile. The study could therefore be seen as a starting point for others on the factors that firms take into account when introducing commercial mobile platforms to sell their products or services. Numerous firms are shown to be receptive to adopting this way of doing business, even though some impediments are still present, meaning that they are unlikely to introduce MS. In our work, we have characterized, in detail, a sample of Spanish firms with an interest in the application of new marketing technologies. We then compiled groups of motives and impediments for and against MS from their point of view, so as to arrive at a classification of Spanish firms on the basis of those motives and impediments and a good number of characterization variables. To the best of our knowledge, this is the first study that applies this approach to Spain. It is a useful work for firms that are considering an exclusive approach to SM or in a complementary way to other sales channels that might be traditional or online. The survey respondents in our sample, on the whole, defined mobile marketing in terms of publicity and promotions through that medium and to a lesser extent as sales through the mobile. Only very few have applied these strategies, however they do highlight that it is a medium with a sales potential for almost any product (except industrial ones). According to ONTSI (2010), MS is at present used for low implication products and alerts, competitions and melody downloads.

Table 4. Comparison of the essential characteristics of the two types of firms

| VARIABLE | CATEGORIES | % Sceptical | % Receptive |
|---|---|--|--|
| Sector | Consumer goods/Industrial goods/ Technological Services/ Non-technological Services | 27% / 36% / 14% /23% | 28% / 21% / 24% / 27% |
| Size | Small / Medium / Large | 50% / 41% / 9% | 32% / 34% / 34% |
| Average age of the firm staff | 20-29 years old/30-39 years old 40-49 years old/Over 50 years old | 28% / 25% / 22% /25% | 9% / 57% / 30% / 4% |
| Position of interviewee in the firm | Owner / Manager / Commercial Director / Other type of director / Info. Sys. Technician / Employee | 27.3% / 13.6% / -- -18.2% / 9.1% / 31.8% | 19.2% / 14.1% / 13.1% / 25.3% / 19.2% / 9.1% |
| Marketing strategies applied | Online sales / Email marketing Personalized Emails / Mobile Publicity / Viral Marketing Social Networks / Mobile sales site / Mobile Sales | 32% / 81% / 57% / 0% 0% / 28% / 0% / 6% | 42% / 87% / 77% / 14% / 17% / 46% / 15% / 10% |
| Comparison of online and mobile selling. Internet sales are... | Quicker / Easier / Safer / More profitable / More expensive / Closer / More interactive | 20% / 20% / 20% / 20% / 40% / 40% / 20% | 52.9% / 28.4% / 41.1% / 41.1% / 29.4% / 29.4% / 41.2% |
| In the firm, there is a director of... | Marketing / Information systems | 32% / 32% | 47% / 32% |

Moreover, we have seen that there are two large groups of motives for MS, which consist of the advantages as perceived by the firm for the firm, and, the advantages as perceived by the firm for the clients. Among the former, we can highlight low costs and perceived facility and among the latter, the straightforward transference of online buyers to the mobile setting, given that MS is considered as an extension of Internet sales. With respect to the impediments, three types have been identified. First of all, there are those that arise from unfamiliarity and lack of confidence in the mobile phone as a sales channel. Second, those that refer to their similarity with online sales and therefore to there being no need to apply MS if online sales are already useful. Third, those that arise from the scant perceived utility at present. Among the first, economic barriers and a shortage of resources stand out, as well as unfamiliarity with the application of MS among workers. Among the second, the perception that it is the same as online sales and that it is not understood as anything different. An important impediment within the last group is the type of mobile device that exists at present (small screens), despite the evident innovations that imply a new competitive panorama.

We have observed that there is a large group of firms that are willing to introduce MS because of the advantages that they associate with them. Normally, these tend to be larger-sized firms, from the consumer and services sectors and those that already possess prior knowledge of marketing strategies through the mobile phone. These firms implement more marketing strategies in general and are willing to develop different mobile business models. A further group of firms perceive little or no utility at present and their unfamiliarity leads to reticence towards this sales channel. These are smaller-sized, mainly industrial firms and hardly implement marketing strategies such as web sites, viral marketing, and MS. If these firms were to think of a business model for mobiles, it would be a traditional sales channel, essentially for products.

In this study, it may be clearly appreciated that the type and size of the firm influence the adoption and diffusion of electronic technologies (Nguyen et al. 2003), such as mobile technology. Furthermore, it will be necessary to lend special attention to the correct integration of traditional sales, where appropriate, with sales through other channels such as the electronic channel (Bradshaw and Brash, 2001) and/or mobile phones. As already stated, MS represents an opportunity for growth that firms should not pass by, although reluctance is certainly still felt within the corporations themselves. However, with the passage of time and the perfection

of the platforms and the devices, as well as the necessary strategies, it is without a doubt a natural step for the great majority of firms that use other types of online sales channels.

Given that MS might entail a competitive advantage for the firm, especially at times of economic uncertainty such as the current crisis, firms need to muster greater interest in the application of mobile technologies. This is because it can serve to complement their sales in other contexts or as a low-cost sales medium for the firm, but one which also brings with it great advantages. Although various firms at present fail to perceive the utility of mobile sales, we believe that it would be necessary to anticipate the future and be pioneers in these types of sales. Public initiatives would therefore be advisable to strengthen the introduction of these technologies in firms. Firms should invest in technological training for their employees, so that they trust more in their application; a problem even in firms that are more receptive to MS. We have seen that those firms that sell online are satisfied. Likewise, public initiatives, training and communication campaigns related to those motives, in order to take full advantage of them for MS, may also be helpful.

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OLD AGE, THE INTERNET AND ADVANCING TECHNOLOGY

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ABSTRACT

The benefits to the old and very old of mental stimulation and connections with family are well documented. eMail and the Web can make very large contributions to both. This paper discusses the advantages and requirements for up-to-date technology such as Notepad computers and 'Smart' Television to make the entry to the digital age for older people not familiar with computers, as easy as possible.

KEYWORDS

Old Age, Access to the Internet.

1. INTRODUCTION

For many years it has been almost accepted wisdom to regard computing as a young person's world. Morris and Ballard (2003) state that "although the research on computer anxiety and attitudes with older adults has yielded mixed results, older adults experience more anxiety and more negative attitudes toward computers than younger adults." In fact in some quarters it has almost become the fashion to disparage the ability of anyone not born into 'the computer age' to take up, or even see the utility of the computer and its inherent communication possibilities. Pesky (2005) refers disparagingly to anyone too old to be in school in 2005 as a "digital immigrant."

This attitude is very unfortunate because the Internet, in its World Wide Web form, might have been especially designed for the elderly or physically disabled. Potentially liberating in ways even surpassing its importance for the young and mobile, it can provide a dimension otherwise totally lacking in the life of someone limited in their mobility or confined by circumstances to a single building. Morris and Ballard (2003) note that "exposure to computers and training in basic computer skills may result in more positive attitudes, greater motivation to learn, and reduced anxiety levels." Shapira, Barak and Gal (2007) in a study of 48 people aged 70–93 found "elderly people who began using the internet felt less depressed and lonely, more satisfied with life than did people who were engaged on other activities." Encouragingly, Hart, Chaparro and Halcomb (2008) report that "older adults in the US are the fastest-growing demographic, and also the largest-growing group of internet users."

Leaving aside medications, Watari and Gatz (2002) list the protective factors "with the most convincing support" against Alzheimer's disease as "education and mental stimulation." The fact that Seniors health in general is closely tied to their mental stimulation is long established (Leonard, 1993, Rönnberg, 1998, Hanson, Lennart, Arvidsson, Claesson, Keady and Nolan, 2007) and an Internet connection to the world, along with other applications routinely provided by a computer can make a very positive contribution to this.

Regular contact with relatives and friends outside the retirement home is another area often mentioned in connection with the promotion of Senior's health (Downs, Ariss *et al.*, 2006). Dobbs, Munn, Zimmerman and Boustani (2005) found that "increased resident activity participation was associated with two measures of family involvement: the amount of time the family reports being socially engaged with the resident and the family's degree of involvement in assessing resident preferences." In a (non-random) study of 122 Canadian adults over 60, Erickson and Johnson (2011) found that "Internet use and self-efficacy remained significantly related." Significantly, 47% of their sample had been using the Internet for less than five years.

It must be said that not all research has found positive connections between Internet access and well-being: Dickinson and Gregor (2006) reviewed the literature and found a lack of empirical evidence to support it.

Much of the government-generated and sponsored material to which Seniors require access is most easily found electronically (Tran and McComb, 2004). At the same time there appears to be an assumption that once safely inside a retirement home, responsibility for monitoring and acting on such material can be safely passed to the home management, or relatives, since access to in Australian supported retirement complexes is usually unavailable (Murnane, 2011). “Loss of control and lack of autonomy lead to learned helplessness” (Rönnberg, 1998).

As well as benefits derived from more frequent contact with relatives, retirees participation in the general environment of the Internet and the ability to ‘go anywhere in the world,’ albeit on a restricted basis, is also a strong attraction. Aside from the purely practical considerations of connecting family via eMail, using the Web is a pre-eminent leisure activity. Scarmeas, Levy, Tang, Manly and Stern (2001) found that “the data suggest that engagement in leisure activities may reduce the risk of incident dementia.”

A younger physically disabled person with no significant brain injury in supported care is in the same position, probably more so. Their mental facilities will not degenerate as will over-80’s, they will be in a much better position to take advantage of the Web, and the chances are they already possess the necessary skills, though depending on their injuries they may require specialised I/O equipment. (See for instance Lathouwera, de Moor and Didden (2008) and Söderström (2009).)

There are many categories of disability which can require fully supported accommodation, meaning a requirement for 24 hours/seven day assistance, and some of these can preclude computer use, but for those who *can* use the technology, the Internet may be the only way they can ‘leave the building’ unaided.

This paper has its base in experience with a group of retirees in a low-care retirement complex in Melbourne, Australia, mainly age 85+, but the argument applies equally to others, confined by physical problems, to a single building.

2. RESEARCH BASIS

Most of the publications concerned with retirees’ use of the Internet refer to populations in their 50’s and 60’s (Russell, Campbell and Hughes, 2008, Sum, Mathews, Pourghasem and Hughes, 2008) and therefore generally self-mobile. There are far fewer publications about those in the 85+ bracket—usually referred to in the literature as the ‘old’ and ‘old-old.’

The research which was the basis and inspiration of this paper was carried out at the Old Colonists’ Association of Victoria’s Leith Park low care Hostel in Melbourne, Australia. Leith Park consists of an extensive area with 118 independent living cottages, a low-care Hostel with 52 residents, including a 12 room dementia wing, and a high-care Nursing Home. (In Australia, ‘low residential care’ facilities, where residents are independently mobile within the building, are generally termed ‘Hostels.’ Facilities offering high level residential care are usually referred to as ‘Nursing Homes.’)

To make the project attractive to the Old Colonists’ management, the ICT in Education and Research Cluster from the University of Melbourne arranged to donate two computers linked to the Internet, arrange and finance an ISP and provide training for the residents. Research findings came predominantly from long-term participant observation with residents learning and using the machines.

Residents were offered instruction in computing and electronic communication skills, initially the use of eMail (Murnane, 2007). Due to the small research budget, this instruction has been limited to three hours on Friday afternoons. Visits occurred at slightly random intervals on 59% of Fridays over the life of the research. Due to the one-to-one teaching method used, the maximum number that could attend on any one afternoon was limited to six.

All residents, whether they join the ‘research’ or not, are free to use the computers and take advantage of the instruction provided. In order that conclusions should be as generally applicable as possible, a standard Windows operating system was used. The alternative of a customized system (Wherton and Prendergast, 2009) was considered but rejected on the grounds that it would make the findings less applicable to other retirement complexes since a PC with Windows was considered to be the most likely thing to be installed, and the most familiar to anyone with some computing experience.

Health problems and other activities organized for residents regularly intervened. Given the age of the participants and their problems with short-term memory, regular twice-weekly visits would have been preferable. In the nature of a retirement home, residents come, stay and go, a fact of life that makes any sort of longitudinal 'before and after' study problematic. The focus of the research to date has been largely concerned with the educational approach rather than quantifying the reactions of participants, though in broad, many positive affects are easy to observe, not least, eagerness to continue lessons. Dickinson and Gregor (2006), having surveyed the literature attempting to quantify the outcome of various experiments in the area and finding them very problematic, conclude "it would be more useful to investigate the training processes rather than focusing on computer use." Leith Park experience bears this out.

Due to a very limited budget, the researcher is also the teacher. This has serious disadvantages for the research program itself, but it also provides significant advantages. For an extended treatment of the methodology employed and its consequences, see Murnane (2010b), but it's form was essentially determined by the residents themselves. It was quickly established that none of the small-group teaching typical of reports of younger retirees learning to use the technology would work. Residents quietly but firmly insisted on one-to-one instruction while seated at the keyboard themselves. Further, they needed essentially the same lesson repeated week after week because of problems with short-term memory (Murnane 2008).

The project began in August 2007 has been running for over four years. To October 25, 2011, 41 residents have taken 447 individual 'lessons' over 126 afternoons. The highest number of 'lessons' to any one resident is 73, and four of the original twelve still attend regularly. Twenty-two have come for less than five sessions. More residents (and staff) use the machines at other times but reliable numbers on that have been difficult to obtain. The Old Colonists Management, convinced of the value of the project, have taken over the provision of an ISP and included a new large combined Computer Room/Library in a recent rebuilding program. This illustrates the value placed on the project by management and staff: the new room occupies space previously taken by two resident suites, representing a significant investment. The Divisional Therapy staff are universally enthusiastic about its benefits. (In Australian supported care facilities, diversional therapists provide leisure and recreation programs and are a vital factor in maintaining residents well being.)

The range of 'students' has been quite wide, from five of the original group of 12 who had never used a keyboard, to (younger) residents from Independent Living Units who are quite competent in various aspects of Information Technology and come for occasional help with specific applications. Hostel residents, by far the largest group, are all over the age of 85, the oldest taking part the research will turn 101 in January 2012. The main interest has been in eMail, agreeing with other research reports (Erickson and Johnson, 2011, Sayago and Blat, 2010). Undoubtedly the most satisfying part of the research is to witness the receipt of the first eMail from family, particularly eMail from grandchildren or a niece (very little, to date, from nephews).

Leaving aside a relatively small range of interests involving the Web in general, such as geographical and historical sites, there is a growing interest in other forms of social activity such as FaceBook and Skype (none to date of Twitter). The easiest general observation to make is the value residents place on being able to access such facilities *independently*.

It is this ability to establish contact *unassisted by another person* that is most prized. Even a telephone call requires the cooperation of a person at the other end (as does Skype of course, used regularly by two residents, including the 101 year-old), but an eMail or a posting on FaceBook acts as an *invitation*: an invitation to continue contact.

3. TECHNOLOGY: PROBLEMS AND PROMISES

The standard Windows or Apple computer interface presents many problems to the over-80 beginner. It is easy to forget the sheer amount of information displayed on a typical computer screen. The experienced user ignores most of it, concentrating only on the thing he or she needs to, but to the elderly beginner, quite probably with short term memory problems and knowing nothing about the logic of it all finds it very confronting. It is not only a matter of where to look and what to do when you get there, but how the different elements are manipulated: click, double-click, drag&drop, when and where to type. Setting up an eMail account may take half an hour and the need for most of the information required can be baffling. Most of what is learned is likely to be forgotten in a day or so. Password entry presents a particular problem and it may take a year of once-a-week lessons before the 'student' can log-in and look at their eMail by themselves.

Many will never get there. Physical problems presented by a keyboard and various forms of pointing device complicate everything (Murnane, 2010).

There are some current developments, and some in immediate prospect that can help.

3.1 Speed

I began the Leith Park research with the tentative assumption that computer speed would not be an important factor. At the time this was rather academic since the only equipment available was two 2.2 Gig Pentium machines with very limited memory donated by the Melbourne Graduate School of Education Computer Facility (EdIT), which had reached the end of their four-year 'turn-over' life.

My initial experience and observations seemed to bear out the assumption that residents did not require a lot of computer speed since they showed very little interest in programs usually regarded as requiring it. They seemed to get along as well as might be expected, given their age and experience. Indeed, my first papers reported that the computers, by then six years old, were quite adequate (Murnane, 2008). It was not until EdIT donated two replacement machines in 2010 that I realized that this was a mistake.

The replacements were 3 Ghz PCs with 1 Gig memories. Since the new computer room was set up to take three computers I kept one of the originals and added the two 'new' ones. It was not long before two things became evident: the faster response time *was* a definite advantage, both for beginners and experienced users, and whenever possible, residents would always choose the faster machines. Without actually expressing the idea that the computers are better because their response time is quicker, the universal opinion is that 'they are easier to use.'

It is now evident that the faster the machine responded to commands the easier the residents find it to use. They might sit for some time contemplating their next operation—in general I try not to intervene until it becomes apparent that they do not know what to do—but once something is acted on, immediate reinforcement can be seen to engender satisfaction and confidence. Hesitation on the part of the machine tends to destroy these vital feelings rather quickly.

Internet speed is another matter and from the first I thought that a fast Internet connection would be significant. I spent some time researching ISP reported reliability, and settled on an ADSL 2+ connection through iiNet. Cable was not an available option or I would have chosen it. The speed was indeed entirely satisfactory: response time was very fast and did not appear to affect resident's ability to learn and use the system, and two residents main use for the facility was to watch time-shifted versions of TV programs and these ran without a hitch.

When my ISP funding ran out, the Old Colonists' Management, convinced of the benefits, took this over and connected the computers to their existing network. Immediately speed dropped considerably and became very variable. Web links often time out: 'log-in' pages are particularly prone to problems and log-in procedures are by far the biggest stumbling blocks for the users, even the more experienced. Essentially, any computer response that produces an error presents a major hurdle and may cause the resident to abandon the session completely if (human) help is not immediately on hand. Seniors new to the Internet have a very strong tendency to blame themselves when things go wrong, or do not happen within the usual time interval. Typically they simply stop and ask '*What did I do wrong?*' Such bafflement can rather quickly lead to rejection of the technology. The thing over-80's need most of all is *confidence*. Any problem, or even just hesitation in bringing up pages, saps it very quickly. Any idea of watching streamed television has had to be abandoned, although Skype is largely unaffected.

An obvious step here was the preparation of 'Help' sheets. Students from LaTrobe University studying Volunteering, prepared some excellent, colorful material, tailored explicitly for the residents. The graphics show the screens as set up and the most important pages from Hot Mail, Google and MS Word. They are never consulted, lying in exactly the same places on the desk from week to week.

The current Australian Government is committed to the installation of a National Broadband Network (NBN) (Conroy, 2010, Conroy, 2009). The major opposition parties are equally committed to providing broadband services by other means if they win the next election. Whichever party is in power they must realise the absolute importance of providing broadband to all parts of all retirement complexes. *Fast Internet speed is vital.*

3.2 Information, Presentation, Pointers and Familiar Environments

The sheer quantity of information displayed by a computer running Windows or Apple OS, most of which the experienced user will probably ignore, the way the interface is manipulated and the unfamiliarity of the computer environment, form an interrelated group of factors that conspire to present the older beginner with problems. It is possible that NotePad computers and Smart television may help ameliorate some of these.

The mouse presents a double problem to the old beginner. Not only do they have to master its functions, correlating their hand movements with a hard-to-see pointer on the screen, but arthritic hands find difficulty in its physical operation. The small directional arrows at the ends of scroll bars are a particular problem. Hard to see if you are not looking for them, they are also difficult to manipulate given that *any* mouse operation for unaccustomed, possibly arthritic figures is likely to be difficult. Further, their physical action confuses: to go down the page you use the down-arrow, but that causes the screen to scroll-up, something even the more experienced find counter-intuitive.

At Leith Park quite a lot of this has been overcome by the use of large track-balls (see Murnane, 2010 p. 258) but touch-screen technology offers an even better solution. Touch-screens, by their nature, can be simpler than a desktop operated by a mouse because of the extra, largely intuitive, operations available. The scrolling, page-turning and enlarging functions of a NotePad computer or mobile phone are examples: they dispense with scroll bars and their associated arrows completely as well as providing several other not so obvious functions, and it is not necessary to locate the arrow-head first.

A NotePad, as well as being more intuitive, is also lighter and easier to use in any surroundings. We have yet to acquire any at Leith Park, (something anticipated for early 2012), but when purchased, the intention is to investigate their use away from the computer room. It is expected that the ability to use one in bed or in an armchair will make their use more appealing, while the simplified interface will make up, at least to some extent, for the probability that experienced help will be further away. (Known wireless-reception problems in the building may complicate matters.) It will be interesting to see if the easy way with which the computer can be passed to someone sitting adjacent will promote mutual help, something somewhat lacking with the desktops, despite encouragement. Information sharing should be much easier.

A further extrapolation of the NotePad idea is Smart Television. 'Smart Television' is the term generally applied to a television set connected to the Internet and able to operate as a Web browser. (The obvious alternative label, 'Internet Television,' rather confusingly applies only to video streamed from the Internet.) An otherwise ordinary television can be 'smart-enabled' by connecting it to an external Internet-connected device such as a PlayStation or X-Box, but the required processors are increasingly found built into the sets themselves. They can be operated by the familiar infra-red point-and-click controllers or more flexibly by remote keyboards, and many manufacturers are offering an application which can be downloaded to a mobile phone or NotePad computer. In the latter cases, the easy flexibility of figure-tip operations are restored.

A television is a very familiar object, as is its manipulation through a remote control. From their conversations, the old do subscribe quite strongly to the idea that computers are for the young and to the idea that you can be too old to learn about them (Murnane 2008). With an interface (termed by some manufacturers as 'the dashboard'), simplified to make it fit into the familiar television environment at normal viewing distances, small symbols are dispensed with and only the essentials likely to be of direct interest appear as very large icons. *A Smart TV is expected to help overcome, if not banish the specter of an unfamiliar technology.* Add a remote keyboard and you have a system that handles eMail, Skype, FaceBook and simple Web accessibility as well as functioning as a standard television. Immediate research needs include studies of the old and old-old's ability to manipulate the interface, use a remote keyboard and generally relate to the environment. The next question is to what extent those not attracted to a computer will want to learn and use one.

Smart TV does have drawbacks. The most obvious is cost. At the moment they command a significant premium over their less featured relatives but this can be expected to change rather quickly. Some Smart TVs come with inbuilt wireless, the others can be connected through a separate box, otherwise Internet cabling will be needed. (The Leith Park Hostel, a rather old building, is notorious for Wireless Internet black-spots.)

If the set is placed in a public space it is immediately obvious that the idea of using it for eMail, FaceBook or Skype etc. has problems, and someone using the set for their own purposes may interfere with those who might just want to watch a program, but there are potential advantages, depending on the circumstances. Residents do like to share photographs and even text from eMail and social Websites, and this

would be encouraged on a large TV in a public area (something prominent in their current advertising). It remains to be seen how this might work out, what types of applications or programs become popular, and do residents use the TV for some things and computers for others. It is also possible that smaller Internet-enabled sets suitable for private suites will become attractive. Leith Park Hostel residents who possess their own Laptop computers (usually presents from children or grand-children) show a very marked preference for using the public computers, at least partly because of the complications a telephone Internet connection brings. The projected simplicity of use is attractive and experiments with it need to be made to discover the actual problems and the real advantages.

Smart TV is in its infancy. Exactly what appears on the screen and the functions it can call upon depend on the manufacturer, rather than being standard. But being simpler than the standard operating systems of a desktop or Laptop it is possible that developments will converge on standards very suitable for the inexperienced old and old-old. The possibility of controlling them via a NotePad or mobile phone expands their attraction significantly.

4. CONCLUSION

The evidence that mental stimulation aids both mental and physical health is well established. Evidence that this can be improved by access to computers and the Internet is strong and growing. Greater contact with family and friends is also recognised as very beneficial and eMail, FaceBook and Skype etc. are obvious ways to promote it. The Internet also provides the only way anyone confined to a single building can 'leave' it unassisted. The importance this assumes for such people should not be underestimated. Research at Leith Park has shown it to be central to their thinking and very important to their well-being.

Several developments in technology integrating the Internet, hand-held devices and television give promise of greater rewards, more simply realised. Further development of the associated operating systems ('dashboards') promise even more.

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RURAL COMMUNITY DEVELOPMENT STRATEGY BEYOND THE ACCESS TO INFORMATION: THE ROLE OF TELE-CENTERS IN BANGLADESH

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ABSTRACT

Telecenters is one of the promising models recognized by the United Nations (UN) to achieve the global access of ICTs. This paper provides insight in the role and uses of Information and Communication Technology for Development (ICT4D) projects with a specific focus of telecenters in developing country Bangladesh. This study covers four aspects of the functioning of telecenters grounded in social, economical and action resources: 'situated success', 'information culture and tradition', 'typology of resources' and 'functioning'. The study contributes to the theory and practice of ICT for development with impact analysis of ICT4D project. The understanding of community capability building is addressed by identifying core capabilities of ICT for the rural community, and highlighting the relationship between the ICT and development. The study also demonstrates how ICT may bridge the gap between the policy and actual practices of rural community with respect of ICT development.

KEYWORDS

Information and Communication Technology for Development (ICT4D), Access to Information, Telecenters, Rural Community Capability Building, Developing Country.

1. INTRODUCTION

Telecenters are considered as major catalysts for information and knowledge that can stimulate many development opportunities and services in rural areas. Under certain conditions it can help the rural livelihood through sustainable strategies (UN, 2004). It is also bringing the benefits of new communication technologies to rural people who do not have access to technology at their home or through their work place or at a n e ducational institution. There are different discussions in literature regarding sustainability of telecenters in rural perspectives especially in developing country (World Bank, 2005). Literature on ICT for Development covers both optimistic and pessimistic thinking regarding the potential of telecenters (Heeks, 2005; Heeks, 2008; James, 2005; Kumar and Best, 2006; Harris et al., 2003). From the optimistic perspective, ICT is considered as a catalyst for development and a tool for faster information exchange and transmission which is reducing costs of information and communication practices. The pessimistic position concerns the viability of projects. Researchers identified deep-seated issues in developing country such as poverty, illiteracy, lack of ICT skills, and lack of ICT investment (Heeks, 2003; Heeks, 2008; Kumar and Best, 2006; Maitrayee, 2008; Sein et al., 2008). The sustainability of donor funded ICT projects in developing countries has been a major concern for the donors as most of the projects terminates after the fund finishes. Hence, the donor agencies are concerned to identify the reasons for the non-sustainability of these ICT4D projects in developing countries. (Development Gateway, 2003). The literature on ICT for international development has paid little attention to the participants of this latter community, and this issue is being considered as 'empirical vacuum' in ICT for development impact research areas (Keniston, 2002; Huerta & Sandoval-Almazan, 2007).

This underlying reason shapes this paper's motivation to work on the social impact of one of the ICT4D projects in Bangladesh and addresses the strength and weakness of this rural ICT initiative. It also aims to explore the resources to access the ICT and ICT driven capabilities in rural community context. This paper considers resources that are directly and indirectly connected with human capability. A lot of ICT

investments and diffusion have been made in rural areas as in Bangladesh aiming the success of ICT4D and digital Bangladesh. But it is still not clear how these ICT diffusions and adoption processes could work effectively for actual rural community development. The following two research questions are addressed:

1. What resources are needed for the capability building of the rural marginalized community in the context of this 21st Century e-Society?

2. How can the community based ICT4D program make an impact on the strengthening resources and capabilities of rural community of Bangladesh in context of their social and economical realities?

Based on some empirical study in the Youth Community Multimedia Center (YCMC), an ICT center in rural Sitakunda area in Bangladesh, this research is aimed to investigate the role and impact of telecenter by using the theoretical lens of Sen's Capability approach (Sen, 1989) and Heeks' resource perspective view (Heeks, 2005), and investigate the relationship of resources, rural community capability building and actual telecenters driven information practices.

This paper is organized into four sections. The first section presents a short review on recent ICT initiatives in Bangladesh. The following two sections include the theoretical basis of the work and the research setting and methodology. The next section presents the findings and impact analysis of the project considering the four key perspective of 'situated success', 'information culture and tradition', 'typology of resources', and 'functioning' followed by the final section of discussion and conclusion.

2. ICT AND BANGLADESH

The Information and Communication Technology sector is currently the fastest growing sector in Bangladesh. Among other things, the government has declared a national ICT policy in 2008 with the aim of creating 'Digital Bangladesh' (Ministry of Science and Information & Communication Technology, 2011). Bangladesh govt. prioritizes the policy for pursuing ICT for development (ICT4D) that is focused on the issues such as the access and better delivery of government services to citizens, citizen empowerment through access to information.

Bangladesh is one of the most world's densely populated countries in the world. The economy of Bangladesh is based on agriculture, and 74% of the population lives in rural areas. In the rural areas, people live in poverty and suffer from illiteracy, ill health, unemployment, and lack of ability to access government - or others agencies' services. However, academics and development agencies define poverty not only by economical and social deprivation indicators but also by lack of information and access to information (Heeks, 2003; Sein et al., 2008; UNDP Bangladesh, 2010). In this context, Bangladesh government, International aid agencies and Non-Government Organizations have taken several initiatives in supporting of a telecenters strategy in Bangladesh, one of them being the Bangladesh Telecentre Network (BTN) which is a coalition of organizations for fostering telecenters movement in Bangladesh (BTN 2011). Presently more than 2300 telecenters are in operation all over Bangladesh to provide a range of information and services to rural communities.

A number of large and ground breaking ICT initiatives have been taken by Bangladesh government recently, among them the development of digital National ID is the most significant initiative. The digital National ID card project was completed during 2007-2008 with the help of United Nations around 80 million peoples' basic information with digital photo under a single database. One of the other significant initiatives is the development of National E-Information cell (www.infokosh.bangladesh.gov.bd/), an online store of databases that contains information related to people's life and livelihood in various sectors of Bangladesh including agriculture, education, health, law and human rights, tourism, employment, citizen services, non-agriculture initiatives, industries and commerce, science and technology, environment and disaster management.

The current government strongly believes that the success of Digital Bangladesh lies in mainstreaming the marginalized population into the development goals and set of actions with ICT as the enabling tool. This vision of the government is the driving force behind the establishment of 4501 Union Based Information and Service Centres (UISCs) in every 'Union Parishad' (last tier of administrative unit) to serve the rural citizens. Upholding these ICT enhanced services to door steps of poor and marginalized people, UISCs are going to play a vital role on the greater transparency, accountability of local govt. and trying to ensure the livelihood information access through ICTs (UNDP Bangladesh, 2011).

3. THEORETICAL BASIS

ICT is considered as an extremely potential enabler in bringing sustainable development to developing countries and ICT driven information and knowledge can bring social and economical development (Bailur, 2007b; Duncombe and Heeks, 2002; UNDP, 2005). However, in developing country it has been quite difficult to understand the connectivity with development of rural community. Thus, research has employed a new view of this development approaches considering the developing country (Heeks, 2008; Heeks, 2005; Gigler, 2004). Heeks in his work gives much more focus on information above information driven technologies (Heeks 2005). He considers the technology a dead box, as long as if it does not support information processes. From the social resource perspective, Gigler (2004) gave important approach in this regard, stating that the technological factors such as infrastructures, computer ownership and access to technology cannot solve the major challenge of ICT development in developing country. He considers the major challenge to be transferring data access from internet or telecommunications into meaningful information and a availability of social resources to implement the information into the practices in the communities. Other researches has argued that the Sen's (1989) capability approach can derive potential findings at micro level focusing on its non-income variables (Comim, 2001; Gigler, 2011; Gigler, 2004). The link between Sen's capability approach and ICT has been synthesized in Robeyns' work (Robeyns, I. 2005b). According to Sen (Sen, 1989) development should be conceptualized in terms of

- People's capabilities to function
- Effective opportunities to undertake the action
- The activities that they want to engage in and
- Be whom the people want to be

Heeks (2005) information chain model provides a method on achieving successful ICT implementation in developing context, and he also mention that the technology must be understood in its context of economic, social, and action resources, which can help to transform the data resources into information to achieve the actual outcome from ICT4D projects at community level. Heeks' information chain model (Figure 1) illustrates how raw data needs to be *accessed*, *assessed* and *applied* by the users, before *actions* can take place.

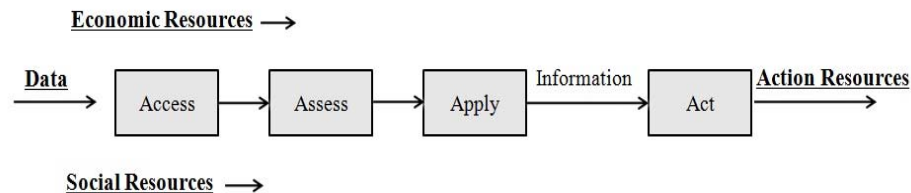


Figure 1. The Information Chain Model (Heeks, 2005)

Considering my case ICT4D project I could identify what kind of resources offer this community ICT initiative and how these resources function in the ICT centers in rural community. I could also identify how rural community participants assume that capability development is key driving force to maintain the ICT sustainability beyond the funding period. The capability approach provides a framework, which has strong connections with the resources demonstrated by Heeks (2005) to make successful access to ICT-enhanced information in rural context. Hence, the capability approach and resource understanding are used to explore the functionality of ICT means in rural area in developing country.

4. RESEARCH SETTING AND METHODOLOGY

An empirical study was carried out at the site of the tele-center Youth Community Multimedia Centre (YCMC) in Sitakunda sub-district of Chittagong, Bangladesh during September to November 2010. YCMC, established by Non-Government Organization named Young Power in Social Action (YPSA), developed out of a UNESCO supported project on ICT Innovations for Poverty Reduction in 2004. It was established with a

combination of traditional technology like radio, TV and newspapers and new technologies such as computers, Internet, photocopiers and digital devices like video camera, scanner and printers.

Sitakunda sub-district is surrounded by the hills to the east and the Bay of Bengal to the west. In 2001, around 300,000 people lived in this administrative unit. With only very low employment degree in the industry, a large number of the local people work in agriculture, and as many as 25,000 semi-skilled and unskilled workers find employment in the largest ship breaking industry in Asia, which is situated in Sitakunda. Only very few indigenous people own their own land, and the area has limited facilities for communication, primary education and health.

A qualitative research approach was used in this study to address the research questions while the qualitative data were collected and analyzed using an interpretative method. The qualitative approach was chosen to support an ethnographic approach that aims to establish a better understanding of the motivation of the users, the operators of the center and the capability building trajectories of the individuals as well as the rural community level. Data collection was done using interviews, site observation, group discussion and informal conversations with users of this centre. In total eleven interviews were carried out with users and trainees in the center. The informants were questioned regarding the issues relating with their motivation and mainly what had inspired and hindered them in their learning from the telecenters. Two extensive interviews with two key-informant provided deep background knowledge about the center, its history and activities. One of the key informants was the program officer of YCMC and the other was the telecenter's operator. Instead of focusing on the direct impact of the ICT, the data collection and analysis was designed to find out the indirect impact of the ICT intervention among the target group. Analysis of documents such as YCMC's records and annual reports has provided insight into the wide range of activities undertaken at the centre. Observations were done for the purposes of gaining additional data and to provide enough background knowledge that was used for both interviews and informal conversation with local users of the facility.

5. FINDINGS AND IMPACT ANALYSIS

The concept of this multimedia center YCMC is to improve the human capacity building by providing information accessibility to people and groups who are unfamiliar with ICT. This center has taken a comprehensive approach to include diffusion, which involves a systematic program of activities designed to spread the ICT message in rural areas. According to the program officer of YCMC, the ICT diffusion is time-consuming and resource-intensive. Sustainability of this type of program largely depends on long term funding for smooth operation and equipment availability. The current status of YCMC has been changed to an independently running center and is being operated by self-generated income. Following are some of the pilot ICT initiatives and activities taken by the center in the last few years:

- Volunteer groups were organized and trained to develop audio and video contents on various social development issues.
- Information disseminated through local cable operators to reach the civil society. The participants were asked to develop need-based contents on various issues such as human rights specially on women and child rights, public health and hygiene, AIDS, drugs, and environmental issues.
- Prepared content packages aimed at even completely illiterate people. This provides information to grassroot levels in an attractive form and promotes the general interest in ICT.
- Published newspapers and distributed locally.

In what follows I present the indirect impact of the ICT project on capacity building process derived from the data collected from the case project. The analysis is based on the issues related to resources, capability building which are constituted by this center's ICT access and other economical and social aspects.

During a group discussion with center's operator, users and community people, the operator expressed very optimistic opinion regarding the center considering his previous experiences. The operator found the center to be a potential ICT access point for the local people as the operator himself is an example in this regard. He took computer training and video editing training during 2004-05 from this center. Around 180 village adolescents were given the opportunity for free basic computer training with some of the most popular ICT programs during that time. After the initial training program, around 30 participants received further training and they were later engaged in digital content development work. They developed audio, video and multimedia programs on local community concerns and needs mainly in local language. Because

of the language the content could be understood even by illiterate people of the community. The video content was prepared with the participation of local people based on the local cultural contexts and issues. Around 18 participants then agreed to form a team of volunteers. They voluntarily collected raw data from the remote area on various issues relating to the villagers daily life and occupation, and produced various video and audio materials highlighting those practical problems. They also produced various interactive, but traditional stage shows and activities such as *Forum theatre* and *folk music* considering the social tradition and context of learning. YCMC disseminated those media contents and theatre in different remote and hilly areas in Sitakunda, using the cable TV casting through the local cable operator and VCD player. Community people were very much interested to follow this type of programs. As a result, both the producers and viewers of the materials participated in capability building process through the resources of the tele-center. Local people started to improve their livelihood and become aware about various social issues and at the same time YCMC became increasingly popular in those village areas in that period. But, due to the shortage of available financial resources it has been very difficult for the center to continue this kind of activities after the funding period. It was also difficult to prepare the local digital content and maintain the social learning programs with forum theatre.

YCMC has been operated independently for last three years without any external funding. At the moment, the center has to finance all activity from the income generated by an internal computer training program and the provision of internet access for users charging a small fee. Also, data entry tasks undertaken for the local authorities sometimes provide a source of income for both the center and the users who are hired to do the job. Although the center has a poorly equipped computer lab with old configuration computers, the lab needs supporting tools such as IPS and an oil generator in case of power failure in the area, something which is very common in Bangladesh. The operator also mentioned that it is only possible to survive on a self-generated income if fees are not subsidized for the poor and marginalized students or rural users. Despite of a feeling of pride for their overall past achievement, YCMC is still concerned about the future of the big marginalized community who actually needs various practical information in easy and convenient way.

However, considering these different turnover and challenges of this YCMC, the following sections explain the impact of this center in terms of these four standpoints '*situated success*', '*information culture and tradition*', '*typology of resources*' and '*functioning*'. These four perspectives of impact analysis reflect a spectrum of understanding of the effect of ICT projects in rural developing countries.

5.1 Impact in terms of 'Situated Success'

In this section, I summarize the key activities, opportunities and obstacles (see in figure 2) of the ICT program considering a three stages of time frame from establishment to till date. The activities of the ICT center has high potential which can contribute to the success of this project in different stages, but it also visible that the center has faced a lot of challenges over the period of time.

During the center's inception the objectives were to include the whole community by transmitting ICT handling information transmission/dissemination, as well as providing ICT skill and training to the community youth group to help them develop knowledge on community information need, and adoption practice following a participatory approach. Each stage of its operation, the ICT center continues to succeed as a result of the situational demands. For example, even at the 'Self-operated' stage this center has a lot of opportunity because of the state's policy of digital vision of Bangladesh. Besides, people have in general become more aware about the benefit of technology and are eager to know, how they can exchange and share their information through ICT. Hence, evidence from this empirical study suggests that the success of this center is situated which is bound to social, cultural, political and environmental contexts. Hence, I could say that the apparent success of this center is '*situated success*', because this center has been bounded to the particular combination of local contexts and good timing opportunity of digital Bangladesh vision.

| | Funding period | Transition Period | Self-operated period |
|--------------------------|--|---|--|
| Activities | <ul style="list-style-type: none"> ▪ Capability building through ICT training ▪ Organizing volunteer groups ▪ Disseminating information ▪ Demonstration of the need based information and awareness building with the help of forum theater | <ul style="list-style-type: none"> ▪ Capability building through ICT training among village youth groups at a subsidized price ▪ Disseminating information in rural areas through different ICT equipments with the help of organized volunteer groups | <ul style="list-style-type: none"> ▪ Capability building through commercial training on basic computer programs ▪ Providing Internet facility for rural peoples |
| Identified Opportunities | <ul style="list-style-type: none"> ▪ Talent and enthusiasms of youth groups to cope with new technology easily ▪ Feeling of self esteem of Youth groups by involving themselves in this kind of social work ▪ Use of ICT tools in participatory Forum theater | <ul style="list-style-type: none"> ▪ Commercial Training on basic computers can be a good source of generating income ▪ Low cost Internet service is another source of income to sustain the ICT center. ▪ The potentiality of the Volunteers to work independently for more challenging ICT venture | <ul style="list-style-type: none"> ▪ The commitment of trained Volunteers to sustain this ICT center ▪ Enthusiasm of young and educated rural people to learn computer and internet technology ▪ On line services by public and private enterprises |
| Identified Obstacles | <ul style="list-style-type: none"> ▪ The requirement of diversified information for the marginalized people ▪ Persistent challenge to work in an unfavorable social and cultural environment | <ul style="list-style-type: none"> ▪ Insufficient financial capability to carry on the operating cost ▪ High rate of volunteers drop out because of better job opportunity ▪ Additional cost for training new volunteers | <ul style="list-style-type: none"> ▪ Requirement of additional investment for generator or power backup ▪ A big portion of marginalized and elderly people are not included within the reach of YMCA services |

Figure 2. Summary of the activities, opportunities and obstacles of YCMC

5.2 Impact in terms of ‘Information Culture and Tradition’

If I look at the ICT initiatives in terms of this perspective then it is evident that this center took ‘*Forum theater*’ and ‘*folk music*’ approaches to disseminate the socio need based information and knowledge development purposes. According to the rural community people and the program officer of this center, this Forum Theater was a very popular to local people because it was a blended show with ICT and traditional entertainment approaches. This center has moved to commercial strategy to provide ICT access to rural people, but still people acknowledge their service valuable to them. With this observation, I would say that the ICT motivation depends also on the information culture and tradition, and it is also recognized that social exclusion from ICT development is not only related to inequalities in social-economic status issue but also a issue of institutional arrangements and discrepancies of traditional norms of social life (Trauth et al., 2006).

5.3 Impact in terms of ‘Typology of Resources’

The three stages of this ICT4D project as mentioned above, have some significant relation with economical, social and, data and action resources. With respect to resources, Heeks (2005) points to the importance of four sets of resources, and to understand the sustainability of the tele-center, I have discussed with the help of these four resources.

1. *Data resources*: The digital contents on various issues such as health; reproductive rights; human rights focused on women and child rights issues; government forms and information; instructions/manuals for computer programs; job announcements; etc.

2. *Economic resources*: The facilities of the centre (computers, printer, scanner, etc.); the funding to allow subsidization of cost for the marginalized people; the knowledge and skills of the centre operator, instructors and the volunteers gained.

3. *Social resources*: The form of motivation, confidence and knowledge found in the users, community people and operator. The credibility and trust gained by the centre staff and volunteers among members of the local community. The presence of peers in the centre also serves as a pivotal social resource for the users/learners.

4. *Action resources*: A little harder to identify these resources in the study. Some examples I can include here such as the improved employment opportunities for users who have undertaken the formal training; get better opportunity in ICT environment and the enrolment as volunteer into the centre or other NGO's. The notice board can be seen as action resources. The operator is arranged the notice board with transformed data resources considering the rural peoples' information need and understanding level and this could consider as an outcome of his skills and motivation.

It is observed from the study that the ICT center has been using different types of resources to adopt ICT and ICT-enhanced community development activities in rural areas, but it is also visible that capability development can be evolved in every stages of its operation. One significant assertion from one of the volunteers can be explained in terms of resources. He admitted that he had taken training from the center without any cost and did work for the centre by collecting data and preparing participatory video content to demonstrate the rural community. Although he has now moved to city for his further study and job purposes but he still visits this centre to meet his previous friends. He has sent his younger sister to take ICT training from this centre. From this assertion I could extract following three kinds of resources to this ICT initiative; social resources (motivation, skills, knowledge of ICT), action resources (able to take new job) and economical (supporting sister for ICT training). I can find another resource aspects from the program officer's appreciation, he stated that 'During our transition period many skilled volunteers left this center because of their financial need and their family responsibility, and they got good jobs in different national media organization' Hence, it is apparent that ICT4D project can contribute to ensure resources and ensure the use of the resources effectively under certain conditions if it wants to include more marginalized community into these development initiative. Therefore, if we look into the different strength of these ICT4D activities we can see that during the funding period they have economical resources (funding), social resources (such as youth motivation and collaborative works). When they used these resources to understand and transmit the data resources into information resources to motivate big community then it worked. Currently one of the major strengths of the YCMC is its training activities. In the early stage, the centre became a significant rural poor community capability building force in this sub-district Sitakund. The transformation of data into information and knowledge requires capability, which was accomplished by the motivation and skills of young generations as well as by their in-depth understanding of the rural community's information need.

5.4 Impact in terms of 'Functioning'

One trainee, who received ICT training from this center without any cost earlier, now works as an operator in the center. He has motivation and passion for this center as well as for rural marginalized community. These streams were created into him, when he was involved in 'Forum Theater' activities as a social worker and circulated news in remote areas with the help of new technology. It shows that ICT evolutions can build rural marginalized youth's future with new technology as well as play vital role to motivate them to work for community development. If I consider the capability building approach with resource perspective then social and economical resources are strongly associated with the human capability building process. The data analysis shows that this ICT center has played a potential role for enlarging a person's 'functioning'. Sen (1989) defined human development as the process of enlarging a person's 'functioning', and capabilities to function, the range of things that a person could do and be in her / his life. He also defines a functioning is an achievement, where a capability is the ability to achieve. Functioning is more directly related to living conditions where capabilities are notions of freedom, the real opportunities regarding the life one people may lead.

The multimedia center's activities can be seen as links between the resources and capability building e.g. the skills and values of the community peoples. These centers made strong role to create capabilities of rural

youth groups through the social, economical, action and data resources vice versa. I can say that these capabilities of youth groups are producing the new social, economical, data and action resources for their family and community. Here I can draw a relationship (see in figure. 3) between the different resources and capability building based on this ICT4D project in rural community in developing country.

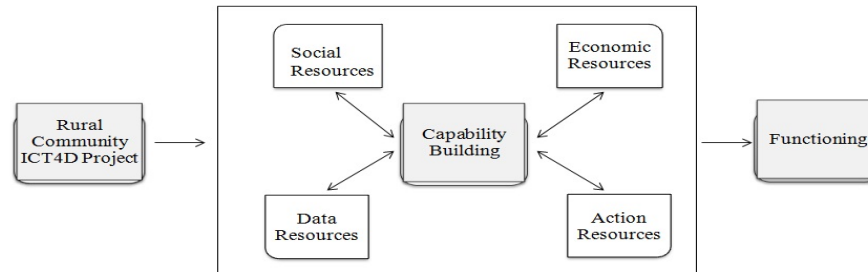


Figure 3. Relationship between resources and capability building in ICT4D project in rural community

Based on this study, I would say that this center is functioning for rural marginalized community during the funding and transition stages. In those periods of time it included very remote marginalized group who are usually excluded from any ICT facility for their socio-economical realities. Therefore the capability has been recognized as a central point for functioning of ICT4D project for rural marginalized community in developing country.

6. CONCLUSION

The above findings indicate that this ICT4D project is an initiative with broader outcomes and implications than as simply an approach to ICT-enhanced information access. Besides, this center can be used as a medium to community capability building despite of different economical and social issues. The ICT-enhanced community capability building also actively promotes the formation of resources which could support the sustainability of ICT4D project beyond its funding period. In a country like Bangladesh, economically it is impossible to provide full ICT access to individual households, especially in rural areas. The hard work of many development organizations to disseminate information suffers from this reality. By addressing these challenges, Youth Community Multimedia Centre (YCMC) have been actively working to overcome some of the challenges of the digital divide in village areas of Sitakunda. Although this ICT4D project had lack of long term commitment and short of financial capability to run its activities for long period of time for marginalized group but it certainly made a good example for that village area and community people. Still it has potential resources in human capability building processes in spite of having dilemma to include the mass community into their digital literacy activities.

From institutional point of view YCMC cannot sustain financially without external funding from other development organizations, when it wants to include the rural poor community. On the other hand, it became a powerful vehicle to promote ICT enabled change processes in development activities when there was a strategic plan and support from other development organizations. It is evident that the movement of this centre to self-operated stage compelled them to exclude the rural poor people from this development activities, hence it could be said here that institutional policy as well as government regulation on ICT based initiatives may sideline the poor in rural developing country.

This article provides four aspects 'situated success', 'information culture and tradition', 'typology of resources' and 'functioning' to understand the role and impact of tele-center in rural area of Bangladesh. These four aspects, grounded on theoretical framework of capability approach and resource bounded information flow, represent specially the core capabilities of community telecenters in rural community development. There is need to further develop these four aspects applying in different context of rural community development process, and that can also explore new perspectives. These strategies can make deeper and broaden our understanding on ICT4D project sustainability issues.

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USING FOCUS GROUPS WITH VETERANS TO IDENTIFY ISSUES TO ADAPT A COMPUTERIZED TAILORED INTERVENTION TO ADDRESS PTSD RELATED BEHAVIORAL RISK FACTORS

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ABSTRACT

Combat exposure for military service members in Iraq and Afghanistan has increased the incidence and prevalence of posttraumatic stress disorder (PTSD) and associated behavioral risk factors. With the increased need for behavioral health services in this population, there is value in examining evidence-based interventions that help veterans to self-manage behavioral risk factors contributing to PTSD. This study evaluated the relevance of an evidence-based computerized tailored intervention (CTI) developed by Pro-Change Behavior Systems for behavioral risk factors associated with PTSD in veterans and identified veteran-specific issues for future adaptation. Three focus groups with a total of 21 male veterans were conducted. Three CTI programs, previously developed to address smoking cessation, stress management, and depression prevention in a general adult population, were evaluated for their applicability to a combat veteran population. Qualitative methodology was utilized to categorize major themes and subthemes regarding acceptability of the programs to veterans. Participants thought the existing CTI programs were generally applicable to veterans; however, they identified several issues, such as activities in which veterans do not typically engage and graphics that were reminiscent of combat experiences. Veteran participants also made some population-specific suggestions to the program content, including the addition of feelings of alienation and difficulty gaining support from non-veterans. This evidence-based CTI system addressing multiple behavioral risk factors associated with PTSD is largely applicable and can be successfully adapted to serve veterans.

KEYWORDS

Computerized tailored intervention, posttraumatic stress disorder, veterans, transtheoretical model

1. INTRODUCTION

1.1 Posttraumatic Stress Disorder and Related Problems in Veterans

Military combat is an extreme traumatic stressor involving exposure to actual or threatened death or serious injury, which puts deployed soldiers at a high risk of developing posttraumatic stress disorder (PTSD). Combat-related PTSD prevalence is from 2% to 31% among combat veterans in the United States, two to four times the estimated PTSD prevalence among U.S. civilians (Richardson, Foa and Acierno, 2010). Studies with recent combat veterans have reported slightly higher PTSD prevalence rates than older generations, as high as 48.7% (Helmer et al., 2007).

Compared to other traumas, combat trauma is more likely to result in delayed onset of PTSD, unresolved PTSD symptoms, and social or occupational impairment (Prigerson, Maciejewski and Rosenheck, 2001). Combat-related PTSD in veterans may also increase the risk for other psychiatric disorders, physical health conditions in later life (O'Toole, et al., 2009), and can remain a lifetime problem for some (Ikin, et al., 2007).

PTSD is related to many behavioral risk factors in veterans, which may influence one another. Among Vietnam veterans, active PTSD increased smoking risk while remitted PTSD decreased risk (Koenen, et al., 2006). Cigarette smokers with PTSD were also more likely to report higher levels of PTSD symptoms, depression, and trait anxiety compared to non-smokers (Beckham, et al., 1995). Integrating smoking cessation into PTSD treatment can result in greater prolonged abstinence compared to specialized cessation treatment (McFall, et al., 2010). Furthermore, recent combat veterans with PTSD symptoms also reported significantly more depressive symptoms and vice versa (Lapierre, et al., 2007).

1.2 Barriers to treatment of PTSD in Veterans

Among returning veterans from Iraq or Afghanistan with a mental disorder, less than half indicated an interest in seeking professional help and fewer reported actually receiving treatment (Hoge, et al., 2004). These individuals were also twice as likely as those without a mental disorder to express concerns about stigma and other barriers to mental health care.

The VA also recognized some problems in disseminating traditional therapies for PTSD in veterans (Bradley, et al., 2010). One issue was veterans' motivation to participate in the treatment. Another obstacle was time constraints of mental health professionals. The diversity and geographic dispersal of veterans also requires better access to mental health services (Tanielian and Jaycox, 2008). Thus, exploration of effective alternatives that are stigma free, easily accessed, wide reaching, prevention oriented and/or cost-efficient may help bridge the gap between increased needs and limited resources.

1.3 Computerized Tailored Interventions for PTSD in Veterans

Many obstacles to providing veterans with cost-effective treatment for PTSD may be addressed by computerized tailored interventions (CTIs). Anonymous access and anytime availability, which CTIs can provide, may help reduce the barriers to mental health care in the military (Greene-Shortridge, Britt and Castro, 2007). Internet-based CTIs also offer interactive individualization of treatment, collection of precise user data, wide reach to a large population, easy access, relatively low cost, and timely update (Ruggiero, et al., 2006). Internet-based early intervention for people who experienced terrorist attacks – somewhat similar to deployed soldiers – has shown promising feasibility (Ruggiero, et al., 2006). CTIs appear to be as effective as some form of professional help in the treatment of tobacco use (Klein, et al., 2010).

In addition to the potential benefits provided by a CTI, CTIs based on the Transtheoretical Model (TTM) may offer additional advantages through its motivational enhancement approach (Prochaska and Velicer, 1997). The TTM conceptualizes health behavior change as progress through different stages of motivational readiness to change health risk behaviors. There are five stages along a continuum of readiness to change, which are precontemplation, contemplation, preparation, action, and maintenance. In this change process, decisional balance, self-efficacy, and processes of change help individuals move forward toward change.

The TTM has been employed in CTIs for various behavioral risk factors and proved to enhance their efficacy (Evers, et al., 2006; Levesque, et al., 2011; Prochaska, et al., 2001). TTM-based CTIs assess users' stages of change and provide specific feedback based on their individual readiness for behavior change. This approach increases participation rates compared to action-oriented programs (Prochaska, et al., 2001).

Moreover, when TTM-based CTIs target multiple health behaviors, they appear to offer more benefits to individuals than do those single-behavior-change programs (Johnson, et al., 2008). Individuals who progressed to the action or maintenance stages of change for one behavior were also more likely to make progress on a second behavior (Mauriello, et al., 2010). This co-action builds the foundation for the potential efficacy of a multi-behavioral CTI in changing both target and associated non-target behaviors.

1.4 Purpose of the Present Study

No TTM-based CTIs have been developed specifically for, or tailored to, veterans. This focus group study, part of a larger project (Jordan, et al., 2011), was intended to bridge this gap by evaluating the applicability of an evidence-based CTI to address smoking, stress, and depression in veterans, the results of which may be used for future adaptation.

2. METHOD

2.1 Participants

Participants were recruited from veteran communities in Hawai'i, who were screened for eligibility based on predetermined criteria (see Table 1). Ten qualified veterans were recruited for each focus group that would evaluate a CTI program addressing one of the three PTSD-related behavioral risk factors, i.e., smoking, stress, and depression. Twenty-one veterans participated (70% participation rate), nine in the smoking cessation group, six in the stress management group, and six in the depression prevention group.

Table 1. Eligibility criteria for participants

| Eligible Individuals | Ineligible Individuals |
|--|--|
| 1. Veterans age 18+ years | 1. History of mania, schizophrenia, other psychoses, or active substance use |
| 2. Iraq or Afghanistan service experience preferred | 2. Special medical conditions that may prevent engagement with the CTI program, such as history of significant head injury |
| 3. Computer literacy at the beginner level or higher | 3. Suicidal ideation |
| 4. Cigarette smoker preferred | 4. Severe PTSD symptoms |
| 5. Mild to moderate PTSD symptoms preferred | 5. Severe depressive symptoms |
| 6. Mild to moderate depressive symptoms preferred | |

2.2 Procedures

All procedures were approved by the two institutional review boards involved. The focus group methodology was informed by Morgan (1998). Two practice sessions were conducted to familiarize research staff with the procedures and to finalize the protocol. Each focus group began with the informed consent process and completion of a brief assessment, followed by introductory questions and the evaluation of one of the three CTI programs using a discussion guide for that particular program. All focus groups were recorded. The focus groups were led by a trained facilitator, with an assistant facilitator and two note-takers help with the process. Each focus group lasted approximately two hours. Food and water were provided during the focus group sessions, and a \$25 gift card was provided to each participant at the end of the meeting.

2.3 Data Analysis

The focus group analysis followed the guidelines recommended by Krueger (1998). Immediately after each focus group, the facilitator, assistant facilitator, and note-takers debriefed the process and noted group dynamics. The audio recordings were transcribed and all identifiers were removed to protect confidentiality. The transcript created was then compared with the notes to ensure completeness and accuracy. The analysis entailed breaking the transcript into meaning units and then grouping similar meaning units to form themes. To be considered a theme, an idea had to be mentioned at least twice. After extraction of themes, major themes were identified and examined in terms of the applicability of existing CTI programs to veterans. Particularly, themes specific to veterans were summarized to direct future adaptation.

3. RESULTS

3.1 Participants

Participants were male veterans from different age groups, diverse ethnic backgrounds, and all branches under the Department of Defense. The mean age was 49.6 years and the average length of military service was 59.4 months. Only a small portion (14.3%) were living with a partner and less than half (42.9%) reported having one or more children.

Table 2 presents the distribution of stages of change for the three target behaviors. In the smoking cessation group, many were in the contemplation stage, and none in maintenance. For the stress management and depression prevention groups, participants were approximately evenly distributed across different stages except for the action stage. All five stages were represented across the three groups.

Table 2. Participants' Stages of Change

| Stage of Change | Smoking Cessation (n = 9) | Stress Management (n = 6) | Depression Prevention (n = 6) | Total (n = 21) |
|-------------------|------------------------------|------------------------------|----------------------------------|-------------------|
| Pre-Contemplation | 1 (11.1%) | 1 (16.7%) | 0 (0%) | 2 (9.5%) |
| Contemplation | 5 (55.6%) | 1 (16.7%) | 2 (33.3%) | 8 (38.1%) |
| Preparation | 2 (22.2%) | 1 (16.7%) | 1 (16.7%) | 4 (19.0%) |
| Action | 1 (11.1%) | 0 (0%) | 0 (0%) | 1 (4.8%) |
| Maintenance | 0 (0%) | 2 (33.3%) | 2 (33.3%) | 4 (19.0%) |
| No Response | 0 (0%) | 1 (16.7%) | 1 (16.7%) | 2 (9.5%) |

3.2 Applicability of the Evidence-Based CTI to Veterans

In terms of the program content, participants thought it was appropriate for veterans who were having difficulty quitting smoking, managing stress, or preventing depression. They found the concept of stages to be helpful for self-evaluating and stage-tailored feedback encouraging for progress. In terms of decisional balance, participants identified with most pros and cons provided. Participants especially liked aspects of the system that acknowledged their autonomy as veterans. The individually tailored feedback on processes of change was also considered to help them adopt useful strategies or maintain effective strategies already employed. Many participants believed that the included goal-setting would be very useful in helping them move forward through the stages. In particular, small steps toward specific goals were especially appealing because it increased the manageability of behavior change. Scientific and user-friendly language each gained some support, with a preference for a combination. They particularly preferred text that is clear, concise, specific, informative, and easy to understand. Most graphics in the programs were considered relevant to the information presented in the corresponding text and helpful for users to better understand the content or feel more positive about changing. For example, pictures of the bright beach and grassland in the stress management program were thought to be relaxing and representative of a way to manage stress.

Although the majority of the content was appropriate, some was considered difficult or inappropriate. When reviewing the screenshots, participants had difficulty understanding a couple of professional terms without a definition or explanation, such as "transtheoretical" and "contemplation". They also had difficulty relating to the function of the "pros and cons" exercise. In addition, they indicated that some benefits (e.g., improvement in appearance) and certain activities (e.g., yoga) in the CTI may not appeal to veterans. Furthermore, they did not like graphics that triggered combat memories or unhealthy behaviors, including the beach at sunset and cigarettes. They also suggested that helping relationships were a source of stress rather than support for veterans because of difficulty relating to non-veteran friends and family members.

Some suggestions for adaptation were proposed during the discussion. Inclusion of more scientific-based information in a user-friendly language was recommended. Providing more veteran-specific helping strategies was proposed, such as "couples counseling" for post-deployment relationship building and avoidance of isolation for the depression prevention. Participants also suggested that the content of the graphics be consistently related to the written information.

With regard to the program structure, participants thought the programs were well constructed for users to navigate. The text was generally considered clear, concise, and easy to understand. Most screenshots from the

programs were perceived to provide a good balance between text and graphics. The color, size and layout of different components, i.e., text, graphics, and icons, were largely endorsed as appropriate in terms of usability and appearance. Especially, participants liked graphics that were engaging, pleasant, calming, and explicit. They believed that screenshots appearing less compact were appealing to depressed users.

In spite of all the strengths reviewed above, some structural problems that might affect the applicability of the programs were identified. Some screenshots from the depression prevention program were thought to have too much text. Some graphics in the depression prevention program were thought to be too dark or depressing. Regarding the layout, the proportion of the text in some screenshots was visually overwhelming.

Several additional suggestions for adaptation were made to further improve the applicability to veterans. Bulleting points were recommended to simplify the narrative text. Light color schemes, such as lavender, sky blue, and pink, were suggested to make the programs appealing to both genders. In addition, a few participants proposed using a consistent layout throughout each program to make it easy for users to follow.

3.3 Identified Veteran-Specific Issues

In addition to the applicability of existing CTI programs to veterans, issues specific to veterans were elicited. Three major issues were identified from the transcript. One noticeable issue to veterans was that their support systems were largely confined to the VA programs and peer veterans. They expressed a feeling of alienation from non-veterans after returning from combat and difficulty communicating with them. They admitted that it was especially stressful and challenging for them to communicate with and gain support from family members in changing unhealthy behaviors related to combat experience. They articulated a need for educating family members about combat experience and strategies for effective communication with non-veterans.

Another salient issue to veterans was the influence of the stigma and shame around mental health problems and their treatment. Although participants acknowledged the significant improvement in this area, they still reported difficulty admitting receiving counseling or therapy to a medical provider. In addition, some participants emphasized the importance of confidentiality promised by the CTI for disclosure; in contrast, other participants did not have any concerns about the issue once they were out of the military.

Another significant challenge for veterans was avoiding unhealthy behaviors in high-risk situations. Some participants shared that it was extremely difficult to resist alcohol use if they were having trouble falling asleep. Some indicated difficulty avoiding smoking when they were drinking alcohol or coffee because they habitually engaged in these behaviors simultaneously. Others reported that they were more likely to resort to unhealthy behaviors once the healthy behavior failed to work. Last ly, frustration due to the lack of understanding and support from family was also identified as a trigger for engaging in unhealthy behaviors.

4. CONCLUSION

The present study evaluated the applicability of an evidence-based CTI to address behavioral risk factors for PTSD in veterans for future adaptation. Participants represented different age groups, diverse ethnic backgrounds, all branches under the Department of Defense, and all five stages of change. The major findings indicated that the existing CTI is largely applicable to recent veterans returning from Iraq and Afghanistan. A few changes can be made to further tailor the intervention to the specific needs of veterans.

Participants thought the concepts and strategies based on the TTM were very helpful for veterans to improve motivation to change, take action toward goals, and maintain change over time. Especially, the concept of self-efficacy was strongly endorsed by participants. Only some minor revisions were suggested to make the content more appropriate to veterans, such as removing pictures triggering combat memories or unhealthy behaviors and adding strategies helping veterans handle relationship and avoid isolation.

Possible explanations for this general applicability of the content could be the generability of theoretical foundation of the CTI – the TTM, which integrates principles of change from leading theories and applies the results of over 30 years of research. Further, the system's previous successful application to multiple health risk behaviors in various populations (Driskell, et al., 2008; Evers, et al., 2006; Levesque, et al., 2011; Prochaska, et al., 2001) may make it readily acceptable to veteran participants. Finally, veterans may be similar to the general population in terms of their motivation and process of change when the targeted

behaviors are the same. This implies that the TTM components, i.e., stages of change, decisional balance, self-efficacy, and processes of change may be involved in all individuals' change in health risk behaviors.

The content that participants suggested to adapt may reflect some issues general to people in the process of change or specific to veterans. For example, their difficulty selecting one answer to the stages of change question may imply the ambiguity about change in individuals' process of change. Participants' strong reaction to pictures reminding them of desert terrain in Iraq may suggest PTSD symptoms after combat exposure. Their comments on helping relationships, managing relationship stress, and avoiding isolation seems to indicate veterans' feelings of isolation and difficulties with relationships.

Participants found the CTI screenshots easy to follow and providing a good balance between text and graphics. No systematic change to the structure is needed for adaptation. Only a few suggestions were made to reduce the portion of text and to use a calming, pleasant color scheme appealing to both genders.

Because the CTI went through a series of system testing when it was developed, the usability and appearance of all structural components have been well established. In addition, the CTI has been applied effectively to multiple health risk behaviors in various populations as mentioned above, indicating the general applicability of system structure. Participants' preference of concise text and simple layout may be related to their military training and experience. Although all participants were male, their proposal to use a color scheme appealing to both genders may reflect a perceived increase of women in the military.

One of the primary interests is to find out veteran-specific issues for future adaptation of the existing CTI. Three major issues identified are perceived insufficient support from family members, concerns about stigma of seeking mental health care, and problems with resisting health risk behaviors in high-risk situations. These are consistent with findings from previous studies with veterans. Strains in family functioning have been widely reported (Wheeler, 2007). Many service members believed that they might be perceived weak or discriminated by leadership if they seek counseling (Hoge, et al., 2004). Furthermore, interaction between substance use, stress, depression, and PTSD has been documented in veterans (Durai, et al., 2011).

The particularly challenging issues reported by veteran participants may help direct further adaptation of the existing CTI and development of new intervention programs to address these issues. First, strategies for effective communication with non-veterans could be added to the existing CTI. In addition, new programs can be developed to help family members better understand veteran's combat-related experience and support their behavior change. Second, provision of confidential online CTI programs targeting different mental health problems in veterans may allow them to seek help without feeling stigma. Third, more intervention programs addressing multiple comorbid problems in veterans, like the CTI examined here, should be developed to help them successfully cope with high-risk situations. Some processes of change in the existing CTI could also be tailored to help veterans resist unhealthy behaviors in veteran-specific high-risk situations.

Although the study is a good first step to developing a veteran-tailored CTI addressing behavioral risk factors associated with PTSD, there are some limitations to be considered. First, all participants were male veterans; therefore, the female perspective may not be reflected. Although the majority of veterans are male, there are increasingly more females, especially in recent veterans returning from Iraq and Afghanistan (Franklin, 2009). As a result, it is important to learn about female veterans' opinions on the applicability and adaptation of the existing CTI. In addition, only 14.3% of participants were married but 57.1% were separated or divorced. Thus, their perceived problems with family members might be biased by their personal experiences although family dysfunction has been previously documented (Wheeler, 2007). Furthermore, all participants were living in Hawai'i; however, this concern is tapered by the fact that many participants are from different states across the mainland. In addition, the diversity of participants' demographic variables and stages of change also enhances the representativeness of data.

In addition, only a representative sample of screenshots was selected and shown to participants. Hence, participants did not have a chance to experience the interactive aspect of the CTI, which may influence applicability. Indeed, participants' understanding of certain components, such as specific feedback on previous choices, dramatically improved after explanation of the interactive process. It may be reasonable to expect that participants would find the CTI more acceptable if they had interacted with the programs on a computer. Furthermore, because participants did not review all the content included in the programs, certain content they suggested to add may overlap with what already exists.

In conclusion, the evidence-based CTI is generally applicable to recent veterans returning from Iraq and Afghanistan. Some minor modifications can be made to further tailor the programs to veterans' specific needs. As a group, veterans have a distinctive sociodemographic profile (Koepsell, 2002). Examining the mental health effects in recent veterans has been of increasing importance, particularly since research has

shown that deployment and exposure to combat result in increased risk of PTSD, major depression, substance abuse, functional impairment, and increased healthcare utilization (Hoge, et al., 2006; Hoge, et al., 2007).

This study provides a solid first step to adapt an evidence-based intervention to address behavioral risk factors associated with PTSD in veterans. For veterans who are not ready for in-person psychotherapy, have practical issues attending therapy sessions, or fear stigma associated with seeking mental health care, this veteran-tailored, motivational enhancement CTI may provide unique benefits. In addition, veterans with mild PTSD symptoms and comorbid behavioral risk factors may find this CTI sufficient to resolve their problems. In this sense, the adapted CTI will make evidence-based mental health care more accessible to veterans in need without adding concerns about stigma and costs.

Based on the results from this study, the existing CTI will be adapted and beta-tested. Then a usability study will be conducted to examine and improve its system structure. This will be followed by a feasibility test to explore preliminary efficacy of this veteran-tailored, TTM-based CTI in addition to further examination of its acceptability and usability. If this adaptation of an evidence-based intervention to veterans proves to be successful, it may provide the field a usable model for adapting evidence-based interventions.

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TRUST AND COOPERATION INCENTIVES FOR WIRELESS USER-CENTRIC ENVIRONMENTS

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ABSTRACT

The flexibility inherent to wireless technologies is giving rise to new types of access networks and it is allowing the Internet to expand in a user-centric way. In this kind of scenario, trust, reputation as well as adequate incentives for cooperation are of vital importance. This paper provides an overview on the state of the art in trust and reputation in wireless environments, identity disambiguation and cooperation incentives. It underlines the current shortcomings in these fields and establishes the relation between these previous concepts in order to form a more robust and reliable Internet, where the end-user is directly involved in the connectivity value chain.

KEYWORDS

Trust, cooperation incentives, user-centricity, wireless, identity disambiguation

1. INTRODUCTION

Wireless networks today are partially being formed by nodes (e.g. Internet access points, smartphones, femtocells) that are owned and carried by humans. As such, these *user-centric networks* (UCNs) are giving rise to new Internet architectures, where broadband access is complemented by e.g. *Wireless Fidelity* (Wi-Fi) clouds, having an active involvement of Internet end-users.

This represents a paradigm shift in the Internet evolution, as the user may be in control of parts of the network, in a way that is acknowledged (or not) by Internet stakeholders. In such scenarios where several strangers are expected to interact for the sake of robust data transmission, trust and reputation are of vital importance as these establish a way for the nodes involved in the system to communicate with each other in a safe manner, to share services and information, and above all, to form communities that assist in sustaining robust connectivity models.

UCNs have a few characteristics which make them complex to control: i) they are supported both by static, fully dedicated nodes as well as by nodes provided by end-users on-the-fly; ii) in their majority, they are complementary to broadband access but are located on the last hop to the Internet end-user, which is not always accessible from the operator perspective; iii) as some nodes are carried by Internet end-users, their networking composition and organization follows a social behavior, highly affected by human movement features. UCNs are therefore in the category of self-organizing, viral systems, where often anonymous nodes can try to become part of the system and as such, UCNs require that trust and reputation systems/metrics should be attack resistant in order to ensure that the architecture is as robust as possible.

Due to their characteristics, a successful deployment of UCN relies on the combination of: i) trust and reputation systems/metrics aiming to create a more flexible system than the usual communication protection schemes (e.g. VPNs); ii) Identity disambiguation aiming to create UCNs resistant to attacks such as Sybil [1] and similar ones [2]. In this paper we consider Sybil attacks to be the ones that are most worrying in UCNs because they take profit of identity multiplicity, which is something easy to achieve in *User-centric Networks*, as there is no limit in the amount of nodes or virtual identities that a given user can own; iii) cooperation incentives aiming to persuade users to behave in a correct manner in order to create a sustainable and scalable system, in exchange of some form of compensation/remuneration.

This paper provides an overview on trust management, identity disambiguation and cooperation incentive, as well as a brief analysis of how these three techniques can be combined to create UCNs as self-organized sustainable, scalable and safe systems. Firstly, *identity disambiguation* can offer a great help on the issue, by helping to prevent identity related attacks such as Sybil and similar attacks [1]. Secondly, the paper analyses how *cooperation incentives* can assist in complementing trust and reputation by persuading the involved parties (Internet users and providers) to behave in a correct way, in exchange of some form of compensation/remuneration, to encourage cooperative behaviors.

The rest of the paper is organized as follows: Section 2 presents related work. Section 3 goes over a few notions on trust and reputation management in mobile wireless environments and introduces a few relevant identity disambiguation techniques, Section 4 analyzes cooperation incentives both from the Internet end-user perspective and from the operator/provider perspective. Finally, Section 5 presents a discussion on these previous topics and how they relate and interact all together and Section 6 concludes the paper.

2. RELATED WORK

In this section we present some of the related work that has attempted to complement trust management with other approaches in order to improve some aspect(s) of network operation.

Salem et al. propose a trust and reputation system [3] that enables the user to choose the best hotspot and discourages wireless Internet service providers (WISPs) from providing a bad QoS to the mobile nodes. They combine trust and reputation with a micropayment scheme to make sure that the MNs will pay for the service they received. In our work, we do not only take into account WISPs, but all kind of operators.

Lin et al. [4], present a solution which integrates the notion of soft trust in order to harness all the potential benefits of open networks and mobility. Our approach does not focus only into security, but also into improving other areas of network operation such as mobility, resource management, etc.

Jøssang et al. [5] discuss in their paper how trust and reputation systems that allow users to rate each other provide, in an indirect way, incentives that promote good behavior and improve the overall system quality. Authors of this paper focus mainly in online services and transactions, and do not take that much into account how cooperation incentives can contribute greatly to make trust and reputation systems more secure.

Ramana et al. [6] present a survey on trust management for MANETs based on protocols and finally they propose some new techniques on trust management in MANETs.

3. TRUST AND REPUTATION MANAGEMENT IN USER-CENTRIC WIRELESS ENVIRONMENTS

In this section, first we review how trust management and reputation have been applied to the domain of mobile wireless environments. We then delve into the application of these systems in UCNs. Such application requires a higher level of context-awareness than in traditional desktop environments and we highlight the shortcomings of some of these systems regarding attack resistance. Afterwards, we present some identity disambiguation techniques that can be used to mitigate one of the most well-known of these attacks, the Sybil attack.

3.1 Trust and Reputation

Research on mobile context-aware applications often emphasizes the dynamic short-term situational aspect of context. Concerning the trust context, most of the previous trust engines have focused on the domain of trustworthiness under consideration, but another type of trust from social research, that is, the “situational decision to trust”, which means that the trust engine’s owner has formed an intention to trust every time a particular situation arises, has been overlooked, even if it may be considered as imbricate with dispositional trust.

In the TriQLP trust engine of Bizer et al. [7], although the policy language allows the programmers to specify time dependent policies, no trust metric including the notion of time is given. Marsh [8] underlined

the role of time as being relevant to each of the variables used in his trust model but again no specific time-dependent trust metric was given. The SECURE was the first trust engine to compute a trust value clearly taking into account privacy and identity management [9] but it did not cover time-sensitive trust metrics. Most of previous trust metrics consider from a time aspect that a trust value is updated only when a user manually resets [10][11] a trust value in another entity or when there is the outcome of a previous interaction with this entity by means of direct observations or recommendations (SECURE [9]). The few trust metrics that take time further into consideration simply propose that the trust values decay over time, even if there is no interaction. Mezzetti [12] assumes that trust values decay as time passes and his metric consists on decreasing the trust value by multiplying the trust value at time t by a factor between zero and one, which is the result of a transitive aging function taking the elapsed time since t . Thus, trust metrics with a more fine-grained integration of time than the time elapsed since the last interaction are needed. The first step in this direction may be to timestamp each interaction and evidence. Once each piece of evidence has a timestamp, the trust metric can use this information for more complex analysis integrating time.

Network selection is also a relevant issue that can be tackled with trust and reputation systems. In Nicholson et al. the selection algorithm [13], focuses on the AP's signal strength as an important metric. They describe the design and implementation of Virgil, an automatic AP discovery and selection system which quickly associates to each AP found during a scan, and runs a battery of tests designed to discover the AP's use suitability by estimating the bandwidth and round-trip-time to a set of reference servers. A paper by Ormond et al. [14] further examines network selection decision in wireless heterogeneous networks based on a user-centric approach, which they say that allows a user to choose the network which meets their best requirements. Their network selection algorithm predicts the data rate on each interface available to the mobile node and makes a decision based on those predictions.

A paper by Wang et al. propose a solution for the problem of enabling peers to represent and update their trust in other peers in open networks for sharing files and especially services [15]. They propose a Bayesian network-based trust model and a method for building reputation based on recommendations in peer-to-peer networks. Buchegger et al. talk about the weakness of reputation systems that can be tricked by the spread of false reputation ratings [16]. The authors propose a fully distributed reputation system that can cope with false disseminated information. In their approach, everyone maintains a reputation rating and a trust rating about everyone else that they care about. Their goal is to make existing systems both robust against false ratings and efficient at detecting misbehavior. They propose a mechanism that makes use of all the available information, i.e. both positive and negative, both from own and from others' experience. To make the reputation system robust they include a way of dealing with false ratings.

Tae et al. propose a solution for sensor networks to distinguish between suitable and "illegal" sensors in terms of efficient and safe communication, by using trust and reputation [17]. They suggest a trust model using fuzzy logic in wireless sensor networks in order to distinguish proper sensors and abnormal sensors. Zia et al. propose a solution to avoid computationally expensive cryptographic techniques to preserve the computational resources and energy of wireless sensor networks [18]. They have investigated trust management based on the reputation determined by neighboring nodes in wireless sensor networks. This provides not only the capability of informed decision making but also extended security in wireless sensor networks.

Kamvar et al. Proposes a variation based on EigenTrust values on EigenTrust algorithm [19]. EigenTrust algorithm is mostly used on peer-to-peer systems. The goal of the EigenTrust algorithm is to identify sources of unauthentic files and bias peers against downloading from them. EigenTrust gives to each peer a trust value based on its previous behavior. Each peer can ask the opinions of the people they trust and weight their opinions by their trust value. Ibrahimovna et al. talk about the benefits of using a reputation system on networking and communication [20]. They provide examples of existing reputation based systems and discuss their functional implementations. Based on their observations, they list minimum requirements for benefiting from reputation-based systems in computer networks.

Androutsellis-Theotokis et al. talk focus on distributed trust and reputation management and propose the MoR-Trust algorithm [21]. MoR-Trust is based on purely decentralized peer-to-peer architectures and algorithms, and is targeted towards systems focusing on collaborative tasks or transactions, and is based on the notion of modeling and expressing trust in terms of a quantitative monetary unit, thus coupling trust estimates with transaction values. In mobile environments McNamara et al. talk about present a service provision framework that reasons about mobility and trust to enable effective service [22]. They propose a framework where each peer can independently reason about the QoS and reliability of other peers to select

the 'best' service provider available without relying on information from other hosts. The decentralized trust management model allows the dynamic calibration of the service selection, based on a history of service provisions; this should in turn promote co-operative behaviors among the various peers.

Voss et al. discuss how to guarantee the privacy of the user in the mobile information dissemination networks that, based on user ratings, increase a user's confidence in some information source [23]. SureMsg [24] (Zhang et al.) is a trustworthy email service that is based on the Instant Messaging (IM) platform and which scores the reputation level of email sender by both: global reputation value and local trust value. This paper proposes an approach that is underpinned by the "six-degree-of-separation" to optimize the local trust algorithm in SureMsg so as to decrease the complexity of computation to the local trust value and to obtain a precise score. Xiong et al. talk about existing threats in Peer2Peer eCommerce community [25]. They present a coherent a daptive trust model for quantifying and comparing the trustworthiness of peers based on a transaction-based feedback system.

The paper by Boukerch et al. [26] argues that although trust and reputation are being used as effective security mechanisms for Wireless Sensor Networks (WSNs), no work has taken so far into consideration the bandwidth consumption and delay overhead that these mechanisms can cause. In their paper, the authors present a novel agent-based trust and reputation management scheme (ATRM) which manages trust and reputation locally while causing only minimal overhead.

Finally, in their paper, Zhang et al. present a novel incentive mechanism to promote honesty in e-marketplaces through the use of trust modeling [27]. In their approach, buyers model other buyers in terms of trust and reputation, and they form a social network with the most reputable ones. Sellers model the reputation of the buyers through their social network, and buyers can ask advice regarding to sellers to their neighbors in the social network. Using this approach, well-reputed buyers will be surrounded by many other buyers and they will get best offers from sellers, which in turn will profit from this as the buyers will give them good and truthful ratings, building up their reputation.

Regarding attack resistance, most (if not all) of these systems, are not resistant to Sybil attacks besides SECURE when trust transfer [28] is used and only positive recommendations are possible, and many of them are as well vulnerable to many other attacks as whitewashing or slandering [2]. This is why, different techniques should be used in order to mitigate Sybil attacks in these systems, being one of those identity disambiguation, which is presented following.

3.2 Identity Disambiguation to Mitigate Sybil Attacks

One way to further mitigate the Sybil attack coming from a number of virtual identities owned by the same real world entity is to try to infer that these identities come all from the same author by analyzing the content submitted by those. It is the reason we survey below the techniques used to infer the authorship of messages.

Olivier de Vel. studied the classification of e-mail documents for the purpose of authorship identification [29]. He used the structural features of the e-mail documents and SVM as a learning algorithm. The experiment on a small number of documents yielded promising results, although classification of some authors was better than others. The fact that some authors are better identified than others indicates that other author features need to be specified. Also, selection of priority classification features must be taken into account to eliminate features that do not contribute to the classification performance.

Rong Zheng et al. developed a framework for authorship identification for online messages to address the problem of tracing identity [30]. In this framework, four writing style features were used (lexical, syntactic and structural), and learning algorithms to build the classification model based on characteristics to identify the authorship of online messages. To test the framework, the authors have done an experiment on online newsgroup messages in English and Chinese, this last one because of its differences with the English language (word boundary, word length or frequency of the 26 different letters of English which does not exist in Chinese). They compared the discriminating power of quad types of features and three classification techniques: decision tree, back-propagation neural networks and support vector machines. The experimental results showed that the proposed approach was able to identify the authors of online messages with Accuracy of 70 to 95%. A great performance was achieved for both English and Chinese languages, which shows the potential of this approach in a multilingual context. However, more research is needed to answer some questions. *How to identify the optimal features set of online messages? How much each feature contributes to performance and how to find the minimum features set that will still get good performance?* Another

challenging research direction is to validate the proposed technique in the field so it can be really useful to help finding an online identity or even to help in the investigation of cybercrime.

Farkhund et al. introduced an innovative method of data mining to capture the write-print of a suspect, which may be a combination of four writing style features of all suspects and the model of a combination of features that appear frequently in the e-mails of suspects [31]. This concept is called frequent pattern, which has proved effective in many data mining applications. Unlike traditional approaches, the write print extracted by this method is unique for each suspect, providing clear and credible evidence to present in courts. The method used by the authors, called AuthorMiner, is used to determine the author of a malicious e-mail from a group of suspects based on the writing features of their previous e-mails. The approach of Farkhund et al. overcomes many previous limitations by dynamically extracting evidence (combinations of feature frequency) from the data and filtering the “noisy” features. Experimentation with this approach with real world data showed that it was a robust one. The authors wish to extend their tools to fit different types of stylometric features and use the concept of frequent pattern in order to identify hidden write-prints of an individual for the purpose of e-mail forensics.

Angela et al. were interested in instant messaging (IM). They proposed IM authorship analysis framework which extracted features (emojis, abbreviations, etc.) from the messages to create the write-print of the author, and applied different data mining algorithms (C4.5, k-nearest neighbour, Naïve Bayes, and SVM classifiers) to build the classification model to perform automated authorship analysis [32]. The parameters were systematically changed during the iterative process to show their impact on the accuracy of the classification method. The experimentation achieved authorship identification prediction accuracies of 88.42% and 84.44% for 19 authors and 25 authors respectively. The authors currently continue their work to enlarge the data set and to explore other classification techniques.

4. COOPERATION INCENTIVES

Cooperation incentives can complement trust and reputation systems by persuading users to behave in a correct way in exchange of some form of compensation/remuneration and by encouraging cooperation among them. This mechanism aims at providing incentives for users for sharing their available resources and even effort. The main encouraging aspect to lead users to cooperate is to provide them with resources and help (i.e., efforts) whenever he/she most needs them. This aspect is fully supported by the fact that cooperation incentive mechanism should employ rules to differentiate good users (those who cooperate whenever possible) from bad users (those who only consume others' resources and may have low trust and reputation levels). This differentiation will surely make the non-cooperative behaviour unattractive in the system. Thus, cooperating becomes a must as everybody wins. In this section, the different types of possible cooperation incentives, namely user-side, operator-side and monetization (which can be seen as both types) are presented.

4.1 User-Side Incentives

Spontaneous networks such as user-centric wireless local loops may address scalability and network operation by means of the intervention of autonomous end-user devices. Cooperation is a central feature of user-centric systems aiming to compensate for the lack of a central and dedicated controlling entity. The user-centric paradigm raises concerns, in particular with respect to the establishment of cooperation between such entities and to the fairness of their cooperation level. In spontaneous networks, such as user-centric wireless local loops, users need to cooperate in order to help one another aiming to mitigate the constraints posed by the dynamic networking environment. Knowing that mobile devices have scarce resources, each of these devices should better not cooperate from its point of view and therefore, it is imperative to find the right incentives for users to cooperate. Despite the potential advantages of enrolling in a cooperation process, it is imperative to give users the option to participate or not in cooperation. That is, user willingness to cooperate must be considered. Three reasons may discourage willingness to participate in cooperation: i) lack of trust on other users, which shall be mitigated by a mechanism able to manage trust among nodes sharing interests within the same/different communities; ii) users are running out of resources, which can be lessened if offering users resources that may improve (e.g., increase battery lifetime, processing power, storage room)

their own operation; and iii) users' egoistic behaviour, that is easily diminished once users know they will have resources available upon their needs. However, independently of what is increasing/decreasing their willingness level, users will easily engage in cooperation if they know that they will get resources whenever they need them.

Costa et al. [33] and Hui et al. [34] propose algorithms that consider users' interest and communities, respectively, to encourage cooperation among nodes through message forwarding on behalf of others. In the former, authors propose a utility function based on the fact that nodes sharing interests spend more time co-located. Thus, the utility function considers node's co-location and degree of connectivity with other nodes and messages are forwarded if encountered nodes have higher utility regarding a given interest than the node carrying messages with content matching such interest. As for the latter, forwarding takes place considering popularity of nodes to locally (i.e., within their community) or globally (i.e., outside their community) reach destinations.

There are many cooperation incentive schemes, which are diverse in terms of the features they implement, the type of reward and punishment used, and their operation over time. Moreover, cooperation among users can happen in different ways, where they: i) share the same (or different) type(s) of resource (e.g., storage, processing); and, ii) split networking efforts.

In what concerns the type of shared resources, it is clear that normally, users cooperate by sharing the same type of resources, such as storage and processing. Madsen et al. [35] propose a scheme in which nodes cooperate by sharing storage: Information is stored by nodes based on coding scheme to provide reliable data delivery especially in scenarios where nodes shut down wireless card to spare energy. Yet in the work of Murray et al. [36], cooperation is done through task processing sharing. Nodes cooperate in order to increase their processing power by opportunistically distributing tasks and sharing data/results. However, what should also be considered by the functionality is that users may have some type of resource (e.g., storage) more than others (e.g., processing) and will surely want to exchange that resource they have the most for those they are in need. Thus, the system must be able to measure the amount of resources users are sharing among themselves and assess what would be the corresponding amount when considering a different resource. This way, fairness can be achieved and this will surely become another incentive for users to collaborate with one another.

In what concerns splitting of effort, this situation may occur when users share the same goal (e.g., download a video) in order to save resources and time. Zhang et al. [37] implement such double-win feature where users spend less time in obtaining parts of the video (as different video descriptors are downloaded by involved parties) and later share these parts in a less energy costly medium (e.g., 802.11a). Additionally, nodes can exchange efforts (i.e., forwarding messages on behalf of others) for other resources (i.e., bandwidth). Zhang et al [38] employ such mechanism in which nodes cooperate by sharing a portion of their bandwidth with other nodes that can serve them as relays.

Additionally to an analysis of incentives for cooperation based on trading different resources or splitting effort, Obreiter and Nimis [39] also classify cooperation enforcement mechanisms into trust-based patterns and trade-based patterns. The authors analyze trade-based patterns as being based either on immediate remuneration or on deferred remuneration. In the special case of self-organized systems the classification of cooperation schemes may be done into reputation based and remuneration based approaches. In reputation-based incentives, the decision to cooperate is based on the reputation of the involved nodes. This type of cooperation incentives requires the availability of reputation management systems that can be either centralized, or decentralized, or both. In contrast to reputation-based mechanisms, remuneration-based incentives provide a more immediate penalty to misconduct. Remuneration brings up requirements regarding the fair exchange of the service for some form of payment, which requires trusted third parties to administer remuneration of cooperative nodes. Remuneration-based mechanisms can be considered both user-side and operator-side incentives and are better explained in Subsection 4.3.

It is also important to mention that for a system, cooperation is not only seen from the resource-sharing perspective, but also from the network-experience perspective. Users are expected to collaborate in order to maintain the wellness of the network. Network operation is easily affected by nodes with bad behaviour (i.e., non-cooperative, greedy) and shall be improved through nodes sharing their own experience in a specific location (e.g., sending information about networking condition in specific areas). This can be seen in the work of Buchegger and Boudec [40], where malicious nodes (i.e., that use more resources than they share) are identified either by direct contact or from vicinity and are penalised (i.e., their packets are not forwarded).

Such uncooperative behaviour will become unattractive and nodes will become more cooperative among themselves.

4.2 Operator-Side Incentives

Operators can obtain advantages in supporting a community based approaches for Wi-Fi sharing, instead of leaving to the single end user the management of its own home network or, on the opposite side, to take full control of the home device with integrated Wi-Fi. Many reasons can be found for which an operator can decide to sponsor this model's adoption for their end user community, such as externalizing to communities of users the cost of Wi-Fi configuration management thus improving the quality perception of the service, extending Wi-Fi coverage for their customers and deal with interferences in high density areas or gaining reputation by supporting local communities.

On the contrary possible barriers to the operator sponsorship of this previous model can be easily found in the de-intermediation that such a model creates between operator customer base and his access infrastructure. It is therefore necessary to identify incentives that might encourage operators to sponsor this approach. Such incentives are expected to improve the potential of interoperability and of business opportunity for access and service stakeholders as for instance, being capable of reducing interferences instead of fighting them back. Aspects to be addressed can be categorized into fairness issues regarding resource allocation in cooperation incentives and optimized network operation, such as load-balancing, interference reduction or dealing with mobility (e.g. movement prediction) to reduce the need for signaling when roaming.

One of the challenging problems facing service providers today is how to increase the profitability while maintaining good service qualities as the network scales up. A peer has a connection to the ISP and possibly connections to other peers with some private links. Each peer needs to determine the appropriate amount of traffic via the ISP's link and the private links in order to maximize its utility as it pays the ISP on a monthly base. The ISP, on the other hand, needs to perform proper resource allocations as to avoid resource monopoly and to maximize its revenue. Two distributed algorithms [41] are proposed to help ISPs to provide a fair and efficient bandwidth allocation to peers, avoiding a resource monopolization of the market. Both distributed algorithms converge quickly in case the ISP has enough resources. The ISP can estimate its revenue with a unit price and also a procedure allows the ISP to obtain the optimum unit price for maximizing its revenue. Finally, the ISP can obtain higher revenue by upgrading its capacity when the network scales up. The proposed methodology provides a systematic way to determine pricing and resource allocation even when the ISP and peers interact with each other.

It is well known that the most congested parts of the backbone network are the peering points and the network operators have little incentive to provision them well and few tools to decide how best to route traffic over them. Rui Zhang-Shen and Nick McKeown [42] propose the use of valiant load-balancing (VLB) to avoid congestion in peering networks. In their approach, the backbone networks do not need to use VLB internally: they simply load-balance traffic over their peering links. The analysis shows how the load-balancing should be done and the result is that no other method is more efficient than VLB in achieving a congestion-free network. Moreover, most networks need to accommodate planned and unplanned interruptions and VLB networks, due to their rich connectivity and path diversity, have many advantages in terms of tolerating failures [43].

Even with industry standards, the roaming agreement setup is a costly and time-consuming process. It is therefore a appropriate for long-term partnerships with large sessions but not suitable for spontaneous collaborations with short sessions. On the other hand, there will be numerous providers with different service offerings, technologies, size and locations. It is not feasible to set up formal roaming agreements with every possible provider. However, since a consumer's access and services are limited by established roaming agreements, if a roaming agreement does not exist, users will either be disconnected or need to buy access at a prohibitively high cost. It is thus highly desirable to enable spontaneous inter-working without pre-established roaming agreements between heterogeneous wireless providers. Not only would consumers get more services and coverage with only one subscription, providers would be able to generate more revenue with flexible partnerships and lower cost in providing more services to their customers. This is also beneficial for start-up providers to quickly offer their differentiated values versus established providers.

To address this need, brokered roaming agreement models have been deployed [44]. With the brokered model, operators establish roaming agreements with a broker and the broker then acts as a proxy to handle all

roaming related signaling and traffic on behalf of the operators. With this model, operators benefit from not having to establish individual roaming agreements with other operators. However, there are also serious drawbacks to this model. First, the signaling, AAA and roaming traffic will have to go through the broker, incurring unnecessarily long latency. Second, operators have limited control and flexibility over establishing roaming terms with another operator. Third, operators have to pay brokers for any traffic going through the broker, and thus the profit margin becomes lower. Zhi (Judy) Fu et al. [45] presents a novel AAA (Authentication, Authorization and Accounting) architecture to support policy-based negotiation for establishing spontaneous roaming agreements. The new architecture integrates policy-based negotiation into the normal user association and authentication process for spontaneous and dynamic roaming agreements and interworking. This integration minimizes changes to existing AAA architecture for enabling the new paradigm of automated provider interworking and cooperation.

4.3 Remuneration and Monetization

Remuneration and monetization can provide both user-side and operator-side incentives in that they motivate them to participate thanks to the direct/indirect benefits they receive. Remuneration can be of two forms: credits, which have a virtual currency which can be earned or spent within the community by providing/consuming some kind of service/resource, and fiat money, which is a real-world currency which can be used to buy credits or gained by selling them. Credits and money work on the same plane, although they have different scopes.

Although wireless communities are usually conceived to provide inherent motivations in many scenarios, explicit remuneration is required to compensate possible asymmetries and time misalignments between benefits and costs incurred by community members. Credits are used to this purpose. The use of virtual currency to stimulate cooperation in self-organizing ad-hoc networks has been discussed since 2001 [46]. In a complex scenario, for each class of service members can expose a participation cost expressed in terms of credits. This cost will be automatically used by the community during negotiation to find the solution that maximizes the quality/cost ratio for a given service. The credits earned by a member while providing services/resources can then be spent in a different scenario to pay for the services/resources offered by other members. Technology acceptance models [47] and game theoretical models [48] can be adopted to study consumers' behavior in virtual communities and their willingness to make transactions involving virtual currency.

Money does not need to circulate within the community, since credits can be used as a local currency, but a monetization mechanism allowing users to trade credits for money is necessary at the boundaries of the architecture in order to make it possible for the user-centric wireless community as a whole to take part in the Internet value chain [49][50] and to interact with external players (including operators and external end-users). The monetization mechanism can be conceived as a money exchange service, possibly managed by third-party entities. The back-end of the monetization block can rely on popular online payment services, such as Paypal.

5. DISCUSSION

In the previous sections, trust management and reputation, identity disambiguation and cooperation incentives have been presented, but a relying relation has been established among them. While trust management and reputation systems can be used isolated in order to provide robustness to a given architecture, from the previous sections it can be perceived that almost all (if not all) of the described systems present shortcomings in some areas, be it regarding attack resistance, field and/or scope of application, etc. Identity disambiguation and cooperation incentives can be used to overcome these deficiencies by complementing and collaborating with trust management and reputation systems.

As said before, one of the main attacks that affect this kind of systems is the Sybil attack. By using novel identity disambiguation techniques, Sybil attacks can be tackled and eradicated, as users can not anymore use many identities in order to perform this attack and to bias the system. Also, identity disambiguation techniques can be used in order to compute the reputation of a given user taking into account all his different virtual identities. In order to do this, information extracted from social networks can be used to compile

reputation evidence that will be in turn taken into account within the trust metric of the system. Such compiled reputation evidence can also be fed-back into those social networks to act as an incentive itself.

Cooperation incentives can also complement trust and reputation systems as users can benefit from them while using the system, thus encouraging user's good behaviour. By providing cooperation incentives, there are economic dynamics involved, encouraging the users to keep using the system in a rightful way as they benefit from it. Incentives provide the user with adequate network resources or useful information, based on the node's interaction to its communities and to/from external communities. This in turn, encourages the user to earn a good reputation level, as other users are more likely to interact with high-reputation users than low-reputation ones, reinforcing the trust and reputation system. In particular, reputation acts as an incentive as long as it represents an enabling condition for taking part in some kind of community, for providing some kind of service, or for taking advantage of some premium services. Reputation cannot be traded for credits or money, but a trusted community node is more likely to be involved in a remunerative task, and in the other hand, the remuneration required by a node to provide some kind of service/resource affects the loss of reputation of that node in case of poor quality of the service/resource provided. Also, earning a high reputation can be seen as an incentive itself, as due to social dynamics, being able to display a high reputation level can be seen as a sign of higher "social status".

The lack of trust between users can influence their level of willingness. Thus, another aspect to increase the willingness level in this case is user interest, which must be considered in cooperation. Users sharing the same interest, although being completely unknown to one another, can be easily encouraged in carrying information on behalf of others. At this point, cooperation not only helps users disseminate information quickly and seamlessly but it also contributes to sparing resources from users who are not interested in that specific content. Cooperation shall be easily encouraged if users share some social relationship. Thus, social ties have an important role in making cooperation among users even more reliable.

All in all, the relation between trust and reputation, identity disambiguation and cooperation incentives can greatly help into building a really solid and reliable architecture and it is a topic that should be subject to further research.

6. CONCLUSIONS

Wireless networks are on a second stage of development, where part of the network nodes maybe owned and possibly carried by humans. This requires the creation of network architectures based on trustful, sustainable and save user cooperation. Hence, in this paper, we present a survey regarding the state of the art in trust and reputation in wireless environments, identity disambiguation and cooperation incentives, which are important building blocks of user-centric architectures. Moreover, we establish a relation between these concepts in a way that they can be combined to create UCNs as self-organized sustainable, scalable and safe systems.

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A HIGH ABSTRACTION LEVEL APPROACH FOR DETECTING FEATURE INTERACTIONS IN WEB SERVICES

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ABSTRACT

Composing *Web services* is prone to *feature interactions*, which denote undesirable behaviors arising when several Web services are used together. The existing methods for detecting feature interactions suffer generally from state space explosion. We develop a method to detect feature interactions in Web services, which targets to reduce such a state space explosion problem while trying to keep an acceptable power of feature interaction detection. The proposed method is based on the use of a language called Use-Modify which models Web services at a high abstraction level. A Use-Modify model of a Web service provides information such as: who uses what, who modifies what, and specifies the frequency of each operation of use and modify by words like “always”, “sometimes” and “never”. Use-Modify is also used to indicate, for each use and modify, whether there are conditions, without giving any information on those conditions. We demonstrate the applicability of our feature interaction detection method in several examples.

KEYWORDS

Composing web services; Feature interaction detection; High abstraction level; Use-Modify; Active/passive objects.

1. INTRODUCTION

When existing Web Services (WS) are *composed* to create new WS, the latter can contain undesired behaviors, which are called *feature interactions* (FI). Example of FI in WS: we consider a supplier that receives orders. When his stock is empty, a supplier forwards any incoming order to another supplier. Consider two WS *Supplier₁* and *Supplier₂* whose stocks are empty. We may have the following situation: *Supplier₁* receives an order and forwards it to *Supplier₂* which in turn forwards the order to *Supplier₁*. The FI manifests itself by a blocking situation where each supplier is waiting the answer of the other supplier.

FI have been intensively studied in telecommunication services (or Telecom-services) (Bouma and Velthuisen, 1994; Cheng and Ohta, 1995; Dini et al, 1997; Kimbler and Bouma, 1998; Calder and Magill, 2000; Amyot and Logrippo, 2003; Reiff-Marganiec and Ryan, 2005; du Bousquet and Richier, 2007; Nakamura and Reiff-Marganiec, 2009), and since more recently in WS. Many methods that have been developed to detect FI are rigorous and have a high power of FI detection. But those methods suffer from state space explosion, such as those applying model-checking techniques. The approach we will adopt to detect FI in WS targets to reduce such a state space explosion while trying to keep an acceptable power of FI detection. We model the behaviors of WS by a so-called Use-Modify language inspired from approaches in (Kimbler, 1998; Chentouf, 2011). Use-Modify is a high abstraction level formalism whose basic principle is to specify “who uses what” and “who modifies what”. The model also specifies coarsely the “frequency” of each “use” and “modify” with words like “always”, “sometimes” or “never”. Moreover, the model also indicates for each “use” and “modify”, whether there is some condition, without specifying any condition.

The structure and the contributions of this paper are as follows. In Section 2, we explain fundamental differences between composing WS and composing Telecom-services. Section 3 presents related work on modeling and composing WS and detecting their FI. In Section 4, we propose a Use-Modify language to

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model WS at a high abstraction level. Section 5 presents a Use-Modify-based method for detecting FI in WS. Section 6 demonstrates the applicability of our method for detecting all the FI of the benchmark of (Weiss et al, 2007) and one FI of (Weiss and Esfandiari, 2004). Section 7 demonstrates that our method can be used to detect several FI indicated in (Bond et al, 2009). In Section 7, we consider not only WS composition, but also a Telecom-service composition and a mixed composition of WS and Telecom-service. Section 8 concludes.

2. WS COMPOSITION VERSUS TELECOM-SERVICE COMPOSITION

Let us show that composing WS is different from composing Telecom-services.

1. Telecom-services can generally be abstracted by a few parameters. In (Kolberg and Magill, 2005), a service is abstracted by a triggering party, and origin and destination parties. An in (Chentouf et al, 2004), a service is abstracted by processing points that correspond to steps in a phone call. WS cannot be so simply abstracted, because a WS can be any imaginable software providing a service through the Web.

2. Composing two Telecom-services means running them in parallel. On the contrary, WS composition means designing a new WS by composing existing WS, based on the principle of software reusability. Hence, WS composition requires a design phase.

We deduce that WS composition may be much more complex than composing Telecom-services, and hence cannot be automated in general. To address the complexity of WS composition, several models have been developed, such as orchestration and choreography.

Let us draw your attention to an important difference between Telecom-services and WS in FI detection. The presence of FI between two composed Telecom-services depends generally uniquely on those composed services, since their composition consists simply in running them in parallel. On the contrary, the presence of FI in WS depends on the way WS have been composed, because there are many ways to compose WS.

3. RELATED WORK ON MODELING AND COMPOSING WS AND DETECTING THEIR FI

(Weiss and Esfandiari, 2004; Weiss et al, 2007) raise interest of researchers to WS composition and FI detection. Weiss et al (2007) present a case study which can be used as a benchmark to assess FI detection methods. (Bond et al, 2009) show that FI in Telecom-Services are different from FI in WS.

Let *on-line* (resp. *off-line*) qualify methods applicable during *design* (resp. *execution*). (Xu et al, 2010; Zhao et al, 2008; 2009) study on-line WS composition and FI detection. Xu et al (2010) present an on-line FI detection method inspired from the *Situation Calculus*. Zhao et al (2008) present an on-the-fly approach to compose WS. Zhao et al (2009) identify some challenges and opportunities in on-line FI detection and resolution.

More work has been done in off-line WS composition and FI management, here are some examples. Weiss et al (2006) propose an off-line FI detection method using *Label Transitions Systems* (LTS). Zhang et al (2006) propose a method based on Petri nets that detects one type of FI: *race conditions*. Thomas et al (2003) use Petri nets to describe WS and presents simple examples for merging WS descriptions. Luo et al (2009) present an FI detection method using the model-checker UPPAAL; WS are described in WS-BPEL which is translated into *timed automata*. Zhang et al (2007) present an FI detection method that uses the *model-checker* SPIN (Holzmann, 1997); WS are described in BPEL4WS (Andrews et al, 2003) which is translated into Promela.

Some work has been done on user-interfacing and software-tooling for WS composition. Examples: Liu et al (2007) propose an environment using *Mashup* for WS composition; (Chafle et al (2007) present an integrated development environment for WS composition. FI detection is not studied in (Liu et al, 2007; Chafle et al, 2007).

Karunamurthy et al (2006; 2007) propose an extension of the business model of (Booth et al, 2004) to support WS composition. Karunamurthy et al (2009) go further by studying how WS can be categorized and assembled. FI detection is not studied in (Karunamurthy et al, 2006; 2007; 2009).

Turner (2005; 2007) study WS composition by considering theoretical, software-tooling and user interfacing aspects. The CRESS formalism is used which can be translated into BPEL and LOTOS.

4. USE-MODIFY LANGUAGE TO MODEL WS

In the references of Section 3, the developed FI detection methods (if any) suffer from state space explosion, because they are based on formalisms specifying WS exhaustively. The approach we adopt avoids state space explosion while keeping an acceptable power of FI detection. We develop a so-called Use-Modify language to model WS at a high abstraction level, whose principle is to specify “who uses what” and “who modifies what”. The model also qualifies each “use” and “modify” with words like “never”, “sometimes”, “may be” and “always”. Such an omission of details is motivated by the desire to avoid state space explosion during FI detection. With Use-Modify, WS are specified at two levels: their *interfaces* are specified like objects in object-oriented programming (OOP); and their *behaviors* are specified by so-called Use-Modify relations (UM-relations). A set of UM-relations modeling the behavior of a WS is called its behavior model, or its UM-model. The UM-model describes how a WS behaves but it does not necessarily correspond to its implementation. The UM-model is targeted uniquely to be manipulated by our proposed FI detection method which is presented in Section 5. While designing (and before deploying) a WS, we construct a UM-model of such a WS which is analyzed to determine whether the WS is FI prone. Therefore, our method is off-line.

4.1 Interface Model Based on Object-Oriented Programming

The *interface* of a WS is modeled as a class skeleton in OOP, and the interface of each executable instance of WS is modeled as an object skeleton of a class. By *skeleton*, we mean that the classes and objects are specified by attributes and methods *signatures*. A method signature specifies a function by its name, its input and/or output parameters and its returned result (if any), and *without* a body. Object skeleton corresponds to interface in Java. For brevity, we will omit the terms *skeleton* and *signature* in *class skeleton*, *object skeleton*, and *method signature*. There exist two types of attributes: *basic attributes* and *complex attributes*. Basic attributes are variables of primitive types, like **int**, **float**, **double**, **boolean**. Complex attributes are objects. For clarity, methods, basic attributes and complex attributes are named differently as follows:

- **Basic attributes** (or primitive variables): they are named in italic with the first letter non capitalized. For example, *risk*, *rate*, and *amount*.
- **Complex attributes** (or objects): they are named in italic with the first letter capitalized. For example, *Assessor*, *Approver*, *Lender*, *Supplier*.
- **Methods**: they are named in italic with the first letter non capitalized, and they terminate by (). For example, *quote()*, *approve()* and *assess()*.

An attribute *a* and a method *m()* of an object *O* are referred to as *O.a* and *O.m()*, respectively. *O* can be omitted when there is no ambiguity or when it is irrelevant. We use the notions of feature and WS as follows:

- **Feature**: it is a basic WS which is not composed of other WS. A feature is modeled as an object. When several similar features are used, they are modeled as objects of the same class. A class is named with all letters capitalized, for example, **SUPPLIER**.

- **WS**: it is composed of features and/or WS. Like features, WS are modeled by objects and classes.

Consider examples of features and WS in (Turner, 2007) and give an idea of how they can be modeled as objects. We do not give details; we just indicate one or two attributes and methods for each feature or WS.

Example 1: The feature *Approver* has a method *approve()* and a basic attribute *rate*. *approve()* evaluates a loan proposal and decides to refuse or approve it.

Example 2: The feature *Assessor* has a method *assess()* and two basic attributes *risk* and *rate*. *assess()* evaluates the *risk* of the loan. If *risk* is low, an acceptance response is returned with a proposed loan *rate*. Otherwise, *approve()* of *Approver* is invoked.

Example 3: The WS *Lender* is composed of the 2 features *Approver* and *Assessor*. *Lender* has two attributes that correspond to *Approver* and *Assessor*. *Lender* has also a method *quote()* and a basic attribute *amount*. The method *quote()* approves or assesses a loan of a given *amount* in the following way: *quote()* invokes the method *approve()* of *Approver* if *amount* \geq 10000, or the method *assess()* of *Assessor* if *amount* $<$ 10000.

We have shown how WS have their *interfaces* modeled as objects. In the remainder of Section 4, we show how WS have their *behaviors* modeled at a high abstraction level by Use-Modify formalism. In the above three examples, the behaviors are indicated for information, they are not described in the objects.

4.2 Use-Modify Formalism

A method is said *active* if it modifies (sometimes or always) the value of some attribute (of any object). An object is said *active* if it contains an active method or a complex attribute which is an active object. A basic attribute cannot be active. A method or object is said *passive* if it is not active. Intuitively, an active object modifies some attribute. Let *active access* to an attribute mean an access that modifies the attribute.

The action “use” is used with various “intensities” as follows:

- “use!” means “to have *certainly* access to”.
- “use?” means “to have sometimes access to”; by sometimes, we mean under some specified or unspecified conditions.

- “use#” means “may have access to”, i.e., we do not know if there is an access.

- “use%” means “has not access to”, i.e., has never access to.

In the same way, the action “modify” is used with various “intensities” as “modify!”, “modify?”, “modify#” and “modify%”. The difference between “use” and “modify” is that “modify” corresponds to an active access, while “use” corresponds to an access which may be passive or active. More precisely, we have the following so-called Use-Modify relations (or UM-relations):

“L use! R” means that R is accessed in *every* situation where L is executed.

“L use? R” means that R is used in *some* situation where L is applied (maybe in all situations). This UM relation should be used in the following two cases:

- We know that L uses R in some situations and not all situations; those situations may be specified (as conditions) or unspecified (may be unknown).

- We know that L uses R, but we do not know if it does it in all situations.

“L use# R” means that we suspect that L uses R, but this is not certain.

“L use% R” means that L never uses R.

“L modify! R” strengthens “L use! R” by specifying that R is modified whenever L is applied.

“L modify? R” strengthens “L use? R” by specifying that R is modified in *some* situation where L is applied. This UM-relation should be used in the following two cases:

- We know that L modifies R in some situations and not all situations; those situations may be specified (as conditions) or unspecified (may be unknown).

- We know that L modifies R, but we do not know if it does it in all situations.

“L modify# R” means that we suspect that L modifies R, but this is not certain.

“L modify% R” means that L never modifies R.

use# and modify# should be avoided by the designer because they model coarse information meaning “do not know”. use# is compatible with use!, use? and use%, and modify# is compatible with modify!, modify? and modify%. use# and modify# have been defined because we will show that they can be deduced by rules.

“!”, “?” and “#” are not written in some contexts where they are irrelevant. In this case, we write “use” to mean “use!” or “use?” or “use#”, and “modify” to mean “modify!” or “modify?” or “modify#”.

4.3 Semantics of Use and Modify When Applied to Methods and Attributes

To use a method $m()$ means to call $m()$; to use a basic attribute x means to read x or change its value; to modify a basic attribute x means to change the value of x . Note that is a non-sense to modify a method. Let us define inductively the meaning of use and modify a complex attribute. Note that a complex attribute is an object, and hence has its own attributes and/or methods:

- to use an object means to use one or more of its attributes or methods;
- to modify an object means to modify one or more of its attributes.

4.4 Contextual Conditions on Use-Modify Relations (UM-Relations)

The behavior of a feature or WS is modeled by a set of UM-relations and possibly by so-called *contextual conditions* on some UM-relations. Consider for example a WS $Supplier_1$ to which an order can be sent, e.g., by calling its method $order()$. $Supplier_1$ can itself call the $order()$ method of another supplier of the same class $SUPPLIER$. This is specified by the UM-relation “ $Supplier_1.order() \text{ use? } SUPPLIER.order()$ ”. Assuming a supplier does not call its own $order()$ method, we associate to this UM-relation a contextual

condition stating that in this context, *SUPPLIER* does not comprise *Supplier₁*. This is noted: “*Supplier₁.order()* use? *SUPPLIER.order()*” with “*SUPPLIER not comprising Supplier₁*”.

4.5 Some Rules on UM-Relations

Here are some rules that must be respected for the sake of *consistency*:

- In “L use R”, L must not be a basic attribute.
- In “L modify R”, L must not be a passive attribute nor a passive method.
- In “L modify R”, R must not be a method.

The following five rules are due to the fact that “always” and “sometimes” are incompatible with “never”.

R[m! ≠ m%]: We cannot have at the same time “A modify! B” and “A modify% B”

R[m? ≠ m%]: We cannot have at the same time “A modify? B” and “A modify% B”

R[m! ≠ u%]: We cannot have at the same time “A modify! B” and “A use% B”

R[u! ≠ u%]: We cannot have at the same time “A use! B” and “A use% B”

R[u? ≠ u%]: We cannot have at the same time “A use? B” and “A use% B”

In Sections 4.5 and 4.6, we will present rules to derive new UM-relations from existing UM-relations.

When a rule derives a UM-relation Y from a UM-relation X (noted $X \Rightarrow Y$), we say X is stronger than Y (or Y is weaker than X). The following three rules are due to the fact that modifying is stronger than using:

R[m! ⇒ u!]: “A modify! B” ⇒ “A use! B”.

R[m? ⇒ u?]: “A modify? B” ⇒ “A use? B”.

R[u% ⇒ m%]: “A use% B” ⇒ “A modify% B”.

The following two rules are due to the fact that “always” is stronger than “sometimes”:

R[m! ⇒ m%]: “A modify! B” ⇒ “A modify% B”.

R[u! ⇒ u%]: “A use! B” ⇒ “A use% B”.

The above rules $R[m! \Rightarrow u!]$ and $R[m! \Rightarrow m%]$ can be combined as follows:

“A modify! B” ⇒ (“A use! B” **and** “A modify% B”).

The latter five rules consist in deriving a weaker UM-relation. Their relevance is just pedagogical to draw the attention on the fact that some UM-relations are weaker than others, and that the objective of modeling is to identify and keep uniquely the strongest UM-relations. In Section 4.6, we will present more useful rules.

Here are two examples of UM-modeling (i.e., modeling with UM-relations) related to the *Approver*, *Assessor* and *Lender* introduced in Section 4.1.

Example 4: Here are UM-relations deduced from the literal descriptions in Examples 1-3 of Sect. 4.1:

- M1: *Lender* use! *Lender.ute()* // *Lender* starts by the execution of its method *quote()*
- M2: *Lender.quote()* use! *Lender.amount* // *quote()* receive *amount* as input parameter
- M3: *Lender.quote()* use? *Approver.approve()* // *quote()* calls *approve()* if *amount* ≥ 10000
- M4: *Lender.quote()* use? *Assessor.assess()* // *quote()* calls *assess()* if *amount* < 10000
- M5: *Approver.approve()* use! *Lender.amount* // *approve()* uses *amount* as input parameter
- M6: *Approver.approve()* modify? *Approver.rate* // *approve()* computes *rate* if the loan is accepted
- M7: *Assessor.assess()* use! *Lender.amount* // *assess()* uses *amount* as input parameter
- M8: *Assessor.assess()* modify! *Assessor.risk* // *assess()* computes the *risk*
- M9: *Assessor.assess()* modify? *Assessor.rate* // *assess()* computes the *rate* if *risk* is low
- M10: *Assessor.assess()* use? *Approver.approve()* // *assess()* calls *approve()* if *risk* is high.

Example 5: Let us use the benchmark of (Weiss et al, 2007) to present other examples of use? and modify?. Examples 5-7 of this benchmark are related to accessing the user profile. We consider a WS *Supplier* that needs to have access to user profiles. We assume that each profile contains two parts: a confidential part and a public part. The two parts can be read and modified by the profile owner. The confidential part can also be read by some trusted entities, while the public part can be read by anyone.

All what concerns a user is represented as an object *User* with an attribute *profile*. The latter represents the user profile and is itself an object with two attributes *conf* and *pub*, for the confidential and public parts respectively. Here are some UM-relations where *Supplier* is a trusted or untrusted supplier.

- N1: *Supplier* use? *User.profile* // *Supplier* can read *profile* with the following restriction:
// *Supplier* can read the confidential part only if he is trusted.
- N2: *Supplier* modify% *User.profile* // *Supplier* cannot modify *profile*
- N3: *Supplier* use? *User.profile.conf* // *Supplier* can read *conf* only if he is trusted

N4: *Supplier* modify% *User.profile.conf* // *Supplier* cannot modify *conf*
 N5: *Supplier* modify% *User.profile.pub* // *Supplier* cannot modify *pub*

4.6 Rules to Synthesize New UM-Relations

Our FI detection method is based on UM-models of several WS S_1, \dots, S_2 to be composed. To make the FI detection more efficient, we should enrich the UM-models by using rules to derive new UM-relations from existing UM-relations. Each rule is identified in the form **R_i** and also in a form **R[...]** that helps to guess the statement of the rule. In the following, “A and B \Rightarrow C” means that if we have A and B, we synthesize C:

R1: **R[u!u! \Rightarrow u!]**: “L use! U” and “U use! R” \Rightarrow “L use! R”
R2: **R[u?u! \Rightarrow u?]**: “L use? U” and “U use! R” \Rightarrow “L use? R”
R3: **R[u!m! \Rightarrow m!]**: “L use! U” and “U modify! R” \Rightarrow “L modify! R”
R4: **R[u?m! \Rightarrow m?]**: “L use? U” and “U modify! R” \Rightarrow “L modify? R”
R5: **R[m!u! \Rightarrow u!]**: “L modify! U” and “U use! R” \Rightarrow “L use! R”
R6: **R[m?u! \Rightarrow u?]**: “L modify? U” and “U use! R” \Rightarrow “L use? R”
R7: **R[m!m! \Rightarrow m!]**: “L modify! U” and “U modify! R” \Rightarrow “L modify! R”
R8: **R[m?m! \Rightarrow m?]**: “L modify? U” and “U modify! R” \Rightarrow “L modify? R”

In the above eight rules “L x U” and “U y R” \Rightarrow “L z R”, y equals to “use!” or “modify!”. If we take y equal to “use?” or “modify?”, we obtain less accurate UM-relations with z that equals “use#” or “modify#”. Let us explain this in the following example: a method L calls a method U in all situations (L use! U), and U reads an attribute R only when it is called by another method than L (U use? R). Hence, L never reads R. Therefore, “L use? U” and “U use? R” do not guarantee that L uses R. In general: “L use! U” and “U use? R” \Rightarrow “L use# R”, which must be interpreted as “we suspect that L uses R and we must verify if this suspicion is correct or not”. Here is a list of rules of the same category, which derive actions “use#” and “modify#”.

R9: **R[u!u? \Rightarrow u#]**: “L use! U” and “U use? R” \Rightarrow “L use# R”
R10: **R[u?u? \Rightarrow u#]**: “L use? U” and “U use? R” \Rightarrow “L use# R”
R11: **R[u!m? \Rightarrow m#]**: “L use! U” and “U modify? R” \Rightarrow “L modify# R”
R12: **R[u?m? \Rightarrow m#]**: “L use? U” and “U modify? R” \Rightarrow “L modify# R”
R13: **R[m!u? \Rightarrow u#]**: “L modify! U” and “U use? R” \Rightarrow “L use# R”
R14: **R[m?u? \Rightarrow u#]**: “L modify? U” and “U use? R” \Rightarrow “L use# R”
R15: **R[m!m? \Rightarrow m#]**: “L modify! U” and “U modify? R” \Rightarrow “L modify# R”
R16: **R[m?m? \Rightarrow m#]**: “L modify? U” and “U modify? R” \Rightarrow “L modify# R”

Example 6: Consider Example 4 of Section 4.5. If we apply Rules R1-R16 to the UM-relations M1-M10, we obtain the following UM-relations that enrich the UM-model of *Lender*. For simplicity, we have omitted to indicate the object of each attribute or method.

Applying R1 to M1 and M2 : *Lender* use! *amount*
 Applying R2 to M3 and M5 : *quote()* use? *amount* (weaker than M2, hence irrelevant)
 Applying R2 to M4 and M7 : *quote()* use? *amount* (weaker than M2, hence irrelevant)
 Applying R2 to M10 and M5: *assess()* use? *amount* (weaker than M7, hence irrelevant)
 Applying R9 to M1 and M3 : *Lender* use# *approve()*
 Applying R9 to M1 and M4 : *Lender* use# *assess()*
 Applying R10 to M4 and M10: *Lender.quote()* use# *Approver.approve()* (weaker than M3, hence irrelevant)
 Applying R4 to M4 and M8 : *quote()* modify? *risk*
 Applying R12 to M3 and M6 : *quote()* modify# *rate*
 Applying R12 to M4 and M9 : *quote()* modify# *rate*
 Applying R12 to M10 and M6 : *assess()* modify# *rate*

In this example, the suspected accesses deduced from R9 and R12 are effective, hence we can replace use# by use?. We have not shown the influence of contextual conditions in the application of rules; we will illustrate their influence in Section 6.1.

5. FI DETECTION METHOD BASED ON USE-MODIFY LANGUAGE

There exist many FI detection methods with a high power of detection, but which are prone to state space explosion. We propose an FI detection method that reduces this problem while keeping an acceptable power of FI detection. Instead of always detecting FI with certitude, our method may indicate in some cases FI with certitude, but in other cases, it just draws the attention on suspected FI, which then need to be checked. This is the price to pay to avoid state space complexity. In this Section, we propose an off-line Use-Modify-based method to detect FI in a WS during its design (from scratch or by composing existing WS). The approach is to construct a UM- model of the WS under design and then to detect FI by analyzing such a UM-model.

5.1 Some Useful Notions of Certain, Possible and Potential FI

(un)certain FI: A FI is *certain* if it occurs in *all* execution paths. Otherwise, the FI is said *uncertain*.

(im)possible FI: A FI is *possible* if it occurs in *some* execution paths. Otherwise, the FI is said *impossible*.

Potential FI: A FI is *potential* if we do not know whether the FI is possible or not.

Here are basic relations and properties which may be useful, where $neg(R)$ means the negation of R .

$neg(certain) = uncertain$, hence $neg(uncertain) = certain$

$neg(possible) = impossible$, hence $neg(impossible) = possible$

$certain \Rightarrow possible$, hence $impossible \Rightarrow uncertain$

potential is independent of certain/uncertain

potential is independent of possible/impossible

Let us propose a two-step method for detecting FI in a WS during its design. The method is applicable for WS being designed from scratch or by composing given WS S_1, S_2, \dots, S_n . In the design from scratch, the FI detection has no input; while in the design by composition, the inputs are UM-models of S_1, \dots, S_n . In both cases, Step 1 (Section 5.3) consists in constructing a UM-model of the WS under design. Step 2 (Section 5.4) consists in checking whether there exist FI in the newly constructed UM-model. Let **NewWS** denote the new WS under design. The following subsections describe the inputs and the steps of FI detection.

5.2 Inputs: Use-Modify Models

If **NewWS** is being designed from scratch, we do not need any input. If **NewWS** is being designed by composing several WS S_1, S_2, \dots, S_n , the UM-models of S_1, \dots, S_n are the inputs of the FI detection procedure. An approach is to require that the owner of any WS publishes its UM-model, if the owner authorizes that the WS be composed with other existing WS for the design of a new WS. The designer of **NewWS** can then have access to the UM-models of S_1, \dots, S_n . If a WS S_i has no available UM-model, a solution is that we construct a basic UM-model of S_i from the knowledge we can have of S_i .

5.3 Step 1: Constructing a UM-Model of the WS Under Design

A UM-model of **NewWS** which is being designed by composing several WS is obtained by merging (automatically) the UM-models of the composed WS, followed by non-automatable treatments on the obtained UM-model. A non-automatable treatment consists in removing, adding and/or replacing a UM-relation. If **NewWS** is being designed from scratch, we need to construct manually its UM-model. After that, the obtained UM-model of **NewWS** is enriched “maximally” by synthesizing *all* the new UM-relations that can be obtained from Rules R1-R16 (Section 4.6). This can be done with a fix-point method which repeats the application of Rules R1-R16 until no new UM-relation is generated. The method converges because of the *finite* numbers of Rules (R1-R16) and actions (use*, modify*). Note that this enrichment is automatable.

5.4 Step 2: Detecting Generic or Specific FI

Our method indicates some FI with certitude, while it just draws the attention on other suspected FI, which then need to be checked. FI detection consists in analyzing the UM-model of **NewWS** obtained in Step 1, and in generating an FI detection verdict. The analysis consists in checking the following FI patterns:

Case 1. There exists a UM-relation “ $a()$ use! $a()$ ” or “ $a()$ use? $a()$ ” or “ $a()$ use# $a()$ ”, where $a()$ is a method. This is symptom of *looping behavior* (Example of Sect. 6.1):

If it is determined that $a()$ is *never* executed from the original state, the FI is *impossible*;

Else if the action is “use!” and $a()$ is *certainly* executed from the original state, the FI is *certain*;

Else if the action is “use!” and $a()$ is *possibly* executed from the original state, the FI is *possible*;

Else the FI is *potential* (Example in Section 6.1).

Case 2. There exist UM-relation(s) that “modify” and possibly “use” the same entity. That is, we have two or more UM-relations “ $K\ m\ R$ ” and “ $L\ n\ R$ ”, where m = modify and n = use or modify. This is the symptom (hence the *potentiality*) of *resource conflict* or *race condition*. (Examples in Sections 6.4, 6.7, 7.1, 7.2, 7.3)

Case 3. There exist UM-relation(s) obtained (in Step 1) by changing (removing, adding or replacing) some UM-relation(s) of S_1, \dots, S_n ; this may imply losing mandatory characteristics or adding forbidden characteristics of S_1, \dots, S_n . Hence, the *potentiality* of FI that needs to be checked (Example in Sect. 6.2).

Case 4. There exist UM-relation(s) with restrictions which must be checked. By the generic term “restriction”, we mean the following situations:

- There exist “use?” or “modify?”, which are associated to specified or unspecified conditions (Sect. 4.2).

Hence the need to check that every specified condition corresponding to a use? or modify? is satisfied.

- There exist “use %” or “modify %”, hence the need to check that such use or modify is never applied.

The two sub-cases of Case 4 are illustrated in Section 6.5 with use? and modify%.

In addition to the generic Cases 1-4, we may have the following *specific* cases.

Case 5. There exist UM-relation(s) that “use!” or “use?” methods $p()$ and $q()$ which are incompatible with each other. This is a symptom of *inconsistent behavior*. Consider the following two sub-cases (a) and (b):

(a) “**A use! $p()$** ” and “**A use! $q()$** ”: the inconsistency associated to these UM-relations is certain assuming that A is reached.

If we determine that A is *never* reached from the original state, the FI is *impossible*;

Else If we determine that A is *certainly* reached from the original state, the FI is *certain*;

Else if we determine that A is *possibly* reached from the original state, the FI is *possible*;

Else (i.e., we cannot determine whether A is possible), the FI is *potential*.

(b) “**A use? $p()$** ” and (“**A use? $q()$** ” or “**A use! $q()$** ”): the inconsistency associated to these UM-relations is potential assuming that A is reached.

If we determine that A is *never* reached from the original state, the FI is *impossible*;

Else the FI is *potential* (Example in Section 6.3).

This case is said *specific* because it necessitates additional specific information (given as input of the FI detection procedure) indicating the incompatible methods.

Case 6. There exist (resp. do not exist) *specific* UM-relation(s) specified as forbidden (resp. mandatory) (Examples of Sects. 6.2 and 6.6). This case is *specific* because it res additional specific information (given as input of the FI detection procedure) indicating the mandatory and forbidden UM-relations.

FI detected with Cases 5 and 6 are said *specific*, while FI detected with Cases 1 to 4 are said *generic*.

6. DEMONSTRATION OF FI DETECTION IN THE BENCHMARK OF (Weiss et al, 2007) AND IN AN EXAMPLE OF (Weiss and Esfandiari, 2004)

We demonstrate our FI detection method in a benchmark of eight FI which are constructed on the case study of a virtual bookstore (Weiss et al, 2007). The following *individual* WS are defined: **iPassport** is an *identity management* WS that simplifies authentication with multiple service providers; **PayMe** is a *payment processing* WS that allows payers to make secure payments online, and simplifies credit card processing for payees; **ShipEx** is a *shipping* WS that provides shippers with guaranteed delivery of product, and simplifies tracking of a shipment for shippers; **Shark** is a *caching* WS that improves performance by storing the results of previous requests. Three *composite* WS **Amazin**, **Supplier** and **Customer** are constructed from the above individual WS. **Amazin** is a *virtual bookstore* which relies on **Suppliers**, and gives **Customers** access to its virtual catalog and the option to order books from the catalog through an **Order Processing** features.

6.1 Example 1 of (Weiss et al, 2007)

The FI manifests itself by a blocking situation in the following way. An order is sent to *Supplier₁* (by calling a method *order()* of *Supplier₁*) who forwards the order to *Supplier₂* (by calling a method *order()* of *Supplier₂*) because his stock is empty. Then, *Supplier₂* in turn forwards the order to *Supplier₁* (by calling a method *order()* of *Supplier₁*) because his stock too is empty too. Hence, we reach the blocking situation where each supplier is waiting the reception of the ordered book from the other supplier. Let us see how our FI detection method detects such FI. Each of *Supplier₁* and *Supplier₂* is specified by a set of UM-relations with contextual conditions. As seen in Section 4.4, we have the following UM-relations with contextual conditions:

UM1: “*Supplier₁.order()* use? *SUPPLIER.order()*” with “*SUPPLIER not comprising Supplier₁*”;

UM2: “*Supplier₂.order()* use? *SUPPLIER.order()*” with “*SUPPLIER not comprising Supplier₂*”.

In Step 1, the UM-relations are composed. We apply rule R10 to UM1 and UM2, but after setting *SUPPLIER* of UM1 and UM2 to *Supplier₂* and *Supplier₁*, respectively: UM1-UM2: “*Supplier₁.order()* use# *Supplier₁.order()*”. We are in Case 1 of Step 2 (Sect. 5.4). *Supplier₁.order()* can be executed from the initial state, and hence the FI is *possible*. Note that this scenario can be generalized to a loop involving more than two suppliers: *Supplier₁* is waiting *Supplier₂* who is waiting *Supplier₃* ... *Supplier_k* who is waiting *Supplier₁*.

6.2 Example 2 of (Weiss et al, 2007)

The FI manifests itself by the fact that, if an ordered book is in the cache (because it has been previously purchased), then the process payment is shortcut. Hence, the order is completed without payment. Let us see how our FI detection method detects such FI. *Supplier* and *Caching* WS are specified by a set of UM-relations. Consider a method *completeOrder()* which is called in *Supplier* when everything is ready to start payment and delivery processes. The payment process starts by calling a method *pay()*. A UM-relation which is particularly relevant in this example is: *completeOrder()* use! *pay()*.

In Step 1, the UM-relations of *Supplier* and *Caching* are composed. This example illustrates the situation where composing two WS requires a human intervention to change the process payment of *Supplier* as explained above. The present composition has the effect to replace the call of a method *pay()* by a conditional call. Hence the above UM-relation is replaced by the UM-relation “*completeOrder()* use? *pay()*” (i.e., “use!” replaced by “use?”). We are in Case 3 of Step 2 (Sect. 5.4). Another way to detect the FI is to consider that the UM-relation “*completeOrder()* use! *pay()*” is specified as mandatory. The FI is deduced by the fact that the composition has modified this mandatory UM-relation. We are in Case 6 of Step 2 (Section 5.4).

6.3 Example 3 of (Weiss et al, 2007)

We consider two situations of FI that may occur when the order of a book is aborted (before its completion):

(a) **FI Called “Order Processing – Delivery” in (Weiss et al, 2007):** The FI manifests itself when, due to timing errors, a process payment is aborted while the delivery is completed (instead of being aborted). Hence, the possibility to receive an unpaid book (as in Example 2, but for a different reason).

(b) **FI Called “Order Processing - Process Payment” in (Weiss et al, 2007):** The FI manifests itself when, due to timing errors, a delivery is aborted while the process payment is completed (instead of being aborted). Hence, the possibility to pay for a book which is not received.

A supplier WS is composed of several features such as: *ProcessPayment*, *Delivery*, and *OrderProcessing*, each one being described by UM-relations. In Step 1, these UM-relations are composed to obtain a UM-model of *Supplier*. Let us see how our FI detection method detects FI. The UM-model of *Supplier* uses the following methods: *abortOrder()* is called to abort the current order, *pay()* is called to start payment for the ordered product, and *deliver()* is called to start delivery of the ordered product. *abortOrder()* is incompatible with *deliver()* and *pay()*, because payment and delivery must not be done when an order is aborted. The UM model contains the following UM-relations: “*Supplier* use? *abortOrder()*” “*Supplier* use? *deliver()*” “*Supplier* use? *pay()*”. We are in Case 5 of Step 2 (Section 5.4). The combination of the 1st and 2nd UM-relations is a symptom of inconsistency, because *abortOrder()* and *deliver()* are incompatible; this is illustrated by FI (a). The combination of the 1st and 3rd UM-relations is a symptom of inconsistency, because *abortOrder()* and *pay()* are incompatible; this is illustrated by FI (b).

6.4 Example 4 of (Weiss et al, 2007)

The FI considered here is due to an ambiguity on the semantics of price. More precisely, the FI manifests itself when some features use the term price, but assigning it different semantics. For example, one feature considers the price *including* taxes, while another feature considers the price *excluding* taxes. Let us see how our FI detection method detects such FI. The UM-model and Step 1 are as in Example 3 (Sect. 6.3). The UM-model of *Supplier* uses two methods *orderProcessing()* and *fulfillOrder()* that modify an attribute *price*, that is, we have the following UM-relations: “*orderProcessing()* modify? *price*” “*fulfillOrder()* modify? *price*”. We are in Case 2 of Step 2 (Section 5.4).

6.5 Examples 5, 6 and 7 of (Weiss et al, 2007)

We consider Examples 5, 6 and 7 together, because they correspond to several variants of the same problem: *non respecting the profile access policy*. Intuitively:

- **In example 5** (called “Authenticate User - Access profile” in (Weiss et al, 2007)): an untrusted supplier accesses some information in the profile of the customer.
- **In example 6** (called “Access Profile - Access profile” in (Weiss et al, 2007)): a trusted supplier accesses some information in the profile of the customer, which must be accessible uniquely to the customer.
- **In example 7** (called “Manage Profile - Access profile” in (Weiss et al, 2007)): a supplier accesses some information in the profile of the customer when the latter is not connected.

After Step 1, we obtain UM-relations such as: “*Supplier* use? *profile*” “*Supplier* modify% *profile*”

We are in Case 4 of Step 2 (Section 5.4). The “use?” corresponds to the specified condition requiring that only the authorized suppliers can read a user profile. The “modify%” corresponds to the restriction specifying that no supplier is authorized to modify a user profile. Hence, the need to check if these authorizations are respected. The FI of Examples 5, 6 and 7 are due to the non-respect of some authorizations.

6.6 Example 8 of (Weiss et al, 2007)

The FI manifests itself by a blocking situation where *Supplier*₁ is waiting *Supplier*₂ who in turn is waiting *Supplier*₁, which corresponds exactly to Example 1. Hence Examples 1 and 8 are identical, but in Example 8, the FI is presented with a different viewpoint: *None of the suppliers is available to the other one*. A way to detect this FI is given in Section 6.1. Let us present another way to detect this FI. We assume that an attribute *available* is set to false by *Supplier* when he cannot treat requests. The UM-model obtained after Step 1 will then contain the following UM-relation “*Supplier* modify? *available*”, which is a symptom that availability changes and hence *available* can be false in some situations. Let us consider that all UM-relations “X modify? *available*” or “X modify! *available*” are specified as forbidden. The FI is deduced by the presence of a forbidden UM-relation. We are in Case 6 of Step 2 (Section 5.4).

6.7 Example of (Weiss and Esfandiari, 2004)

The FI manifests itself when the *Spell Checker* and the *Formatter* use different languages, e.g., US English and UK English. At the formal level, this FI is similar to the FI of Example 4. In the latter, two methods modify an attribute *price*. In the present example, two features *SpellChecker* and *Formatter* modify an attribute *lang* specifying the used language. That is, we have the following UM-relations: “*SpellChecker* modify? *lang*” “*Formatter* modify? *lang*”. We are in Case 2 of Step 2 (Section 5.4).

7. DEMONSTRATION IN THE DETECTION OF SEVERAL FI OF (Bond et al, 2009)

Bond et al (2009) present an interesting comparative study showing that FI in Telecom-Services are different from FI in WS, and hence FI detection methods developed for the former cannot be easily adapted for the

latter. We will apply our FI detection to three types of FI given in (Bond et al, 2009): FI between two WS; FI between two Telecom-services; FI between a WS and a Telecom-service. As we will see, the three FI are detected with Case 2 of Step 2 (Section 5.4).

7.1 FI between Two WS of (Bond et al, 2009)

The FI manifests itself when the *Logging* WS uses the encrypted information (purchase order or payment information) while *Logging* needs to use the information *before* it is encrypted. After Step 1, we obtain UM-relations where an attribute *paymentInfo* is modified by a method *encrypt()*, while another method *logging()* reads the attribute *paymentInfo*. That is, we have the following UM-relations: “*encrypt()* modify! *PaymentInfo*” “*logging()* use! *PaymentInfo*”. We are in Case 2 of Step 2 (Section 5.4).

7.2 FI between Two Telecom-Services of (Bond et al, 2009)

Contrary to previous examples, here we consider Telecom-services instead of WS. The FI manifests itself when a caller rejected by *Call-Blocking* (*CB*) of a callee is able to leave a (potentially unwanted) voicemail via *Voicemail* (*VM*). The particularity of Telecom-services is that Step 1 may be automated (see Section 6.3). We obtain UM-relations where an attribute *callStatus* is modified by *CB* (to busy status) and read by *VM* (busy status is the trigger of *VM*). That is, we have the following UM-relations:

“*CB* modify! *callStatus*” “*VM* use! *callStatus*”. We are in Case 2 of Step 2 (Section 5.4).

7.3 FI between a Telecom-Service and a WS of (Bond et al, 2009)

This is a special case, in the sense that we have a *mixed* composition, i.e., a WS is composed with a Telecom-service. The FI manifests itself when a customer wants to be joined by an agent to talk with him (WS called *TTA*), while he has configured the Telecom-service Do-Not-Disturb (*DND*) to reject all calls. After Step 1, we obtain UM-relations where the attribute *callStatus* (already used in the example of Section 7.2) is modified by *DND* (to the status busy, for example) and read by a method *tta()*. That is, we have the following UM-relations: “*DND* modify! *callStatus*” “*tta()* use! *callStatus*”. We are in Case 2 of Step 2 (Section 5.4).

8. CONCLUSION

We have developed a method to detect FI among WS, which makes a trade-off between reducing state space explosion and increasing the power of FI detection. The proposed method is based on a language called Use-Modify which describes WS at a high level by indicating uniquely information such as: who uses what, who modifies what, and the frequencies and restrictions of each use and modify. We have demonstrated the applicability of our FI detection method in several cases. Indeed, we have applied our method to detect all FI of the benchmark of (Weiss et al, 2007) and for the detection of an FI in (Weiss and Esfandiari., 2004). We have also applied our method to detect several FI indicated in (Bond et al, 2009), where the composed services can be WS and/or telecommunication services. We think that our FI detection approach can be better than (Weiss et al, 2007) because in the latter many modeling formalisms have to be used: Goal-oriented Requirement Language (GRL), Use-Case Maps (UCM), and Finite State Processes (FSP).

As a future work, we plan to study FI *resolution*, which consists in solving the detected FI. Another planned future work is to develop a Use-Modify-based prototype to validate and improve our approach.

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ONTOLOGY-DRIVEN E-SCIENCE PLATFORM FOR OCEAN SCIENCES

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ABSTRACT

Taking a knowledge management approach we have developed an E-Science platform—termed as *Platform for Ocean Knowledge Management (POKM)*—to support the oceanographic research community to investigate the underlying characteristics of oceans and marine life. The architecture of POKM showcases a unique synergy of semantic web, services oriented architectures, web services and visualization technologies. POKM takes a unique knowledge management approach by exploiting semantic web technologies to semantically describe the data, scientific models, knowledge artifacts and web services. To establish interoperability between the concepts from different domains we have developed two ontologies, one to model the domain and the other to model e-science services. We present details of the domain and service ontologies and demonstrate their application towards ocean knowledge management.

KEYWORDS

E-Science, Semantic Web, Ontology, Knowledge Management, Ocean Sciences

1. INTRODUCTION

Eco-scientists are studying how environmental changes are directly impacting oceans and marine life within the ocean. In the ocean science research community there is a growing trend to establish a range of interpretations and relationships between (i) raw observational data and modeled observations; (ii) observations and their potential causes; and (iii) observed states and predicted states. In order to pursue these challenging scientific explorations, there is a need for a collaborative E-Science platform that allows the timely sharing of (i) multi-modal data collected from different geographic sites, (ii) complex simulation models; and (iii) high-dimensional simulation results.

Taking a knowledge management approach we have developed an E-Science platform (Jankowski, 2004)—termed as *Platform for Ocean Knowledge Management (POKM)*—to support the oceanographic research community (Bos, 2007; Cummings, 2005; Hey, 2005; Zhao, 2004; Hine, 2007). The functional portfolio of POKM includes a suite of services to (a) *enable* the selection and sharing of multi-modal data collected from different geographic sites, (b) *perform* analytics and simulations, using complex simulation models, to understand various phenomena such as behavior of marine animals, affects of oceanographic parameters of temperature, salinity, etc.; (c) *visualize* multiple data layers at a geographic location and simulation results of models via various globe-based, 2D and 3D plots and animations; (d) *publish* simulation models for use by the entire community of scientists; (e) *interconnect* two different research communities so that they can seamlessly interact and share data, scientific models, experiment results, knowledge resources and expertise without the usual impediments of terminology mismatch, conceptual variances, data heterogeneity and knowledge misalignments and misinterpretations (Bos, 2007); (f) *catalogue* experiment-specific data and knowledge so that they can be used for future experiments and analytics; and (g) *enable* researchers to design and execute complex experiments by composing specialized experimental workflows—an experiment workflow may entail a systematic arrangement of multiple services, such as data/knowledge collection, simulation models, analytics and visualization—that are suited for their scientific tasks (Agun, 2011; Lin, 2009). POKM is supported by the CANARIE network (Canada's high bandwidth network) that allows the transfer of high-volumes of ocean data and to facilitate collaboration between eco-scientists across the world to conduct multi-site scientific experiments.

In this paper we present the functional design of POKM, focusing on its knowledge management components. We discuss the semantic web research leading to the definition of two core ontologies—a domain ontology modeling the ocean knowledge and data resources and a service ontology modeling the web service descriptions (De Roure, 2004). We present details of these ontologies and demonstrate how they are applied to support the data management services for our E-Science platform—i.e. POKM

2. POKM ARCHITECTURE

The design of POKM showcases a unique synergy of semantic web, services oriented architectures (Cabral, 2004), web services and visualization technologies. POKM takes a unique knowledge management approach by exploiting semantic web technologies to semantically describe the data, scientific models, knowledge artifacts and web services (Hey, 2005). POKM pursues a high-level abstraction of ocean and marine science domains to establish a high-level conceptual interoperability between the two domains. This is achieved by developing a rich *Domain Ontology* that captures concepts from both domains and interrelates them to establish conceptual, terminological and data interoperability. To define the functional aspects of the e-science services we have developed a *Services Ontology* that provides a semantic description of knowledge-centric e-research services. These semantic descriptions of the e-science services are used to both establish correlations between domain and functional concepts that are the basis for data retrieval and visualization.

The POKM infrastructure is modeled along a services-oriented architecture that exposes a range of task-specific web services accessible through a web-based portal (Cabral, 2004; Gottschalk, 2002). POKM's underlying design philosophy is to exploit the web as a services platform to deliver knowledge-centric services for the oceanographic research community—a knowledge-centric service is deemed as a specific function that can help oceanographic researchers conduct their scientific work in a collaborative and knowledge-intensive environment. POKM offers a distributed experiment environment in which researchers can collaborate through a suite of knowledge-centric services. Figure 1 shows the architecture of POKM.

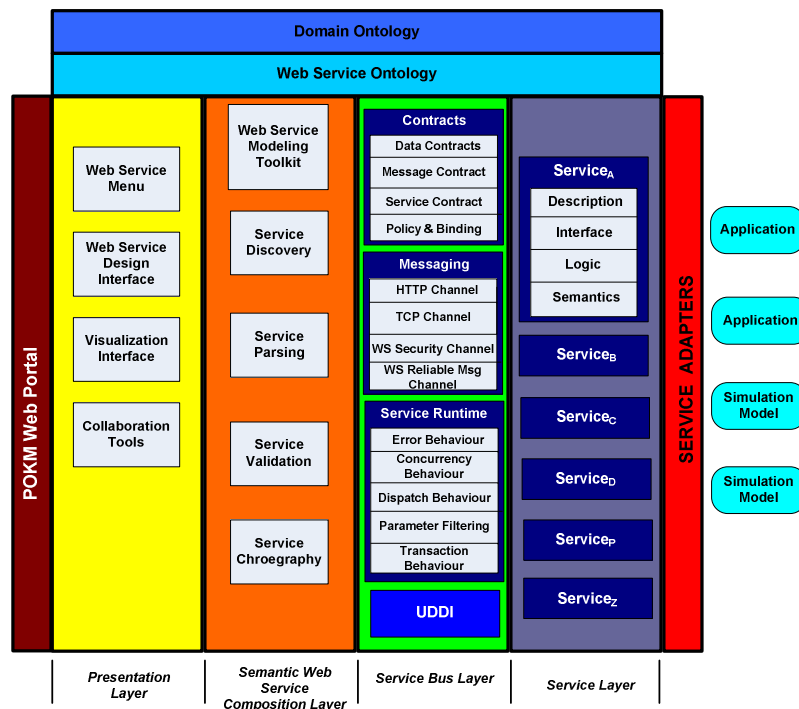


Figure 1. Functional design of POKM

2.1 Services Layer

The services layer offers a range of services to assist scientists to design and perform experiments using resources and services provided by POKM (Agun, 2011, Cabral, 2004). The services layer offers a range of capabilities as follows:

Data fetching capabilities comprise a set of data fetching services that enable researchers to specify their data request and then fetch the data from: (a) databases—this is usually for marine animal tracking and detection data; and (b) data files—this is typically for ocean data represented in netCDF format. The data request can be provided in three ways: (i) using a graphical query generator that uses metadata and semantic descriptions present in the domain ontology to help the researcher construct a formal query; (ii) specifying an SQL query; and (iii) using a visual interface (such as Google Earth (GE) plug-in) to specify the region for which data is required. In this case, the user draws a bounding box—i.e. the longitude and latitude—for the region of interest and then specifies the ocean or animal parameters to be retrieved for that region.

Data transformation capabilities, a set of services that enable the automatic transformation of data from one format to another, either to use the data in a specific model or to visualize it. For instance, a subset of ocean data present in a netCDF file is transformed to KML format to be view in GE plug-in.

Data normalization capabilities, a set of services that enable the normalization of data headers to the standard terminology specified in the domain ontology. Such services are used to (a) aggregate data from different data sources; (b) add a new data source; and (c) bind data to a service description.

Experiment management capabilities enable a researcher to design an experiment and coordinate the resources necessary for conducting it. An experiment constitutes data, the scientific models and algorithms needed for the experiment, and the experiment's workflow (Lin, 2009; Samak, 2011; Seoyoung, 2011). Furthermore, the results of such an experiment need to be presented, shared, visualized and/or stored for further use (any combination). These capabilities retain the user's workspace by managing and maintaining (a) the user's data requests and handling the storage and caching of the retrieved data in the user's workspace for subsequent use; (b) the experiment workflow as specified by the user (Samak, 2011; Seoyoung, 2011); and (c) the results generated by experiments so that it can be either reused for additional experiments, presented and visualized for analysis purposes or shared with other users.

Visualization capabilities enable scientists to derive more meaningful insights from the data and the experimental results. POKM has developed a dedicated data visualization framework that allows scientists to visualize and interact with multiple layers of data as time- and location-varying animations, globe-based views and a range of multi-dimensional plots. At present, the visualization capabilities of POKM offer the following functionalities: (a) visualizing marine animal tracks, such as the migration patterns of leatherback turtle, as an animation using GE plug-in; (b) visualizing the parameters of the ocean—such as salinity, temperature, current—for a bounded region for a specific time period. A time-varying animation is presented using GE plug-in; (c) visualizing an integration of marine animal data with ocean data. For instance, visualizing animal movement in the backdrop of ocean temperature at the corresponding time and location. This is a time-varying animation visualized using GE plug-in; (d) visualizing graphical 2D and 3D plots—such as time series, contour and mesh plots, etc—of ocean parameters or simulation results; (e) visualizing a combination of time-varying animations and viewing a 2D/3D plot of a related ocean parameter in the same session; and (f) visualizing 2D images of experimental results, such as the output of an filtering model depicting the predicted locations of a leatherback turtle over a time period as an image. The above visualization functionalities are available through the POKM portal.

2.2 Ontology Layer

The ontology layer serves as the semantic interpretation of the domain concepts and the semantic description of the services. It functions as the glue integrating the various POKM architectural components and services. We have developed two ontologies—(i) domain ontology and (ii) service ontology.

The *Domain Ontology*, developed using OWL, provides a high-level abstraction of the oceanography and marine biology domains, and establishes conceptual and functional relationships between intra-domain and inter-domain concepts. The oceanography ontology is used for: (a) semantic integration of the heterogeneous data-sets, especially when new data-sets, models and services are added to POKM; (b) aligning different

domain concepts and linguistic terms used by the diverse research community; and (c) normalizing the functional specifications of services to domain concepts and then connecting to data sources.

The *Service Ontology* provides a semantic model for representing the functional description of a service. We used OWL-S to develop a semantic model that captures three aspects of a service; namely, Profile, Model and Grounding. The key feature of the service ontology is that it offers a semantic structure that allows profile and model to provide abstract description of a service using domain concepts specified in the domain ontology. The link between the abstract description and concrete implementation is captured via Web Services Description Language (WSDL) grounding—i.e. mapping concrete notions in the service's WSDL file with abstract concepts in the service ontology.

3. OCEAN KNOWLEDGE MODELING USING ONTOLOGIES

The domain ontology in POKM serves as the formal semantic description of the concepts and relationships pertaining to the Marine Biology and the Oceanography domain. POKM provides a core ontology that contains concepts necessary for modeling Marine Animal Detection Data (MADD), Oceanography Data, data transformations and interfaces of the Web Services in POKM. The taxonomic hierarchy of the domain ontology constitutes 20 highest level classes; 15 of these classes are further decomposed into sub-classes at the lower levels of hierarchy. The domain ontology is developed in OWL and captures a range of ocean and marine life concepts grouped into six main classes.

3.1 Modeling Marine Sciences

There are six upper level classes related to marine sciences—i.e. MarineOrganism, AnimalDetail, Taxonomy, TaxonID, MarineLifeData, MarineLifeDataCollection, DataSource, DataFormat.

MARINEORGANISM represents all marine animals, plants and plankton via classes MARINEANIMAL, MARINEPLANT and PLANKTON respectively. There are four main subclasses of MarineAnimal: FISH, MARINEMAMMAL, REPTILE and SEABIRD. MARINEPLANT has two main sub-classes: ALGAE and SEAGRASSES. Plankton has three sub-classes representing three functional groups of planktons: BACTERIOPLANKTON, PHYTOPLANKTON and ZOOPLANKTON.

ANIMALDETAIL represents all the necessary information to build a marine animal profile. It has five main sub-classes: AGE, LIFESTAGE, MOVEMENTBEHAVIOR, SEX, TAGID. AGE represents the age of the animal. LIFESTAGE represents the current stage of the animal in life, e.g. adult, juvenile, sub-adult etc. MOVEMENTBEHAVIOR represents various movement behaviors of marine animal that are captured by its sub-classes: BEHAVIORALSWITCHING, DISPERSAL, DIVING, DRIFT, FORAGING, MIGRATING and MOVEMENTPATTERN.

TAXONOMY represents 9 main taxonomic ranks used to categorize marine organisms as follows: CLASS, FAMILY, GENUS, KINGDOM, ORDER, PHYLUM, SCIENTIFICNAME, SCIENTIFICNAMEAUTHOR and SPECIES.

TAXONID describes an organism in terms of the above mentioned nine taxonomic ranks.

MARINELIFEDATA represents various aspects of the data about the marine organisms. These include temporal data represented by sub-classes: DAYCOLLECTED, MONTHCOLLECTED, YEARCOLLECTED, DATELASTMODIFIED and TIMESTAMPCOLLECTED, which has two sub-classes of its own: ENDTIMESTAMPCOLLECTED and STARTTIMESTAMPCOLLECTED. The class MARINELIFEDATA is also used to represent concepts related to the cache of the marine data that is represented using sub-classes such as CACHEID, RECORDLASTCACHED, BASISOFRECORD and RESOURCEID. This class also represents other aspects of marine life data using sub-classes: DEPTH, DEPTHPRECISION, TEMPERATURE and TIMEZONE.

MARINELIFEDATACOLLECTION is a class the properties of which are used to capture all the data represented by class MARINELIFEDATA.

3.2 Modeling Ocean Sciences

The classes to model ocean sciences include: OceanRegion, OceanParameter, SatelliteInformation, Instrument, Measure, MovementModel, ModelAttribute, FileType,

OceanRegion represents all ocean regions categorized by five main sub-classes: ArcticOcean, AtlanticOcean, IndianOcean, PacificOcean and SouthernOcean. Each of these classes are further sub-divided into sub-classes representing sub regions of the each ocean region.

SatelliteInformation represents the satellite used to monitor the oceans, represented in terms of nine sub-classes: SatelliteID, Altitude, BestSignalStrength, FrequencyOfTransmission, ElapsedTime, NumOfMessagesRecieved, NumOfSuccessfulPlausibleChecks, QualityIndicator and SensorChannel.

Instrument represents all the instruments used for the observation of oceans and to measure various parameters, such as: temperature, salinity and density of the ocean water, ocean currents, depth, pressure, etc. These instruments are represented as the following sub-classes: ADCP, Argos, ArgoFloat, CTD, ElectronicTag, Glider, GlobalPositioningSystem, Satellite and SubmersibleRadiometer.

MEASURE represents all the spatial and temporal measures of the regions used in the domain of Ocean Sciences, and are modelled as two main sub-classes SPATIALMEASURE and TEMPORALMEASURE respectively. The sub-class SPATIALMEASURE has further sub-classes: HEIGHT, LATITUDE, LONGITUDE AND SPATIALRESOLUTION representing the respective spatial measures of the relevant ocean region. TEMPORALMEASURE has two sub-classes: TIMEINTERVAL and TIMERESOLUTION, representing the respective temporal measures.

MOVEMENTMODEL represents various models used to estimate the migrating and foraging behaviors of marine organisms and their movement parameters such as determining the next positioning estimate of an animal after a period of missing data. These models are represented as sub-classes: FIRSTPASSAGETIME, FRACTALANALYSIS, GEOLOCATIONMODEL, KERNELANALYSIS, STATESPACEMODEL.

MODELATTRIBUTE represents all the attributes of a movement model, represented as sub-classes: HIERARCHY, LINEARITY, OBSERVATIONERROR, OUTPUT, STATISTICALESTIMATIONERROR, STATISTICALFRAMEWORK, STOCHASTICITY and TIME.

Unit represents all the units used to measure geophysical parameters describing an ocean. It has nine sub-classes: DensityUnit, DepthUnit, LightLevelUnit, SalinityUnit, SpatialResolutionUnit, SpatialUnit, TemperatureUnit, TimeUnit, VelocityUnit.

3.3 Relationships between Classes

The purpose of the domain ontology is to inter-relate the domains of Marine Sciences and Ocean Sciences. There are seventy seven object properties and six datatype properties. Only the salient properties are described in this section.

The class MARINEANIMAL (sub-class of MARINEORGANISM) is related to respective sub-classes of the class MARINELIFEDATA through properties *has_age*, *has_sex*, *has_life_stage*, *has_movement_behavior* and *has_TagID*. In addition it is also related to class OCEANREGION through property *has_geographic_area*. Thus, this property relate the domains of marine sciences and ocean sciences.

The class OCEANPARAMETER is related to class Unit through property *has_unit*. This property is given hasValue restriction, to restrict the filler of the property to a specific instance of the class UNIT. For example AirTemperature, which is an OceanParameter *has_unit* Degree Celsius, which is an instance to class UNIT.

The class MARINELIFEDATACOLLECTION is related to respective sub-classes of class MARINELIFEDATA through properties *has_basis_of_record*, *has_cache_ID*, *has_date_last_modified*, *has_day_collected*, *has_depth*, *has_depth_precision*, *has_latitude*, *has_longitude*, *has_month_collected*, *has_record_last_cached*, *has_record_ID*, *has_taxon_ID*, *has_temperature*, *has_time_of_display_collected*, *has_time_zone_collected* and *has_year_collected*. Each one of these properties is a functional property.

The class MOVEMENTMODEL is related to respective sub-classes of class MODELATTRIBUTE through properties: *has_hierarchical*, *has_input_data*, *has_linearity*, *has_observation_error*, *has_output*, *has_statistical_estimation_method*, *has_statistical_framework*, *has_stochasticity* and *has_time_value*.

Each OCEANREGION is related to various OCEANPARAMETERS through properties: *has_density*, *has_flow_velocity*, *has_salinity*, *has_sea_surface_elevation*, *has_water_depth*, *has_water_mass* and *water_temperature*. Class OCEANREGION is also related to respective sub-classes of class MARINELIFE through sub-classes *has_marine_animal*, *has_marine_plant* and *has_plankton*. Note that these three sub-classes relate the ocean sciences domain with marine sciences domain.

The class TAXONID is related with respective sub-classes of class TAXONOMY, in order to capture the identification features of each of the marine species. These properties are: *has_class*, *has_family*, *has_genus*,

has_kingdom, *has_order*, *has_phylum*, *has_scientific_name*, *has_scientific_name_author* and *has_species*. Each one of these properties is a functional property.

4. ONTOLOGIES IN ACTION: OCEAN DATA MANAGEMENT

One of the functionalities of POKM is to seamlessly connect multiple data sources to obtain Marine Animal Detection Data (MADD). Modeling of the domain concepts in the domain ontology enables the integration of the data sources by mapping both schemas and attributes based on concepts as opposed to labels. Furthermore, the domain ontology allows the use of domain concepts to generate abstract data fetching queries, in terms of standard operations, that can provide access to heterogeneous data sources. In this section, we illustrate the data management features of POKM supported by the domain and service ontologies. Figure 2 shows the sequence of operations:

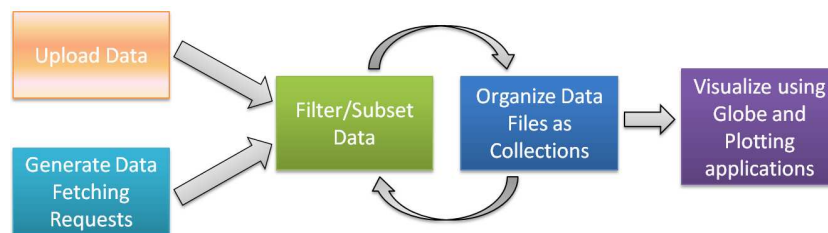


Figure 2. Lifecycle of the Data Fetching and Visualization workflow.

For each user, POKM offers a dedicated space termed as My Collections—this serves as the workspace for the user and he/she is able to store (a) data files—i.e. data in terms of netCDF and CSV formats, and animations of data (with respect to location and time) in terms of KML and KMZ files; (b) simulation models in terms of R scripts, (c) experiment results in terms of data files, plots, images, animations; and (d) scientific experiments in terms of experimental settings, visualization options and data files.

To enable uniform access to heterogeneous MADD sources via POKM, we have defined two core standard operations for querying these data sources: namely, *getCoverage* and *getDetections*. To facilitate this querying mechanism, a Data Retrieval Service (DRS) is implemented in POKM for each MADD source. The *getCoverage* operation provides spatial coverage in terms of rectangular region defined by top left and bottom right geographical coordinates in terms of latitude and longitude, as well as, temporal coverage in terms of minimum and maximum values of time stamps associated with detection records. The *getDetections* operation returns detections records as Comma Separated Vectors (CSV) for spatial and temporal coverage provided as arguments. In order to manipulate these CSV formatted records, automatically, for each DRS a mapping between columns of the header of the CSV generated by *getDetections* operations and concepts of the domain ontology.

We discuss below how we make use of the domain ontology, which stores knowledge about the about the MADD sources and DRS, to fetch MADD from different data sources. We have developed a Meta Animal Data Retrieval Service (MADRS), in order to dynamically discover newly added DRS in the POKM system and to provide a uniform mechanism of invoking the registered DRS.

The MADRS operates on the domain ontology, capturing semantics of MADD sources, to discover DRS described in the ontology. It provides an operation named *getDataSources* to enable POKM Portal or a third party application to discover MADD sources that are accessible via POKM.

By exploiting the standardized signature of the *getCoverage* operation, MADRS is capable of providing coverage of any of the underlying MADD sources. Similarly an operation is provided to request detection records from a particular MADD source by providing spatial and temporal coverage. MADRS is also capable of automatically transforming detection data from CSV to KML. Note that this is possible due to the mapping between the CSV headers and concepts in the domain ontology stored against every DRS. This allows POKM end-users to generate data fetching requests from any selected MADD source and visualize the results without any human intervention (shown in Figure 3).

Data Fetching Request Generation

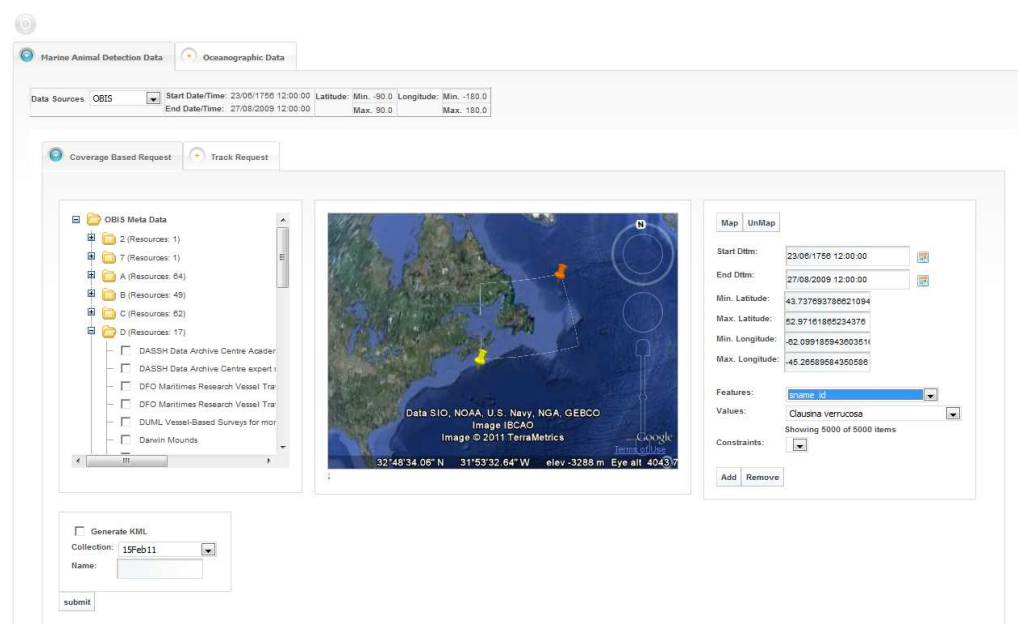


Figure 3. A screen shot of the Data Fetching Portlet showing MADD Fetching Request Submission tab. The screen shot also features the metadata tree for the selected Data Source (OBIS in this case) on the left hand side.

In the previous section, the scientists retrieve specific ocean and marine animal tracks. Now to visualize the data, the scientist is provided with globe-based visualizations of the retrieved data. Fig. 4a shows a visualization of an animal track, whereas Fig. 4b shows the interactive nature of the visualization where by clicking a data point the user can retrieve values for various features. The key feature of POKM is that it synchronizes ocean data with animal detecting data, where the synchronization is at both temporal and geographical levels, such that the visualization plots the animal track on a layer of ocean data—scientists can then examine the behavior of the animal in relation with a specific ocean parameter (see Fig. 4c).

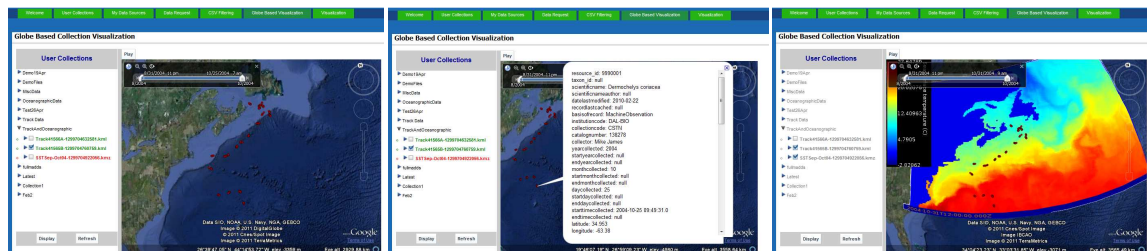


Figure 4. a. (Left) Screen shot of a Globe Based Visualization portlet displaying an animal track in red dots on the globe, b. (middle) Screen shot displaying information about a detection point popped up on the screen by clicking the detection point, c. (Right) Screen shot displaying an animal track rendered over sea temperature.

5. CONCLUDING REMARKS

POKM offers an E-science platform targeting ocean sciences researchers. The key feature of POKM is the underlying knowledge layer—manifested in terms of the semantics of ocean and marine life concepts, captured in the domain ontology and descriptions of the services captured in the service ontology—that enables the seamless integration and interoperability at the data, services and user levels. The domain ontology presented here is scalable to include new concepts and relationships between concepts. The services ontology is coupled with interesting semantic-based methods to discover compatible and relevant services pertaining to a specific user task. In this paper, we have demonstrated the potential of applying knowledge

management methods, specifically the use of OWL-based ontologies to semantically describe the domain and service concepts and to operationalize these concepts in terms of e-science services.

The POKM project is in operation and used by a community of ocean and marine life scientists in Canada. These scientists are using POKM to study the migration patterns of leatherback turtles across the Nova Scotian shelf in the Atlantic ocean.

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TAXONOMY OF PERSONALIZATION IN MOBILE SERVICES

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ABSTRACT

Personalization of mobile services is a growing trend. The increasing capability of smartphones and enabling technologies has opened many possibilities of personalizing mobile services. There are different levels of personalization ranging from personalized wallpaper or ringtones to complex mobile services. The goal of personalization is to support the user by providing the right service at the right moment. Based on recent trends in mobile personalization, a definition of personalization is given. The factors such as *user needs and goals*, *choice and flexibility*, *control and privacy* which are of highly importance for the true realization of personalized mobile services are discussed. The combination of context-awareness and user-modeling is becoming a key approach in delivering personalized services. Based on this trend, three generic levels of personalization: *Basic personalization*, *profile based personalization* and *contextual personalization* are presented to give insight to design perspectives of personalization in mobile service.

KEYWORDS

Personalization, Mobile services, User profile, Privacy, User modeling and Context-awareness.

1. INTRODUCTION

The increasing variety of mobile services raises the need for users to find out how particular services are beneficial to them. Personalization can play a significant role to select and adjust their favorite services from the rapidly increasing diversity of mobile services. Personalization has been involved in many research areas having varied focus and implications which makes it a multidimensional concept. So far the focus of personalization has been on the systems or applications intended for Web or stationary computers (Sunikka & Bragge, 2008). There is a growing need to deliver only the information that is of direct relevance to an individual for a specific purpose at any point in time (Kim, 2002).

In general, personalization is about choice, flexibility and control and it is about people knowing what their needs are and the people that have control over how those needs are being met. For example, personalized news service can deliver news during the day about user's working interests and entertainment news in the evening. In another case, a user usually does shopping during the weekend and wants to receive advertisement only at the weekend; a personalized advertisement service can send advertisements on the days preferred by the user. For the user, it is important to be in charge of the flow of information and services. Personalization aims at supporting users in selecting their favorite services from the rapidly increasing diversity of mobile services and adjusting selected services to their individual needs. According to (Zimmermann et al, 2005) delivering relevant information has two main facets. First, personalization allows users to obtain information that is adapted to their needs, goals, knowledge, interests or other characteristics. User models deliver the main parameters for selecting and adapting information presentation to the individual user. Secondly, contextualization complements personalization so that environmental states or the context of the use can also be taken into account.

In recent years the focus of personalization has changed from simple system personalization to complex service oriented personalization. Users and service providers of mobile services are facing different conceptual and technical challenges of achieving personalization. It is very important to understand what information different types of services require and what information users are willing to reveal for those services. According to (Heikinen et al , 2004) there is a need to find out that for what services, what personal

information the users are willing to share with the surrounding services in order to encompass the service provisioning based on personal information.

However, the meaning of personalization is context sensitive hence it is important to define and understand it clearly from the perspective of mobile services. As described by (Haiyan & Marshall, 2006) that “*the current practice of focusing on ‘how to do personalization’ rather than ‘how can personalization be done well’ suggests that the field is still in its infancy*”. In a way, personalization is a practice that is shaped by the designer’s motives for personalization and viewpoint on “what personalization really is.”

2. MOTIVATION FOR PERSONALIZATION OF MOBILE SERVICES

Personalization has the potential to offer many benefits particularly in reducing information load and finding relevant information (Simon et al, 2010). Users of mobile technologies are getting exposed to information and services, without being able to control the flow of services. Various mobile devices (smartphones, tablets etc.) can be used to access information and services. Due to variety of mobile services, there is an urgent need to filter information, adapt it, and customize it, not only to the individual user but also to the current context of use (Oppermann & Specht, 2000). They further recommended that the future applications must consider the user profile, history and current context of use. Personalization is not only limited to ringtones or logos but now it can be realized at various levels of complexity. Mobile devices can enable context-awareness and personalized data services (Lankhorst et al, 2002) which makes it an ideal tool for personalization. This can offer unique opportunities of providing personalized mobile services to the dynamic.

On the other hand, service providers are delivering multiple types of mobile services. Service providers are facing difficulties in targeting the right user groups, thus missing valuable customers. Hence, personalization is a desirable property of both existing and future services. The main goal of personalization should be to improve the overall experience of user with mobile services. As described by (Ho & Bull, 2010) that the immediate objectives of personalization are to understand users’ preferences and contexts to deliver highly focused, relevant contents matched to their needs. The benefits to mobile users include more relevant contents and fewer problems with information overloading. Providing personalized information to mobile users will create better user satisfaction and will in turn increase the demand for mobile services (Xu et al, 2008).

Early focus of personalization was on content adaptations in different information systems. The meaning and approach of personalization are still needed for mobile services as it is a compelling feature of mobile communication systems for both end users and service providers. However, mobile users can have different needs and focus other than traditional approaches of personalization. Furthermore, mobile devices have some inherent constraints such as limited input-output, wireless connectivity, and computational power and battery issues. All these constraints require specific approaches for personalization. There is a demand to explore more about personalized mobile services and more work is needed to identify new and useful mobile applications and services, including those dealing with personalization of mobile content and location-awareness.

3. DEFINING PERSONALIZATION

There are various definitions of personalization in the literature with different focus. Our objective here is to define and understand personalization from the perspective of mobile services. We have to identify important design factors for practical personalization in mobile services. We have chosen some definitions which are relevant to our focus. Personalization is defined by (Jørstad. et al, 2004) as “*Personalization of a service means that mechanisms exist to allow a user U to adapt, or produce, a service A to fit user U’s particular needs, and that after such personalization, all subsequent service rendering by service A towards user U is changed accordingly.*”

Personalization is defined by (Mussi, 2007) as “*a process of changing a system behavior to increase its personal relevance*”. Another study by (Staffort & Gillenson, 2003) has described that personalization of services is to adapt services to fit the needs and preferences of a user or a group of users. In another study

(Blom, 2000) has defined personalization as “a process that changes the functionality, interface, information content, or distinctiveness of a system to increase its personal relevance to an individual”. According to (Riecken, 2000) personalization is about mapping and satisfying user’s goal with respect to service’s goal. (Krogstie et al, 2004) has stated it as “Personalization means information systems that both automatically adapt themselves to the preferences of the user and that can be explicitly tailored by users through a specific user interface”. Due to the relevancy of user modeling and context-aware approach, we define personalization as “Personalization is a controlled process of adaptation of a service to achieve a particular goal by utilizing the user model and the context of use”.

Some key elements for personalization of mobile services are:

User needs and goal: Sending information about relevant events when it is impossible for the receiver to attend or react to the information (e.g. because the user is in a different city). Sending information about something that is not relevant for the user, (e.g. about a shop where the user never buys anything because it is not of his style), when the user has stated explicitly what he prefers will not be beneficial for the user. Sending irrelevant information at all when the user has signed up for information has a negative effect. The user needs should result in a goal that can be explicitly or implicitly stated, and result in the delivery of a reply to the user’s device, where the reply consists of a result that should satisfy the initial need of the user (Asif & Krogstie, 2011). A common characteristic of any personalization strategy is the necessity to understand and represent user needs, interests, and requirements. The quality of that representation is a major factor in the value associated with the personalization service itself (Perugini & Gonçalves, 2002).

Choice and flexibility: Choice and flexibility can be different at different levels of personalization. For practical use of personalization, it should be easy to use. To be easy to use, it is a presumption that it is quick to learn, and that result of the personalization appears without delay. Also, it is advantageous to avoid current explicit extensive manual configuration. The personalization possibilities should also be available when they are needed. In principle, personalization is concerned with matching and negotiation between user requirements and abilities on one hand and service offerings and resulting adaptation of network and application level services on the other hand (Lankhorst et al, 2002).

Control and privacy: In order for services to be personalized, the user not only interacts with the (primary) service itself, but also provides information on his or her personal preferences, and access rights to this personal information (Lankhorst et al, 2002). The user model that drives personalization is normally based upon user’s personal information and there many are concerned about privacy (Simon, G.et al, 2010). It is very important to understand what information different types of services required and what information users are willing to reveal for those services. In personalization, users should have control over personal information to keep their privacy (Korth & Plumbaum, 2007). User should be aware of the services s/he is using and the personal information required for that service. To control such kind of services and personal information can pose different challenges. One such challenge is to provide a user interface (Heikinen et al, 2004) to handle such services and privacy at the same time. Trust on mobile services is another major issue as described by (Ho & Bull, 2010). Trust has direct impact on the adoption of mobile services (Ho & Bull, 2010; Gao, S. et al, 2011). With increased personalized, the privacy and control of data should continue to be considered in every service.

4. DIMENSIONS OF PERSONALIZATION

Some major dimensions of personalization such as *implicit* or *explicit*, *static* or *dynamic* and *system* or *user oriented* is briefly described in this section.

4.1 Implicit or Explicit

Jørstad (Jørstad. et al, 2004) has split the personalization of services in two. Explicit personalization is where one of the parts sets the parameters of the service manually. Implicit personalization is related to mechanisms connected with the service more or less continuously to adapt the service according to specific user behavior and assumed requirements. Implicit personalization has challenges of recording, storing, processing and analyzing information about users to adapt the service. The study (Haiyan & Marshall, 2006) describes personalization in which the user participates by making choices or providing information to give the system

guidance as to how to adapt is termed explicit personalization. Personalization that is done automatically by the system is termed implicit personalization. According to (Barnes, 2002) a user model is an explicit representation of properties of a particular user, which allows the application to adapt diverse aspects of its performance to individual user's needs.

4.2 Static or Dynamic

Because of the variety of input and output channels, new forms of interaction and continuous updates of user and context models become more important. Basic information of a user remains the same and can contribute to the static part of personalization. Various parts of the user profile remains static for a long period. User can have short or long term preferences which can lead to static or dynamic aspects of personalization. User's context is dynamic and contributes to the dynamic part of personalization. In mobile service personalization, it is important to understand the static and dynamic parts of personalization. Some services may only require static information or some may require real-time information about the user. (Hella & Krogstie, 2010) has divided this information into three categories, 1: Personal information consists of categories of information that is common for all users. It changes seldom and typical examples are name, birth date and address. 2: Stable interests. It is called stable because the type of information does not change frequently, due to importance and relevance of the information to long-term interests of the user. 3: Temporary interests. For a limited time period a user could be interested in for example buying a new digital compact camera. As soon as the goal is fulfilled information in this domain is no longer required.

4.3 System or User-Oriented

Both the system and user can participate in the personalization process (Blom, 2000). A user can subscribe to some services or system can recognize some aspects of user's interactions. But user must have control to accept or reject the choices the system makes. Managing the degree of initiations can play a vital role in achieving a reasonable level of personalization. According to (Jørstad, et al, 2004) explicit personalization either user or service provider has to adjust some parameters for service.

5. LEVELS OF PERSONALIZATION FROM A DESIGN PERSPECTIVE

There are various design approaches with different emphasis of personalization. Modern personalization seems to have different kinds of meanings, from location diagnosis, fitting the visual layout of the message to data terminal equipment, tailoring the content of the message, and tailoring the product. It is easy to get confused with different focus of personalization. If there is no common framework of personalization, there are problems because parties involved do not understand each other (Vesanen, 2007).

There are different technical approaches to achieve personalization such as machine-learning algorithms, agent technology and ubiquitous and context-aware computing (Haiyan & Marshall, 2006). Each approach has a different focus on personalization. Context-aware approaches seem to be most suitable for personalization of mobile services. Context-awareness is one of the key enabling factors for providing personalized services (Liao et al, 2004), (Asif & Krogstie, 2011). Presentation of personal information can play a vital role and hence user modeling is an important feature for personalization (Heikinen et al, 2004). The user model can be used as a building block of personalized service provisioning. Personalization is a practice that is shaped by the designer's motives for personalization and viewpoint on "*what personalization really is*" (Haiyan & Marshall, 2006). Two types of personalization called '*preference personalization*' and '*location personalization*' was studied by (Ho & Bull, 2010).

Different mobile services may require different level of personalization. As described by (Krogstie et al, 2004) personalization becomes increasingly important, both at the individual level where user-interface details such as commands and screen layout are tailored to personal preferences and hardware, and the work level where functions are tailored to fit the user's preferred work processes. So it is important to identify and understand these levels which can be achieved for particular mobile services. These can help to understand the requirement of personalization needed for a particular service and the design concerns. These levels of

personalization based upon user-modeling and context-aware approaches are identified are described in the following sections.

5.1 Simple Personalization - Basic Level

At this level, personalization remains static after the preferences are selected and set.. This includes manual settings of look and feel, display properties and sound preferences. The main focus of this kind of personalization is presentation which requires no knowledge of the user except a few representational preferences. The user chooses and the application will behave according to the user's choices. For example if the user wants to save battery life, s/he can customize the power profile to fulfill his requirements. This becomes more interesting with new modalities of interfaces such as speech recognition, synthesis etc. (Krogstie et al, 2004)

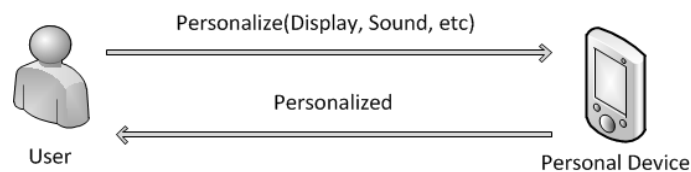


Figure 1. Basic personalization-Level 1

5.2 Profile-based Personalization - Second Level

By knowing something about the user, it will be much easier to improve the quality of services delivered to a user. Information about a user can be used to target services directly to a specific user. To provide personalized mobile services, different types of information are useful. Here our focus is on user's personal profile. The profile contains all the information related to a person as an actor, his goals etc., and follows the user everywhere independently of the context. The information that is to be captured in the personal profile can be divided in three main parts: personal information, stable interests and temporary interest (Hella & Krogstie, 2010). This level provides adaption capability by utilizing user profile either created explicitly or implicitly. User profile describes user related information such as preferences, history, interest and roles or tasks. According to (Zhang, 2003) the user's profile may include user ID, background information, interest and preferences. A list of different types of profiles with varied emphasis is described by (Korth & Plumbaum, 2007) which includes *personal profile*, *preference profile*, *relationship profile* and others. At the same time, personalization of this level can be of any dimension as described in section 4.

Personalized news services (Billsus & Pazzani, 2000; Liu et al, 2010) such as personalize Google news, Yahoo, Lycos and Excite require simple user profiles which represents user's long or short term interests to receive personalized news.

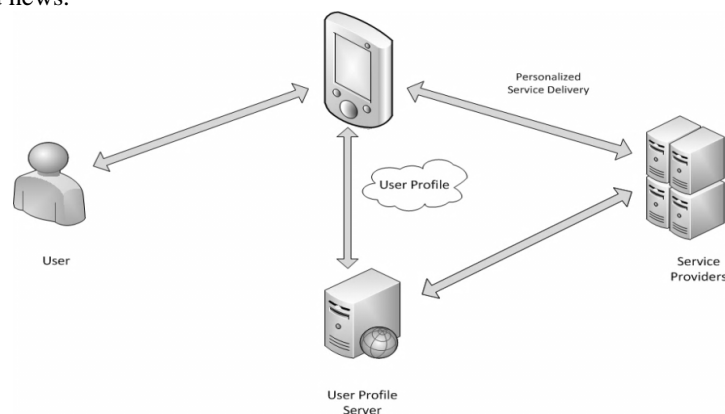


Figure 2. Profile based personalization -Level 2

Direct marketing through SMS messages based on collected information about user behavior through profile subscription has been seen as a powerful personalization feature (Jørstad. et al, 2004). Personalized

mobile service for food shopping (Hella & Krogstie, 2010), personalized product details and in-store customer advice (Jun et al, 2009) and personalized services in mobile learning (Zare, 2011) are similar kind of services.

5.3 Contextual Personalization -Third Level

Personalized services at this level demands both user modeling and context-aware techniques. It is very important to take advantage of the relationship between user profile and user context. At this level, services can be adopted at different levels with the agreement of the user or in compliance with user's context and user model available. The focus of this level is to integrate user's profile and contextual information for personalized services. The services designed at this level are able to adapt to the user situation. Depending on the requirements of personalization at this level one can adapt to any of the dimensions described in section 4. Personalization at this level is extended by context-awareness which can enhance user experience (Asif & Krogstie, 2011). It requires modeling both the user and the context. The context elements (Dey & Abowd, 2000; Krogstie et al, 2004; Sigg et al, 2010) that can play significant role in personalized services are many but here we described only primary level context:

- **Identity:** It is the primary element of user's context which can be used to derive secondary context. This identity information can be utilized in a variety of ways to provide personalized mobile services. Usually identity is static information about a user that very seldom changes.
- **Location:** Location is a crucial element of user's context. Simply knowing that a person is "at home," "in office," "in car" is often sufficient for applications to carry out predetermined actions in given situation, such as turning off a cell phone during a meeting. Other services might utilize the geographical position of the user (e.g. listing the nearest resources of a certain type such as the nearest restaurant).
- **Time:** To get the right information at the right time is beneficial. For personalized services, it will be inconvenient for user if we send information at the wrong time and wrong place.
- **Task or Activity:** It describes what the user is doing. The task context may be described with explicit goals or the tasks and task breakdown structures.

By combining the context information and user profile one can enhance the user-experience with the service. As stated by (Zimmermann et al, 2005) the combination of user model and context model can provide valid models for personalized and contextualized services. Recently, personalized mobile advertising services are utilizing the user's profile and context to enhance the experiences of user. One may expect mobile advertising to be even more appealing to consumers who use *location-sensitive* and *time-critical* m-commerce applications (Xu et al, 2008). The utilization of time- and location-awareness as personalization variables can be highly beneficial.

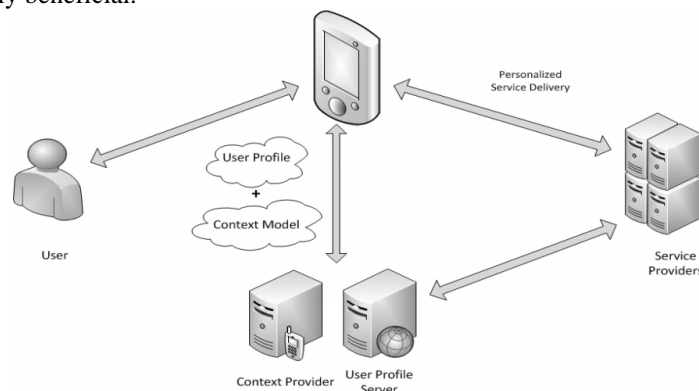


Figure 3. Contextual personalization- Level 3

Personalized geonotes (Brem et al, 2010) are particularly appealing as a means of providing rich personalized information about cultural heritage sites. These kinds of applications offers a way to reduce, perhaps avoid, the anticipated information overload by utilizing user model and the context of use. The three main application areas of contextual personalization are 'Where am I' services, 'point of need information delivery', and 'industrial or corporate' services (Ho & Bull, 2010). All these three areas somehow utilize user's profiles and few context elements such as location or time to deliver mobile services. The study

(Gummerus & Pihlström, 2011) has introduced mobile value framework which shows how context value can enhance the user experience with personalized mobile services.

There are two main streams of research in personalization, one is about technical aspects of personalization and other is about user's behavior (Ho & Bull, 2010). The design perspectives of personalization presented above can delineate the new approaches of designing personalized mobile services. These can help to describe general design choices and guidelines for personalized mobile services. This distinction of levels can help to understand the design requirements at each level of personalization. Personalization at different levels has different issues and concerns. Different levels of personalization are also posing some challenges on both user behavior and technical aspects. Personal Service Environment suggested by (Lankhorst et al, 2002) provides a mechanism to assist a user in finding, adapting and using services that fulfill his needs given his personal profile, his mobility and his context. However, with increasing level of personalization, users are becoming more suspicious about why and how mobile service providers use their personal data, resulting in high distrust (Ho & Bull, 2010). To provide a common frame of reference in understanding, designing and analyzing personalized services, these levels of personalization can help to describe the functional elements needed for service-oriented personalization.

6. CONCLUSIONS AND FUTURE WORK

Providing the same contents or information to everyone at the same time may end up not serving anyone. We have to understand real user needs before delivering the personalized service. User must have control over the service to personalize it; on the other hand service delivered should have the flexibility to fulfill the user's needs. Depending on the user's needs not every personalized service require real-time user context or user model. We have to find out which level of personalization is required for a particular service. One challenge is to find out how to provide personalized services that leave the user in control. The challenge of privacy can be treated as a part of personalization preference and hence should be the part of service delivery. Privacy can also be handled by shifting the control to the user's end which in turn will increase the level of trust. This taxonomy can be used as a basis for the further development of a personalization framework for mobile services.

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EGOVERNANCE – IMPROVING ACCESIBILITY OF MOBILE WEB SITES

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ABSTRACT

When comparing Argentina's population with the number of cellular telephony active lines, it can be assert that the active lines widely exceed the inhabitants. Because of this high concentration of cellular telephony, due to the lower cell phone's price against computer's price, it begins to be necessary for the government agencies to provide services that can be implemented in cellular phones. This paper explains m-Government's characteristics and shows different steps to provide m-Government to government agencies, especially local governments. Additionally, the paper presents a way of implementing m-Government using a content management system named GECODIMO, built according to W3C(World Wide Web Consortium) Best Practices. This software provides local governments with a content manager for mobile devices that can be implemented at no cost because it was developed with open source tools. This system will provide an additional communication media in the environment G2C (Government to Citizen) and G2V (Government to Visitors). This tool has been developed thinking on its flexibility and adaptability, but above all it was developed to reach universal accessibility for all citizens.

KEYWORDS

e-Governance, m-Government, Web, Mobile, Accessibility, CMS

1. INTRODUCTION

1.1 Mobile Devices Growth

Given the tremendous growth of mobile telephony worldwide due to its rapid adoption by the society, for its ease of use and continuous availability, it is necessary for government agencies within their communication strategies, provide additional information and services (ESTEVEZ E 2007), (ESTEVEZ J 2005) to its citizens and visitors through mobile devices. Regarding Argentina, the cellular phone's active lines are: 56,624,200 (CNC 2011) while the population reaches 40,117,096 inhabitants (INDEC 2011). So the mobile telephony penetration index comes to 141.15% (1)

$$\text{Penetration index} = (\text{cellular active lines} / \text{inhabitants}) \times 100 \quad (1)$$

The quantity of cellular active lines is higher than the inhabitants; this fact leads to find a strategy to deliver information and services using mobile devices. This strategy is included within the concept of e-Governance.

1.2 e-Governance and m-Government

The concept of e-Governance is defined by UNESCO as "the use of information technologies and communication by the public sector in order to improve the information delivery, encouraging citizen participation in decision-making process, making the government more accountable, transparent and effective " (UNESCO ne). This also applies for: e-Government, e-services and e-Democracy. The e-services are among the most used applications of e-Governance. They aim to improve the provision of information and provide citizens access to public services. They include also details about addresses, schedule, requirements, events, entertainment, public transportation, jobs, employment policies, bids, maps, sights, etc. Moreover, communication environments derived from e-Governance are: G2A (Government to Administration), G2E (Government to Employee), G2B (Government to Business) G2C (Government to Citizen) and G2V (Government to Visitors).

In this paper the following environments will be considered:

- G2C: This category includes all those services, information, alerts and interaction that especially the local government offers to the citizens of its district.

- G2V: Includes all information and services provided for visitors and town's citizens, and for those people who arrive to the town for attending a job, health, study, etc.

m-Government is a subset of e-Government, specifically regarding the use of mobile and wireless Information and Communication Technologies, like cellular phones, netbooks, notebooks and Tablets connected to wireless LANs (Local Area Networks).

2. M-GOVERNMENT

The concept of m-government was defined by Kushchu and Kuscü (2003, pp 253-260), "as an strategy and its implementation, incorporating all sorts of wireless technology and mobile services, applications and devices to enhance the benefits of the parties involved in the e-Government including citizens, businesses and all government agencies ".

Either to the final users or to the government agents, m-Government contributes to the goal of having information and services available "anytime, anywhere".

m-Government allows citizens to save time and money by the access to government networks using their cellular phones and other type of mobile devices, or by request of information delivered by SMS (Short Message Service).

This way m-Government promotes efficiency in the delivery of services and a more active kind of citizens through SMS information, instant requests, claims and complaints.

m-Government is an e-Government complement, nevertheless a replacement. Although mobile devices are a wonderful access way, they are not useful regarding the transmission of heavy and complex information.

In the "in development" countries, the m-Government shows a meaningful potential, because there is an increasing penetration of the cellular telephony, particularly in urban areas, and it still remains growing.

So "the main challenges of m-Government are: a) service fee b) the access to mobile technology gap, c) the transactions reliability and security and d) the temporary messages overload." (HEEKS 2006)

m-Government must be developed as an e-Government strategy component, according to each country's conditions. That's the reason why m-Government has a number of expectations whose specificity is conditioned by: a) availability of enough qualified personnel, b) back-office appropriate systems c) applications selection (they must be neither trivial, nor complex), and d) its usability degree.

2.1 m-Government's Characteristics

The most outstanding m-Government's characteristics are:

- Power of Pull (Communications initiated by the telephone): The pull is produced when the user demands information through an immediate action like consulting a website, or sending a SMS in order to obtain an answer.

- **Power of Push** (Communications initiated by the network): The push happens without the user intervention. For example: if the user is an alert service subscriber, the alerts are received automatically by the user like for example SMS. The push is especially useful in mobile devices, because of its availability and personalization.

- **Power of Range**: The cellular phones' range is wider than the computers' range. A cellular phone goes with its owner everywhere.

When developing m-Government applications, it is necessary to assure that the users will get exactly what the site promises in the least possible time. But this goal is achieved progressively and little by little.

2.2 m-Government's Levels

The UN (United Nations) classifies the Electronic Government in 5 different levels, showing their applicability regarding Mobile Government (ONU 2001). Figure 1, summarizes each one of the levels. The first level is EMERGENT. From this start level the mobile site could be improving in order to reach the next levels.



Figure 1. m-Government's Levels

Table 1, explains each one of the 5 levels shown in the Fig.1. The importance of the level decreases in the table. The most important level is explained in the first row of the table, and so on.

Table 1. Levels of m-Government implementation

| Number | Level | Explanation |
|--------|---------------|--|
| 5 | Total | All systems are integrated and all the citizen's services are totally online regardless of the government agency they belong. |
| 4 | Transactional | Users can send on line forms. For example: to request information, to get driver license forms, etc. |
| 3 | Interactive | Users can download forms, contact government agents and make complaints. The available information also has links to outstanding legislation. |
| 2 | Expanded | Content and information are updated regularly. The information is available, not only in its original form, but also it is explained and simplified. |
| 1 | Emergent | Basic information is available in a static way |

Although the main goal is to achieve TOTAL INTEGRATION, by means of a unique virtual window, it is necessary to begin setting out the requirements to achieve the m-Government's level of EMERGENT. The first goal is, not only to consider the mobile devices to offer content to the citizens (level 1), but also to plan how to deliver the information synthesized and according to these devices, and be able to offer a solution that includes characteristics and principles that allows the citizen to get updated information and contact with the government agents (level 3). The solution presented in this paper is placed in this level.

Level 4 requires to be able to make transactions, with leads to have an available data base with citizens' private information, and allow the users to ask questions that a lot of times depends of the way the local government uses and process the information. In this level, it is not possible to offer the same solution to all the agencies. Level 5 requires an important decision inside and among the different organizations to unify all the information of all the government agencies in order to create a unique virtual window.

That's why, it is considered so important to propose a solution in order to stand local governments in m-Government Level 3: Interactive.

3. W3C GUIDELINES

There are some cases where a mobile application could be consumed by users with different profiles (different skills and equipment), in these cases the application must be simple to use and standardized so that it can be displayed properly on the widest range of mobile devices as possible. The W3C (World Wide Web Consortium) provides a DDC (Default Delivery Context), which defines the lowest features that must be ensured in all mobile devices to be able to navigate the web. This allows, despite the wide range of mobile devices with different features, to create an application that meets the specification of the DCC in order to ensure proper navigation by the end user.

The DCC specifies the following criteria (W3Cb, 2008):

- Usable screen width: At least 120 pixels.
- Supported markup languages: XHTML Basic 1.1
- Character Encoding: UTF-8
- Supported Image Format: JPEG, GIF
- Total Maximum weight of a page, 20 KB
- Colors: 256 Colors Minimum
- Supported Style Sheets: CSS Level and CSS Level 2
- HTTP: HTTP/1.0
- Script: Not supported by client-side scripting.

W3C proposes 60 Best Practices to design a mobile website accessible and usable (W3Ca, 2008). These guidelines represent best practices and are grouped under 5 categories:

1. General Behavior
2. Navigation and Links
3. Layout and Page Content
4. Page Definition
5. User Input

Once the application is built, it must be validated to check if the application can be navigated satisfactorily by a device that compliance with the DDC. To check this item, the W3C has an online validator (W3Cb 2010).

The validation of the application must be supplemented by evidence of real world mobile devices and also using emulators which allow analyzing how the application would be displayed on different mobile devices considering different versions of operating systems.

4. GECODIMO DEVELOPMENT

Mobile Content management Systems in several cases are prepared for smartphones, excluding a lot of devices that fulfill the minimum requirements established in the DDC. In Argentina a high percentage of mobile phone users doesn't have a smartphone and there are users with phones that doesn't reach the minimum requirements established in the DDC.

That's why the mobile website must be accessible for all kind of mobile phone and not only smartphones. Content and services offered are not so important if they cannot be reached. Otherwise the development effort will not be worth it.

GECODIMO is a tool that allows local governments to implement level 3 of m-Government.

It is a content management system that, through a loading system, allows managing information already organized by categories (eg: news, information, addresses, schedules, announcements, sights, etc.) in order to generate, with the information loaded dynamically, a mobile portal for consultation.

The system consists of a backend sub-system that allows loading data and another one to configure the portal. The generated portal allows querying information using mobile devices.

The system has the following features:

- Fully web configuration system
- Create categories and subcategories in a hierarchical way
- Edit and order the categories
- Allow to disable and delete categories
- Upload content with validity date
- Picture Management

GECODIMO was developed with open source tools to enable the implementation in any environment without licensing costs. It was built entirely in Java using jsp pages and Enterprise Java Bean Technology. The chosen database was MySQL. Figure 2 shows the system architecture

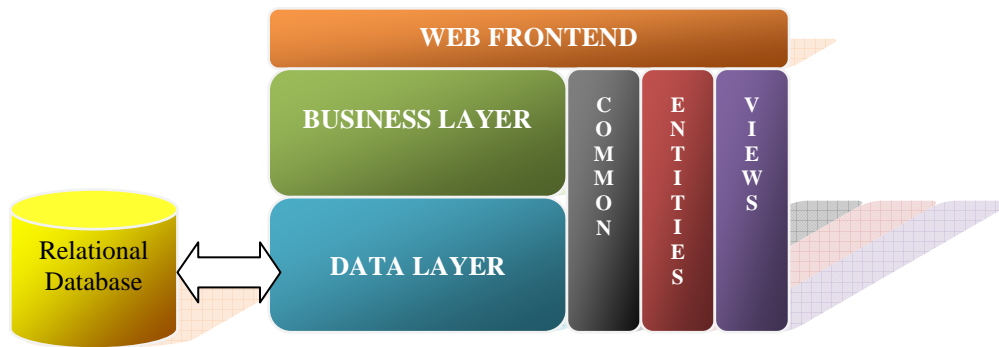


Figure 2. GECODIMO System architecture

The system has two main roles:

1. Administrators: those who use the backend system to configure the system create categories, upload content: news, notices, etc.
2. Mobile users: those who can access from a cell phone and visualize categories and their content.

GECODIMO has two different environments:

- Frontend, where final users or mobile users access the information implemented in XHTML in their mobile devices (see Fig. 3).
- Backend, only accessed by the administration user, which has a graphical interface to simplify the generation of the main menu categories, sub categories (Fig. 4).

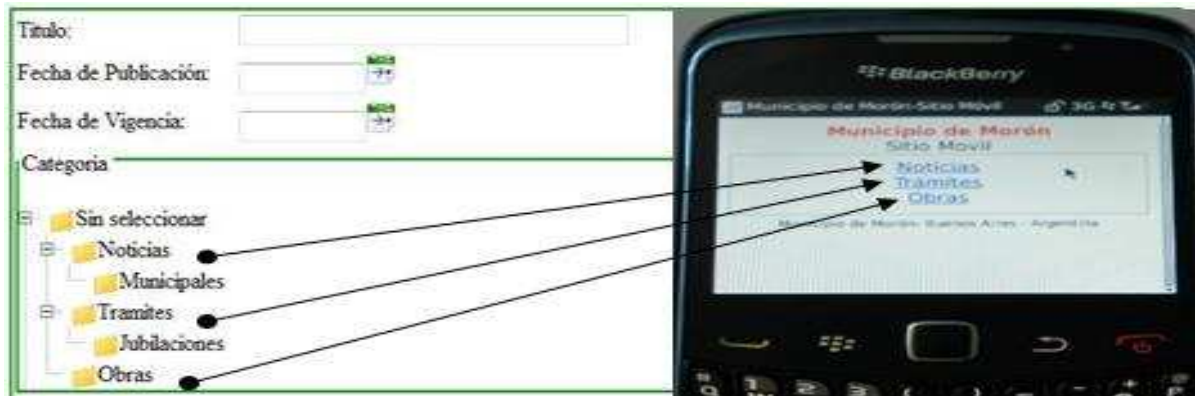


Figure 3. View the main menu on a mobile device

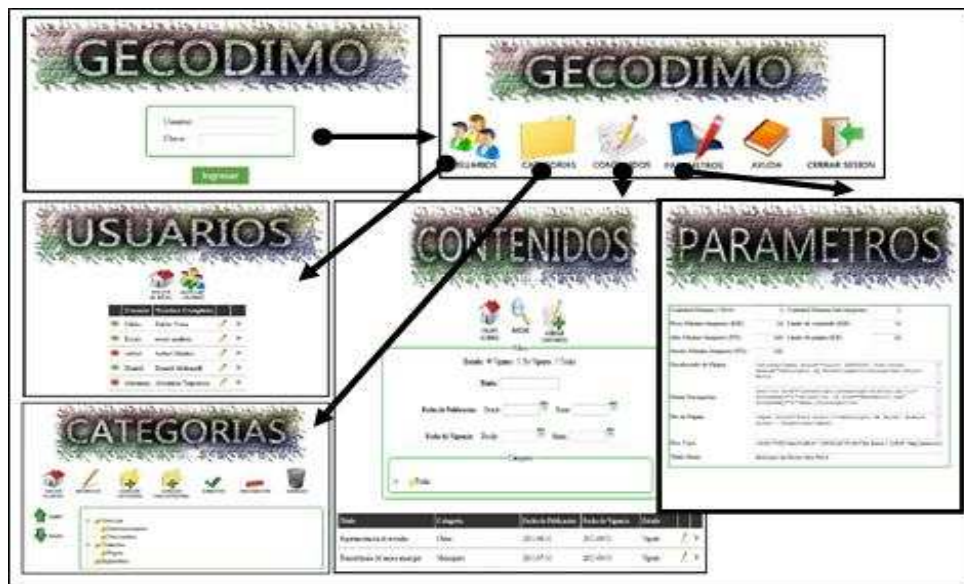


Figure 4. View of the main screens used by the administrator user

5. OTHERS CMS

We have analyzed existing freeware CMS for mobile devices. Most of existing mobile CMS are modules to extend non mobile CMS making the installation a really complex process. We have installed and tested the following CMS: JOOMLA MOBILE, PHPNUKE + WAP 2GO, COTONTI MOBILE (CMSa, CMSb and CMSc). The main features of GECODIMO not present on others CMS are:

- Reaches 100% on W3C mobile validator (W3Ca 2010).
- Has special links for mobile devices (SMS, Phone Call).
- Performs several validations and restrictions on content and images to fulfill W3C best practices
- Automatic menu generation from categories (only COTONTI MOBILE has this feature).
- Table support for data presentation (this feature is also available on COTONTI MOBILE but limited).
- Fully support of bullets and numbering (limited on the others CMS).

6. VALIDATION

It's important not only to develop an application taking in consideration the guide offered by the W3C but also to have the opportunity to validate that the mobile web site is accessible and to analyze the user experience of the user when browsing the website.

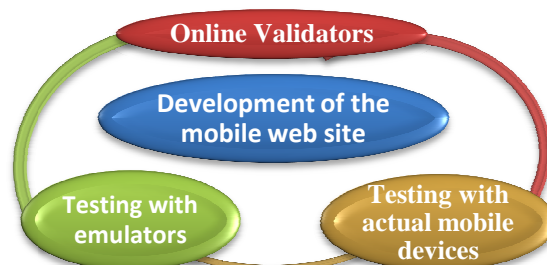


Figure 5. Steps for Mobile Web Site Validation

Figure 5 shows three elements to take into account:

- Online validators developed by the W3C: to check guidelines compliance (W3Ca 2010) and to check website source code (W3Cb 2010).
- Testing with actual mobile devices: it is not enough to see if the application is accessible and if it fulfills the W3C best practices, also it will be essential to analyze the operation of the website. That is reviewing the application such as an end user does. It's necessary to perform many use tests on mobile devices with dissimilar characteristics (screen size, resolution, operating system, browser ...).
- Testing with emulators: It's impossible to have mobile devices with all operating systems and the different versioning that the end user will possible use to browse the site. In order to make a more complete test the user of emulators should be considered in order to test the website on other platforms.

7. ACCESIBILITY VS DEVICE CAPABILITIES

When performing a deep analysis on W3C guidelines a clear doubt arises facing the importance of these directives on perform programming and design thinking on devices with the minimum requirements set on the DDC against taking advantage of the capabilities of smartphones.

When there no exists a unique user profile, like in m-government applications, the application or website will be used by a large number of users with disparate mobile devices with different features. These users will have different capabilities (considering their own limitations and knowledge). That's the reason why it's essential to consider the website accessibility as the central axis.

GECODIMO allows generating web pages that can be accessed from any mobile devices with internet connectivity after being tested with validators, emulators and physical devices. The test performed with different specifications on hardware and software (operating system, browser) have allowed navigating and accessing content without any difficulty. All basic elements are correctly displayed (plain text, formatted text, fixed images, animated images, internal links, external links, etc). Differences can be noted when viewing the main page on devices with higher or lower resolution; even some browsers on devices with high resolution adjust the content to the screen size in order to be viewed without having to zoom.

Operating systems when they have to solve some specific action also respond differently. Although, it has been decided to add to the administration system the possibility of adding special links which may not respond the same way on all operating systems.

Conventional links allows to access another webpage either internal or external, special links allows launching other services like performing a call, sending a SMS, etc. That is, the user will click on the link a SMS will be ready to send with the destination number and the message text configured by the administrator. It's important for the user to know what will happen when clicking a link to create a really usable website. It's also important to take into consideration that the distinct operating systems may react differently with the special links and some of them could even not react at all.

Accessibility is privileged so that the content can be viewed without difficulty by all citizens. But is wishful to give a telephone number to manual copy it to communicate with the organism knowing that many citizens can click on the number and make the call. Then a decision must be taken to avoid excluding citizens and not otherwise limit the features of those devices that can navigate the application with additional resources. To achieve this the system requires the administrator to generate special links with the resource information visible, so that the citizens that cannot use the special links can have the information to make a call or send a SMS manually and the citizens with capable devices will simply click the link and perform the action.

8. CONCLUSIONS

Local governments have a wonderful opportunity to reach and communicate with their citizens through mobile devices, which are "anytime, anywhere" ready to use. This kind of communication implies an especial development in order to be navigated by the citizens. A mobile site must be designed with a tool that considered the especial characteristics of the mobile devices.

It's important considering that a government application must be accessible for the entire population. All citizens having a cell phone with internet access will be able to access the application regardless the cell phone features. While most internet access from mobile devices are made with cell phones, it should be considered that other access can be made from other kind of devices like tablets, eBook readers, game consoles or any other device with internet access. It is therefore necessary to take into consideration these other alternatives. GECODIMO offers accessibility regardless of device capabilities with a system that can be implemented in different environments without an associated cost. By default it has been configured to meet the guidelines of the W3C. According to that basis size of the pages, weight, size and image resolution, the number of sub-categories within a category allowed in the main menu, etc., are limited. After GECODIMO is installed, administrator users are trained in using the content management system, by adding categories, subcategories and contents. GECODIMO is configurable by administrators who can change the parameters (weight, size, etc.), but the training also emphasizes the importance to keep the parameters into the limits proposed by W3C.

Currently the system has been tested using the W3C Validator reaching 100% of compliance. It has also been tested with real phones and emulators to continue the testing stage.

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A MONITORING SYSTEM FOR MULTIPLE RESOURCES SUPPORTING SMART HOUSE AND BUILDING AUTOMATION

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ABSTRACT

In the last few years, a growing interest towards reducing resource consumption and carbon footprint has been the main driver for the development of intelligent systems for smart houses and buildings.

Existing solutions are limited to monitor and optimize the usage of each single utility or resource, such as electric power, water and gas. However, higher savings can be achieved by monitoring and collecting data from multiple utilities and sensors in combination at the same time, instead of focusing on the optimization of the single factor.

We present a novel solution to support integrated monitoring and data collection in a smart house with the objective to reduce utility cost and toxic byproducts. We discuss the requirements for the metering system and we propose an architectural solution satisfying these requirements. Furthermore, we describe a system prototype implementing the proposed architectural solution. The experiments carried out on the prototype show that our proposal is a viable option to support the monitoring of multiple resources interacting with heterogeneous sensors and external interfaces.

KEYWORDS

Smart House, Automatic Meter Reading (AMR), ZigBee, Wireless M-Bus, Building automation.

1. INTRODUCTION

New technologies such as ultra low power microcontrollers with radio frequency communications and high precision low power sensors are the foundation for automatic monitoring systems that support the reduction of environment footprint and costs related to resource utilization in future smart houses and buildings. Currently available solutions for monitoring offer limited features, as they focus mainly on a single type of resource (e.g., electrical power) or they take into account only a limited type of sensors and applications (e.g., Zigbee based power meters for interaction with a specific electrical company) (Xu, et al., 2008; Thepphaeng & Pirak, 2011; Zhu, et al., 2006; Yanfei, et al., 2009; Shan, et al., 2008).

This approach places unacceptable constraints to both users and resource providers, as it requires a separate monitoring system for each resource and for each provider, leading to higher costs. Furthermore, this approach to monitor separately each resource is hindering the development of integrated solutions, which in fact will help to better understand consumption patterns, leading to service improvement and logistics optimization simply by analyzing several resources and factors at once.

Available solutions can only support analysis based on a single resource. For example that systems could report “Based on your energy consumption patterns, you could save 360€ per year by upgrading to a more efficient electric water heating” (Froehlich, et al., 2011). Monitoring all the resources can support analyses that provide the users with a full consciousness about the status of all resources consumed by each single object. The new system could report, for example, “Based on your energy, gas and water consumption patterns you could save: 360€ per year by upgrading to a more efficient electric water heating; 470€ per year by switching to a gas water heating, 980€ per year by switching to a solar one. Using the automatic system to manage the boiler, by heating only when is really necessary you could save another 35% of gas or electricity”

Our solution is the proposal of a novel system for the automated monitoring of multiple resources (such as gas, water and electricity). We present the architecture of the proposed system and we provide a detailed view of a prototype implementation of a gateway that can collect data from heterogeneous sensors and

supports interaction with multiple service providers for metering purposes.

Preliminary experiments on the prototype monitoring system demonstrate its viability as a metering solution. In particular we show how the prototype can support heterogeneous sensors over a building. System scalability is evaluated with respect to the number of sensors and data collection process is discussed with emphasis on network failure recovery and safe operation during power outage.

The paper is organized as follows: Sections 2 and 3 describe the system requirements and proposed prototype implementation, Section 4 illustrates the preliminary tests, Section 5 reports state-of-the-art solutions, Section 6 concludes with final remarks and introduces the discussion for the future studies.

2. MONITORING SYSTEM REQUIREMENTS

We now describe our proposal to support the monitoring of multiple resources through heterogeneous sensors and meters. Our goal is to overcome the main limitation of existing solution for automated monitoring where data collection is limited to homogeneous devices.

We focus on an architecture consisting of a central gateway that collects data from the sensors and meters and sends them to remote nodes. This is a common approach for automatic meter reading systems. However, we identify three areas where improvements with respect to the available solutions are required. We motivate the requirements by pointing out potential benefits for both companies that serve resources (such as gas, water and electricity) and for end users. Specifically, we summarize the requirements motivating our proposal in three items:

1. capability to support heterogeneous communication systems;
2. availability;
3. scalability.

2.1 Capability to support Heterogeneous Communication Systems

Heterogeneity in communication systems can occur both at the level of Wireless Sensor Network (WSN) and at the level of gateway interface with external systems. With respect to the WSNs, many resource providers offer multiple resources (for example PG&E, AGL, Enel, ... that provide both electricity and gas). Deploying a different gateway for any group of meters or sensors can be very expensive. By monitoring multiple different resources at the same time, the proposed architecture can reduce to one the number of required appliances. As a consequence, the staff involved in system planning, maintenance, and other features, must only have a detailed knowledge about one gateway system. The meters and the sensors can be various and built by different firms that adopt the ZigBee or Wireless M-Bus protocols.

The gateway must be connected to the network via different interfaces, such as Ethernet or Wi-Fi that may rely on the user DSL connection, or can be equipped with HSDPA to connect to a mobile network. If both connectivity are supported, the gateway can autonomously decide if it is better exploit a free DSL connection, that may be temporarily unavailable (for example if the user turns off its modem), or if there is the need to instantiate a connection to the mobile phone network. Using these interfaces, the proposed architecture can also send data to the cloud data centers, e.g. to Pachube (Haque, et al., 2011). This on-line database allows the developers of resource providers (or to third parties) to feed sensor data, and supports the deployment of software for analysis and of value added applications.

2.2 Availability

For availability we consider that the gateway must be able to receive all the data from the devices, store them, and support basic functions of data filtering, aggregation and reporting for the user. To support this requirement we need an adequate level of performance in terms of CPU, RAM and storage. Furthermore, as the data collection process must be carried out also in the case of electric power outage, we need to consider a backup battery and we must ensure low power consumption for every device involved in the data collection process, to ensure a long battery lifetime.

The local storage of the devices data is required to cope with a possible unavailability of the connection with the external data collectors. To this aim, besides the ability to buffer data and synchronize the storage

with a remote repository, data aggregation and filtering should be possible locally in order to provide basic services for the users without a remote third-party involvement. For example the users must be able to consult all the data about the consumptions and the rooms' status by interacting only with the gateway, possibly through a friendly user interface.

2.3 Scalability

The need for scalability is motivated considering that the proposed architecture should be used in different scenarios ranging from a large building to a small house. While other solutions follow different system setups to cope with scenarios of different size (Lam, et al., 2008), we aim to provide a more flexible and scalable solution. In other words, by adopting the proposed architecture the same gateway can be used in all contexts only by removing or adding peripheral devices. The number of sensors supported by the gateway can range from a few units up to hundreds of devices. Furthermore, components providing additional features (such as a touchscreen-based user interface) can be added or removed in order to satisfy the costs and the energy usage constraints.

3. PROTOTYPE IMPLEMENTATION

The developed prototype is based on the requirements described in Section 2. It aims to support heterogeneous communication systems and to ensure the system availability and scalability.

3.1 The Architecture

In order to satisfy the described requirements, we propose the architecture in Figure 1. The automated monitoring system is composed by three main parts: the Device Sphere (DEVS), the Gateway Management System (GWMS), and the User Sphere (USRS). With the term “devices sphere” we intend all the meters (e.g., gas, water and electricity) and all the sensors, (e.g., luminance, flooding, CO₂ and temperature) that the GWMS is able to support. With term “gateway management system” we intend all the components that are able to collect the data from the DEVS, transform this data in an intelligible format and provide it to the USRS. With terms “user sphere” we intend all the software (such as analysis software, data reporting interfaces and applications) that a user, human or not, can use to interact with the GWMS.

The GWMS and the DEVS are composed by two layer, hardware and software. The hardware and the software of the DEVS can be very heterogeneous and depends on each single constructor. The software layer is usually a proprietary firmware compliant with a standard protocol, that the coordinators should support.

About the DEVS, we decide to support ZigBee and WMBus protocols. The ZigBee is currently one of the most used standards for LoWPANs. It supports many devices, as light sensors, electrical meters, and other consumer and industrial equipment that requires short-range wireless transfer of data at relatively low rates. The WMBus is radio variant of M-Bus European standard (EN 13757-2/3). These two protocols allow the GWMS to monitor multiple different devices and resources, making easier the use of the same architecture in various contexts, such as building automation and smart house.

The proposal is an embedded machine able to support heterogeneous communication systems. This system will be able to support from few to hundreds of DEVS, also during electrical power outages. The system will easily support the selected interfaces and peripherals in order to provide services to the USRS. The network interfaces (as Wi-Fi, Ethernet, ...) support remote monitoring by USRS, potentially interacting with cloud-based platforms, while the peripherals allows the persons to interact directly with the DEVS.

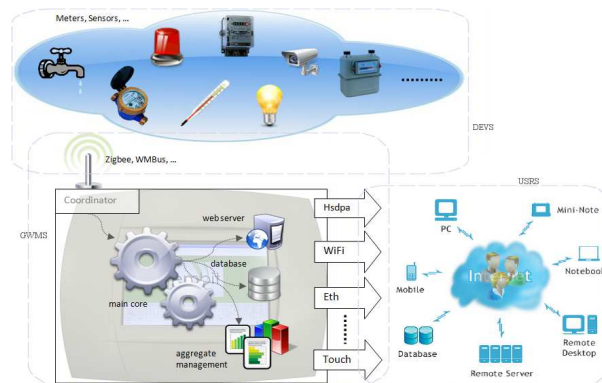


Figure 1. System architecture overview

3.2 Hardware

The hardware used to build the prototype can be divided in two fields, the GWMS (components and interfaces) and the DEVS. The interfaces of GWMS (such as usb keys, Ethernet and touchscreen) and DEVS can be very heterogeneous and its hardware depends on each single device. On the contrary the GWMS components must be known a priori; it is composed by three main components: the main board, the ZigBee and the wireless modbus coordinators.

The Figure 2 shows the hardware created and used for the main board of GWMS (layer in Figure 1). This is an embedded platform mounting an ARM920T CPU, 64Mb of RAM and 1 GB of flash. It was built in order to respect low power and low cost features. This solution is currently equipped with many interfaces as Ethernet, Wi-Fi (WPA2, WPA, and WEP), HSDPA (and UMTS (2100 MHz), EDGE, GPRS, GSM (850/900/1800 MHz), SMS enable), UART/RS232, I2C and SPI. Many peripherals are also available, for example touchscreens (3.5", 4.3" or 7"), USB (keyboards, mices, data storages, ...) and SD cards.

The Zigbee Coordinator is an OEM wireless module developed by Embit (2011) for LR-WPAN applications. The module combines high performance to small dimensions and low costs, providing the system integrator a simple and easy way to add IEEE 802.15.4 / 6LoWPAN / ZigBee / RF4-CE low range wireless connectivity and multi-hop networking into existing products. EMB-Z1322PA is configured as an embedded micro system or simple data modem for low power applications in the 2.4 GHz ISM band. It is based on a Freescale™ MC13224V single chip device which is an ARM7 32 bit controller with 128 Kbytes Flash memory, 96 Kbytes of RAM and 80 Kbytes of ROM. The device includes a hardware accelerator for the MAC IEEE802.15.4, AES security and a 2.4 GHz transceiver.

The Wireless M-Bus coordinator combines high performance to small dimensions and low costs, providing the system integrator a simple and easy way to add WMBus wireless connectivity and multi-hop networking into existing products (Embit, 2011). It is configured as an embedded micro system or simple data modem for low power applications in the 169 MHz or 868/915 MHz ISM band. It is based on Texas Instruments CC1120 coupled with an MSP430 core 5 MCU equipped with up to 128 Kbyte of Flash memory and up to 10 Kbyte of RAM memory.

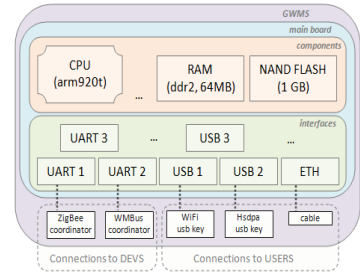


Figure 2. Hardware schema

3.3 Software

The embedded software of the coordinators is a firmware developed by the constructor. These coordinators communicate with the main board through a RS232 and/or a USB interface. The protocols are specific for each different type of coordinator. About the software of main board, is possible to divide it in two groups, the Operative System (OS) and the applications. The operating system kernel is the Linux kernel version 3.0.4 and main userspace software is based on Busybox 1.19.2.

Running on the OS, it is possible to distinguish two types of software: third-party utilities and applications developed by us. In the first group, we have a HTTP server, a database and an SSH server. By comparing different small http servers (*Web Server Comparisons*, 1998), we choose the Thttpd server as it provides the best size-efficiency trade-off. An important feature embedded systems with low computational power is the bandwidth throttling feature that prevents the connection from becoming saturated. The selected SSH (and SFTP, SCP) server is Dropbear, while two different databases are provided: RRDtool (round-robin database tool) and SQLite. RRDtool is the open source industry standard, high performance data logging and graphing system for time series data. RRDtool can be easily integrated in shell scripts, Perl, Python, Ruby, lua or tcl applications. The data are stored in a round-robin database (circular buffer). Hence the system storage footprint remains constant over time. It also includes tools to extract RRD data in a graphical format. SQLite is a software library that implements a self-contained, serverless, transactional SQL database engine.

Three main applications internally developed aim to manage the system, namely the MxZC, the MxWMB and the GWCore. MxZC and MxWMB are the two software that interact with the ZigBee coordinator and the Wireless M-Bus coordinator. The MxZC includes also part of the ZigBee Cluster Library (ZCL) that is developed as an independent library. These two programs provide an interface between coordinators and

GWCore, that becomes able to communicate with the DEVS. The GWCore takes in charge all the activities about data storage, elaboration, analysis and delivery. To do this, it uses also the SSH2, HTTP and HTTPS protocols, and the HTML, CSV, XML and JSON standard formats. The GWCore also have a graphic user interface (GUI) that is directly included in the software in order to obtain better performance. This feature could be enabled at compile-time, allowing to mount or not the touchscreen on GWMS. The GUI could be displayed by remote desktop using a VNC client, also in a secure mode (SSH tunneling).

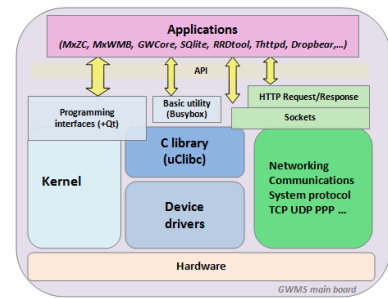


Figure 3. Software schema

4. PRELIMINARY TEST

We carry out a set of preliminary test to validate the proposed prototype, with the goal to demonstrate the viability of our solution for the automated monitoring of heterogeneous resources in multiple environments.

4.1 Experimental Setup

Recalling the main requirements of monitoring multiple resources guaranteeing availability and scalability of the data collection process, we carry out the following tests.

1. Measurement of networks coverage. This test aims to verify if the selected protocols could be used in the houses and also in public buildings with different types of sensors (using different network protocols). We expect that the one-hop coverage is at least: ten meters (a big room) for the ZigBee network; hundred meters (a building area) for the WMBus network.

2. Evaluation of GWMS energy consumption. The objective of this test is to prove the real energy consumption of the whole system, including some communication/user interfaces. Reduced energy consumption is a key feature in case of power outage as it increases the lifetime of batteries. In this test we don't take care of the DEVS' battery lifetime because: it depends on the individual manufacturers; the DEVS send reports to GWMS when the battery becomes low. In any case, according to manufacturer's tests, in the used DEVS the battery of sensors have a lifetime of ca. 2 years while the meters one of ca. 10 years. In case of electrical power outage the key-hardware in terms of consumption will be the GWMS. The expectation is a consumption at most of 5 Watt per hour (max 2,5Wh for an usb key and max 2,5Wh for the main board, coordinators and touchscreen).

3. Performance evaluation of OS and applications. The objective of these tests is the validation of requirements concerning real-time interactivity with USRS, remote administration, and support for multiple different resources. Furthermore, we validate the support of multiple concurrent services. What we expect is the GWMS response at most in 8 seconds for served Web pages and at most of 4 seconds for other services as GUI on touchscreen. These times are related to standard networks status and for one-USRS access (house scenario).

4. Evaluation of the maximum number of supported DEVS. The main objective of this test is the evaluation of the system scalability in extended scenarios such as public or apartment buildings. We expect that the GWMS, without touchscreen GUI, can support networks composed at least form 100 DEVS (e.g. 3 meters and 7 sensors for house, 10 houses). We suppose that these DEVS send the information at most every 30 seconds.

4.1.1 Networks Coverage

In the first test we measure the maximum distance for which the coordinators communicate with one of their device. During the test the antenna is located at one meter from ground level.

Erro! A origem da referência não foi encontrada. shows the maximum distance for different network technologies and scenarios. From our experiments the maximum network coverage is 55m for ZigBee, while for WMBus it is 480m.

Table 1. Networks coverage

| Network type | Coordinator position | Device position | Objects in the middle | Max distance |
|----------------|----------------------|--------------------|----------------------------|--------------|
| ZigBee | into a building | into same building | walls, doors, ... | 25 m |
| ZigBee | into a building | outside | buildings, car, walls, ... | 35 m |
| ZigBee | outside | outside | buildings, cars, ... | 55 m |
| Wireless M-Bus | into a building | into same building | walls, doors, ... | 190 m |
| Wireless M-Bus | into a building | outside | buildings, car, walls, ... | 280 m |
| Wireless M-Bus | outside | outside | buildings, cars, ... | 480 m |

4.1.2 GWMS Energy Consumption

In this test we try the GWMS energy consumption. The GWMS runs with attached the HSDPA usb key and a 3,5" touchscreen, always on. The used battery is a rechargeable one of 20W (5V, 4A); the scenario's temperature between 20 and 28°C. During the various tests, the lifetime resulted approximately of 10 hours.

4.1.3 OS and Applications Performance

In these tests we report information about CPU and RAM usage obtained from Top utility program included in BusyBox. In the first test scenario we try the whole system without active devices in the networks, but with a fixed amount of stored data (ca. 30 DEVS). The tests were done during a user interaction (iter) or not (idle). The user act via touchscreen/VNC or Web server, depending on scenario. In fact, two different configurations were been tested: the first with or without GUI for touchscreen and VNC; the second with or without VNC server.

The GWMS without GUI consumes at most the 12% of CPU and less than 9MB of RAM (14%) even in interactive mode. Adding the GUI (touchscreen), the GWMS consumes from 1% to 35% of CPU, while the RAM usage increases approximately from 22 to 36MB. The max CPU and RAM usage happens during user interactions via VNC (GUI enable). However, in this case the max resources usage is at most the 62%.

In order to test the performance of GWMS, a stress test has been done. Some users, 1 by SSH (Dropbear; login and directory list), 3 by HTTP (Thttpd; GWMS management and DEVS data view), 1 by touchscreen/VNC (DEVS data view), interacted with 3 WMBus meters and 6 ZigBee sensors. The response time was measured into the applications code. The system serves all the users' requests at most in 3 seconds.

4.1.4 Supported DEVS Number

In this test we simulate a ZigBee network composed from many devices (light and temperature sensors, IAS devices, ...) and one coordinator. The coordinator communicates to the GWMS the requests (joins, enrolls) and the data collected from the sensors (sent every 30 seconds). The GWMS stores the data, enqueues and manages all the requests and sends replies to the coordinator. The objective is to monitor how many devices are supported before resource saturation in the GWMS (utilization=100%).

Table 2. Application CPU usage

| Device number | CPU avg (adding) | steady time (adding) | CPU avg (added) |
|---------------|------------------|----------------------|-----------------|
| 25 | 37% | 0s | 9% |
| 50 | 52% | 0s | 22% |
| 75 | 79% | 0s | 36% |
| 100 | 91% | 0s | 47% |
| 125 | 100% | 2s | 60% |
| 150 | 100% | 5s | 74% |
| 175 | 100% | 16s | 85% |
| 200 | 100% | 27s | 97% |
| 225 | 100% | >60s | 100% |

The results show that the CPU is the bottleneck resource. Table 2 and Figure 5 show the CPU usage during and after the join (and enroll for some devices) phase. In particular the 2th and 3th columns data are related to "during the join phase" (adding), while the 4th column is related to "after the join phase" (added). During the joining the CPU

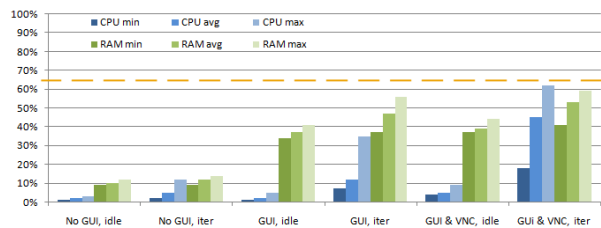


Figure 4. OS and applications resources usage

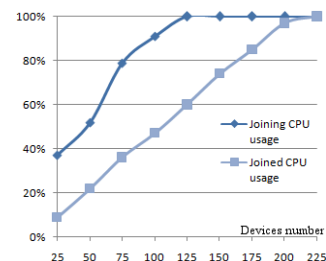


Figure 5. Application CPU usage

supports up to 100 DEVS before utilization reaches the 100% and up to 200 DEVS with a little time-wait. After the join phase the CPU can manage up to 200 DEVS.

4.2 Result Discussion

Starting from the expectations presented in Section 4.1, in the networks range test (Section 4.1.1) we see that all the objectives has been reached. The coverage of the ZigBee network is able to serve the house scenario, as well as the Wireless M-Bus network coverage is able to serve a building area scenario. In this test we try a one-hop ZigBee network, while is also possible to set up a multi-hop one.

About the energy consumption test presented in Section 4.1.2, the result proves that GWMS has lower energy consumption. This feature assures the autonomy of 10 hours in case of an electrical system failure. This low power consumption is also appreciated from a cost-of-energy point of view.

The results about test in Section 4.1.3, confirm that the GWMS has a real-time interactivity with USRS, is remotely administrable, and supports multiple different resources monitoring. In addition the results show that the GWMS is also able to support a multi-user access.

In the last test (Section 4.1.4) we show that the supported network can be very large. In details, we find out that GWMS is able to support 200 DEVS which send data every 30 seconds, instead of the expected 100 DEVS (Thepphaeng and Pirak, 2011). With these results we can assure that the developed architecture can be employed in extended scenario as public or apartment buildings.

5. RELATED WORK

Automated resource monitoring is a critical research topic, as testified by the amount of research carried out both by the academia and by private companies. In particular, the research focuses on two main topics. First, the integration of solutions at the level of wireless sensor network to collect data related to the utilization of resources, second the development of complete solutions for resource monitoring.

With respect to the literature concerning wireless sensor networks for resource monitoring several proposals are available (McLauchlan & Bessis, 2011). ZigBee is the most popular protocol for wireless sensor networks (Xu, et al., 2008; Thepphaeng & Pirak, 2011; Zhu, et al., 2006; Yanfei, et al., 2009; Shan, et al., 2008). The ZigBee topology can range to flat wireless mesh (Zhu, et al., 2006) to centralized systems (Xu, et al., 2008). However, in these studies metering is limited to a single resource because only one type of meter is considered and a single protocol for interaction with sensors is taken in account. Furthermore, these studies are focused on wireless protocol communication detail and do not address the issues of supporting high-level analysis and aggregation of these data.

Another area of research is that of meter reading techniques. While the main goal of Jiang (2010) and Lam (2008) and the most part of the industry is to find the best solutions to transmit the meters data to the companies, the aim of Froehlich (2011) is to shown this data in a useful way to the single users. Other studies taking into account different resources are HydroSense (Froehlich, et al., 2009), to monitor water consumption and detect leaks, and GasSense (Cohn, et al., 2010) as well as Kempton and Layne (1994) focusing on gas consumption. Other analyses related to the issue of metering techniques are found in the Italian Telegestore project (Rogai, 2007) and in the list of vendors that provide a Smart Metering solution (Engelen & Collins, 2010; *ZigBee Alliance*, 2002).

All these efforts aim to monitor a single resource, electricity being the most common example. However, monitoring a single resource inherently limits the ability to support advanced analyses that can provide a significant reduction in resource utilization and consequent carbon footprint. We consider that providing a metering solution that can correlate multiple data sources can lead to a better understanding of user behavior and can improve the effectiveness of the proposed solution to optimize resource utilization.

6. CONCLUSION AND FUTURE WORK

The currently available solutions for automated metering of resources cannot integrate multiple

heterogeneous sensors. However, such features could reduce the cost for data collection and could support advanced analysis aiming to reduce carbon footprint and user expenses.

We propose a novel architecture for automated metering which collects data from multiple sensors and resources, and regulates the utility for the maximum benefit of the consumer, for the minimum toxic emissions and for maximizing the profits of the utility provider. Our design explicitly aims to provide the following characteristics: first, the ability to support several communication protocols for both interaction with sensors and data delivery to remote centers where advanced analyses and value-added services can be provided. Second, availability of the data collection service even in the case of network failure and power outage. Third, scalability up to hundreds of sensors and meters to cover large scale deployment scenarios.

We present a prototype implementing the architectural design and we evaluate its ability to satisfy the design criteria. Our preliminary experiments demonstrate the ability of the prototype system to interact with up to 200 sensors scattered over a large area (up to 480m) and we demonstrate that the monitoring process can be carried out even in the case of power outages lasting up to 10 hours.

Future improvements of the prototype system include the development of applications (deployed locally or remotely) that can support in an intelligent system for disaggregate monitoring, including the ability to predict future resource utilization. This can support what-if analyses for devising utilization patterns, cost plans and hardware upgrades. An additional step is to allow some devices, such as water heating, central heating, air-conditioning, etc., to be automatically managed by GWMS. This last step enables the creation of fully automated smart houses that can provide high comfort at minimum cost.

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MEDICAL DEVICE MANAGEMENT SYSTEM USING AN RF-ID ACTIVE TAG WITH A UNIQUE SENSOR

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ABSTRACT

A management system was developed for detecting both the location of an active tag and the operating condition of a medical electronic device with a tag attached. The RF-ID active tag has a unique built-in sensor that detects the AC (alternative current) power supply to the medical device by measuring electromagnetic fields radiated from the AC power cable and/or the power supply unit of a medical device when the power supply source is connected. When the electromagnetic field changes by connecting or disconnecting an AC plug to an AC power source, the active tag transmits a status report of the operation of the medical device at the same time. This allows the administrator responsible for medical devices to continuously monitor both the location and operating status of a medical device whenever a status change occurs. The administrator can obtain the total working time of each device, which is helpful for planning a maintenance schedule. We did a test of the effectiveness of this system in Shimane University Hospital. The test results showed that RF-ID active tags with electromagnetic field sensors are effective in detecting the operating status of medical devices.

KEYWORDS

RF-ID Active tag, Medical electronic device, Location, Operating status recognition

1. INTRODUCTION

Medical devices are expensive and need to be carefully monitored, but management systems for such devices in Japanese hospitals are presently not well developed. Many medical devices have been installed in large Japanese hospitals such as those found at Japanese universities. Several decades ago, each clinical division purchased and managed its own medical devices. However, this was inefficient and created problems with duplication and excessive maintenance expenses. Thus, many large hospitals founded "medical engineering centers" (hereafter, ME center) which purchase and manage all medical devices. Clinical engineers belonging to these centers are actively involved in their management. The main functions of ME centers are safety control, maintenance control, and a location management. In university hospitals, the number of medical devices necessary can be in the hundreds of models and thousands of individual devices.

Medical devices that are managed by the ME center are allocated to any department that requires their use. The device must be returned to the center after use. However, in practice medical devices often move with a patient to another department or they may be diverted to another patient.

Medical device managers desire to automatically know the employment status of each device. To date, managerial systems with location detection using RF-ID tags have been put in place in some hospitals. However, it is also important that the manager be able to judge whether or not the device can be returned, because the condition of use is unknown in systems where only the location is determined. In addition, no function for measuring the amount of time a device has been in operation has been developed. For these reasons, the existing systems are not nearly as useful as they might be.

To remedy the problems, we developed an active tag that has an electromagnetic field sensor and a built a system for determining if a medical device is in operation, in addition to giving information on the location of a medical device. Herein, we show how the system is constructed and the results of an evaluation of the functions of this system.

An RFID system can be used for various purposes in various clinical settings [Spekman, 2006, Anonymous, 2005, Mehrjerdi, 2011]. However, such systems are mainly used for inventory control or searching for the location of a person or material to which an RFID tag is attached [Kannry, 2007, Macario, 2006, Reicher, 2007]. Because a passive RFID tag itself can send only its ID, systems using active tags have been promoted [Meyer, 2006, Ohashi, 2008]. Some systems in which RFID tags are attached to medical devices have been proposed for hospitals [Kannry, 2007, Macario, 2006, Reicher, 2007]. However, we were unable to find reports of systems for operational management.

2. SYSTEM CONSTRUCTION AND FUNCTIONS

Our system consists of RF-ID active tags (hereafter, tags), repeaters, and a management station (See Fig. 1). Each tag has a sensor assembly and a signal repeater. A repeater has a function that receives the signal from a tag to determine the intensity of the received electromagnetic wave and to transmit information to a management server through a wireless LAN access point with additional information.

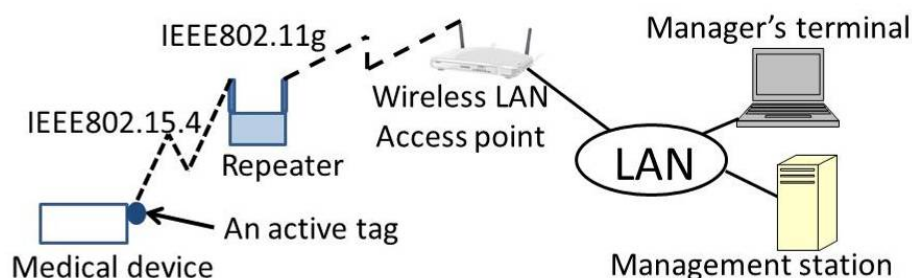


Figure 1. System configuration

2.1 RF-ID Tag

The tag emits electromagnetic signals with information including the tag ID and the status of the medical device. The tag is driven with a single button cell battery and can work without cell exchange for more than one year. The size of the tag made for this trial is 50 mm in width and in depth, and 14 mm in height.

The tag was attached to the casing of a medical device, near the power supply unit. The sensor assembly has a plain antenna that catches the electromagnetic field. Almost all medical devices in Japanese hospitals are driven by AC (alternative current) power, even if the device has a battery. When the electromagnetic field changes by connecting or disconnecting an AC plug to an AC power source, the active tag detects the operational status of the medical device as ON / OFF. To eliminate error detection, we determined the electromagnetic field intensity before the trial and determined the threshold of the electromagnetic field.

The tag periodically transmits the ON / OFF status of the device. The interval of transmission was set for every 10 seconds for this trial. Also, when the status of the device changes, the tag sends the new status instantly. The tag emissions are based on IEEE802.15.4. These transmissions are not for fixed repeaters.

The frequency of the electromagnetic wave the tag emits is in the 2.4GHz band: The output was 1 mW in our trial. Because we used this weak output and because of the positioning of the tag, there is no influence on the medical device [Hanada, 2009]. However, when the appropriate electromagnetic shielding of the medical device is not done according to the international specifications, the condition recognition function may be affected by influence from the electromagnetic waves emitted from the medical device.

2.2 Repeater

A repeater consists of a receiving antenna, an information processor, and an emitting antenna. A photo of a repeater is shown in Fig. 2. After receiving the signals from a tag, the repeater ID and the intensity of the received electromagnetic wave are recorded in the information processor, after which the information is transmitted to the management station through the wireless LAN.



Figure 2. A repeater (The white pole is an antenna for IEEE802.15.4. The black pole is for IEEE802.11g)

A repeater communicates between tags using IEEE802.15.4 specifications (2.4GHz band) and performs TCP/IP communication using IEEE802.11g specifications (2.4GHz band) between the wireless LAN access points. The output of the repeater in IEEE802.15.4 specifications is as weak as 1 mW. In addition, the location of a repeater is usually at a high position on a ceiling or wall. For this reason, we would not expect any influence on medical devices by the use of these repeaters. Communications that follow the specifications and domestic regulations in addition to those of the IEEE802.11g specifications will not have an adverse influence on medical devices [Hanada, 2011].

2.3 Management Station

A management station displays the tag information in tabular form. An example is shown in Fig. 3. The information, labeling statement to display, and the order of display can be changed by the program setup.

| 状態 | UID | 電池電圧(V) | 温度(℃) | 機器名 | 第一候補 | 電池電圧(V) | 第二候補 | 電池電圧(V) | 第三候補 | 電池電圧(V) | 累計稼働時間(h) | 累計停止時間(h) | 稼働率 | 受信時刻 | ボタン |
|------|--------|---------|-------|--------|-------|---------|-------|---------|------|---------|-----------|-----------|-------|---------------------|------|
| 停止 | 0200E3 | 3.11 | 27.0 | | ICU西 | -73.5 | ICU東 | -77.0 | | | 0.41 | 1.41 | 22.4% | 2011/06/15 10:10:51 | リセット |
| 正常稼働 | 020592 | 3.19 | 26.7 | | ICU西 | -77.0 | ICU東 | -85.5 | | | 0.25 | 1.06 | 19.3% | 2011/06/15 10:10:46 | リセット |
| 正常稼働 | 020596 | 3.05 | 27.6 | MEセンター | -61.0 | ICU東 | -89.0 | | | | 0.79 | 1.14 | 40.8% | 2011/06/15 10:10:54 | リセット |

Figure 3. An example of the display of tag information

In this example, the information of each tag is displayed on one line. In Figure 3, the tag shown on the top line, ID:0200E3, indicates that the device is off, and following 2 tags, IDs: 020592 and 020586, are in use. The data in Fig. 3 includes the power status of the attached device (ON or OFF), tag ID, tag battery voltage, temperature of the tag, the nearest repeater ID and the received power, second nearest repeater ID and the received power, third nearest repeater ID and the received power, the total time active and the total time inactive of the device, active period calculated from the time activated and the inactive time, time the signal was received, and the reset button. For each repeater ID in this example, the positional information (repeater's name) is displayed instead of the ID itself. The strongest repeater indicates the nearest repeater to this tag. It is also possible to include a notification about each instrument sent out that includes the amount of time the tag has been active beyond the time set for return.

By naming the repeater ID as the floor or area name where it is in use, the administrator can easily recognize the location of a tag, and thus the location of the medical device. In the management station, the individual number of the device and the tag ID can be identified.

A function that shows tag locations using a floor map can be built into this system, but we did not use it because we felt that the table type display can better show of the information from a higher number of tags.

3. SYSTEM EVALUATION

The examination was done using the new building housing the wards of Shimane University Hospital. The examination was done just before the opening, with beds and fixtures installed but with no patients or staff present. Before the examination, we confirmed that almost no wireless LAN signals were invading from outside and that no other wireless LAN access points than those we used were installed in this building.

First, the position recognition function was examined. Four repeaters were installed to cover one whole floor. The plan and location of the repeaters and access points of the experiment floor are shown in the left of Fig. 4. The floor used for the experiment holds the ICU (Intensive Care Unit), HCU (High Care Unit), and ME center. Most of the walls between rooms are made of concrete. In the examination, one person walked around the floor holding a tag, stopping at each point of a 5 m grid. The electric field intensity received by each repeater was recorded at each point.

Second, in order to investigate the influence of building design etc., a signal detection check was done. A single repeater was placed in the center of the sixth floor, different from the previous test (Fig. 4 Right). There is a staff station in the center of each ward and a small court surrounding the staff station, as seen in Fig. 4. In this experiment, a person with a tag moved around the sixth floor and around the floors immediately above and below the floor where the repeater was placed. The electromagnetic signal intensity received was recorded at corresponding points on each floor.



Figure 4. Left: Floor plan and location of the repeater and access points
Right: Floor plan of the ward floors

A power status recognition test was done after the above experiments. A tag was attached to a syringe pump (as seen in Fig. 5) and the pump was moved around the floor with the power of the pump switched ON and OFF. When the power supply status changed, the display of the station was checked. The syringe pump was set on a stand to eliminate the absorbing effects of the human body. This test was done on the floor shown in the left of Fig. 4.



Figure 5. A tag (arrow) attached to a syringe pump

In the building housing this ward, both wireless LAN of IEEE802.11a and IEEE802.11g specifications were installed on almost all floors, and it had previously been confirmed that the electromagnetic wave reached almost all areas of the floors on which they were installed [Hanada, 2011]. This wireless LAN was working at the time of this examination.

The person who moved the test devices was equipped with a cellular phone at the time of each examination. Because the frequency of the electromagnetic waves that a cellular phone uses differs from what is used by our system, the use of the cellular phone did not influence the test results.

The chief clinical engineer in charge of medical device management in the ME center observed the experiments, and he gave helpful comments and made requests that will be helpful in improving our system.

4. RESULTS

The positional information acquired was sufficiently precise for successful management of the system, as seen in Figure 6. However, almost no signals were detected in storage spaces.

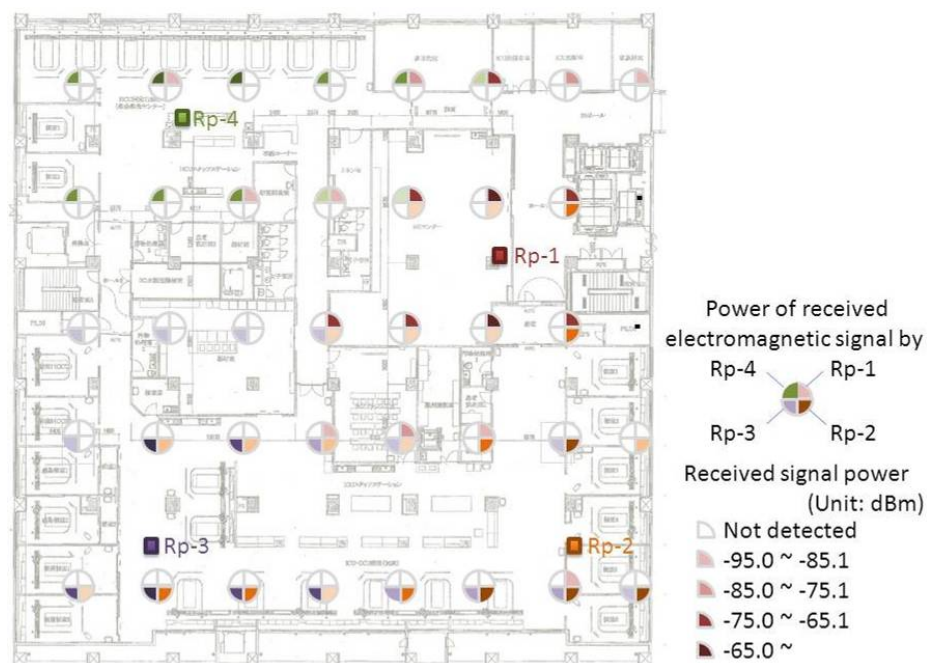


Figure 6. Received signal power by each repeater at each point

At some points, the tag received the electromagnetic wave of the repeater of the next floor, as seen in Figure 7. However, because the electromagnetic wave received from the next floor was weak, we were able to judge the correct position using the electromagnetic wave power information from the order on the display. The power supply status of the syringe pump was easily recognized.

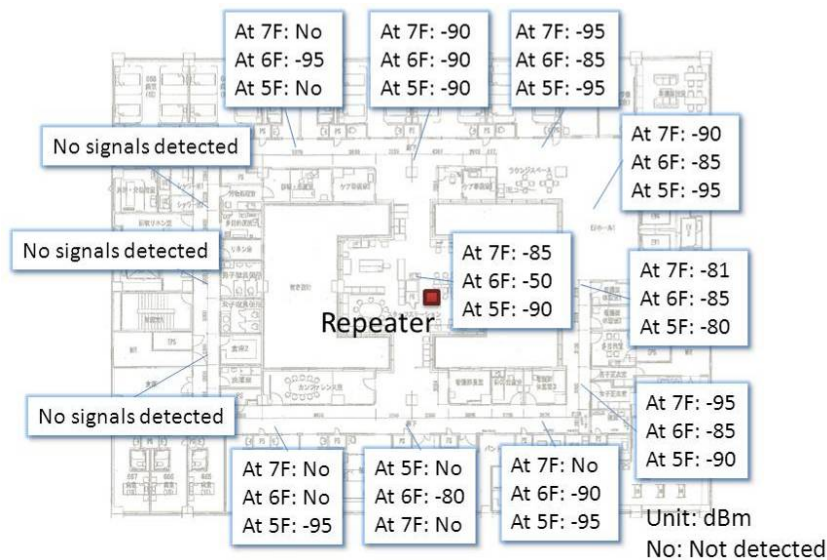


Figure 7. Signal power received at each point. (Only one repeater placed in the center of 6F)

The clinical engineer made the following comments. Because the precise location of medical devices, on the order of 10 cm, is unnecessary, the location as obtained by this system is satisfactory. Knowing the power supply status and the time active are useful for determining when the devices can be returned.

5. DISCUSSION

In some Japanese hospitals, systems for the management of medical devices are not well developed. Of major concern is the batteries used in medical devices. Because the nurses responsible worry that the batteries might run out, they tend to operate medical devices by AC, even though the device can be efficiently driven by battery. We hope the introduction of our system will promote the central control of medical devices. With this system, more efficient management of medical devices, including battery management, can be realized. When a medical device is driven by a battery, the electromagnetic field generated near the power supply unit is weaker than when the AC drive is used. We plan to develop another sensor to detect the operational status of devices that are driven only by batteries.

When medical devices can output their status as a signal, it is also possible to add a mechanism to judge the content of the status to a tag. We are planning to add a signal input mechanism to our tags. However, the output from medical devices is currently not standardized.

The inability to detect signals in storage spaces was not a serious problem. Placing a repeater in the space would be a simple solution to this problem.

The reasons for the detection of electromagnetic waves coming from the adjoining floors are as follows; the glass in the courts provided no shielding capacity, and an open duct was found in the center of the staff station that is part of the pneumatic tube communication system. It was simple to protect against errors in location detection: Notation of the repeaters was arranged so that repeater IDs on other floors could not become the first candidate.

The doors of the patient rooms in the test ward are made of a light metal material and the walls between patient rooms are made with metal frames and chalk board. Metal doors reflect electromagnetic waves and chalk boards are permeable to electromagnetic waves. For these reasons, when the door of the ward was shut,

communication between the repeater in the corridor and an indoor tag stopped in one case. Because wireless communication is affected by building components [Hanada, 2010], it is important to be cognizant of them when using wireless communication systems, including RF-ID tags.

If a manager needed to know the tag position more precisely, it would be necessary to increase the number of repeaters. Shimane University Hospital has installed wireless LAN access points in the corridors of the wards and in some patient rooms. Thus, we think that quite precise position detection can be realized by installing repeaters in almost the same number as access points and that the location of a repeater should be near an access point.

Making a tag to enable communication using IEEE802.11g was also considered. This would make our system simple, but it would mean the detecting precision would be fixed as the location of the access points. Another possibility would be to develop a survey system on the wireless network. Using a repeater would enable us to freely decide the precision of tag location detection.

The idea that displaying the data in tabular form is more effective than a plan view was given by the clinical engineer. Because the staff would be able to memorize the floor plan quickly, a plan view may be useful in the early stages. However, he also said that the station can display much more information using a tabular form than when displaying it in map style. It was also his position that the precision range of several meters order is acceptable. The system was effective in that the medical devices and their data were all correctly detected in this test.

In the future we hope to embed our tag in all of the medical devices used at Shimane University Hospital. Unfortunately, even in the case of the addition of something so minor as a communication apparatus to a medical device, government permission is required in Japan, and the time necessary for approval can be very long, usually several years. We think that our tag can easily improve the operational management of existing medical devices, so we hope the approval process is done quickly.

6. CONCLUSION

In contrast to existing systems, our system offers not only positional information but also information on the operational status and other useful information on medical devices. This system should be very helpful to persons responsible for the management of medical devices, such as the ME center, who would greatly benefit from the efficiency gained by use of this tag system.

We are now making the tags thinner and as small as possible to make it easier to attach them to the medical devices. We are also planning to add other recognition functions and additional information that might be useful to our system.

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PRIVACY IN NEW TOURISTIC LOCATION-BASED SERVICES[†]

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ABSTRACT

Location-Based Services (LBS) are services which offer users information about surroundings where they are located, such as where the nearby restaurants, cinemas, points of interest are. There are many mobile applications already deployed based on LBS services like e-commerce, advertising, etc. Another important field where LBS services can be applied is the tourism industry: tourists demand information related to their location when they are travelling because they are not often aware about the area. But the use of these services opens several privacy concerns because providers make use of user's location information, which is a private data. Moreover, often users do not know whether their location is used and how service providers use it. So, providers should inform their customers about this fact, but many times this information is not provided or is not clear. In this paper we compile the applicable legal framework for this kind of services about the use of private data and how the providers should inform their users. Furthermore, we show how three mobile applications manage their customers' location data and other private data settings, finding that some of them present security and privacy flaws managing private data.

KEYWORDS

Location-Based Services, Tourism, Privacy, Legislation, Security, Personal Data, Location Data

1. INTRODUCTION TO TOURISTIC LOCATION-BASED SERVICES

Smartphones, tablets, and similar new mobile devices are capable to access data networks and they are also able to execute complex applications. Furthermore, these devices implement location systems like GPS or others based on location techniques like GSM or Wi-Fi. The combination of both capabilities can be useful to build new ubiquitous applications based on user location. These applications provide to service customers valuable information related to their location.

Location-Based Services (LBS) are a kind of service offered to the users of mobile devices that provide added value information related to the context where the users are located. LBS include different kinds of e-commerce applications, advertising, general social networks like Twitter, mobile social networks like Foursquare or some Google applications. But the area that can be most benefited by the use of LBS is tourism due to its special features. Tourists usually demand services because they are not aware of the information related with their surroundings, so they are an important target for the LBS.

Touristic Location-Based Services provide travellers the access to touristic information during their trips. All the touristic services that can be improved by the use of the location of the user can be classified in four groups [2] depending on the kind of service:

- Location of people and places.
- Routing.
- Search for locations in the surroundings.
- Information about traveling conditions.

They can also be classified according to the phase of the travel where they are used:

- Planning/Booking.

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- Transport.
- Accommodation
- Information/support at the destination.

These applications gather private information of the user in order to offer him the service. This information could be used to generate a location profile of the user in order to know his usual movements. With the aim to use properly this sensible information, the applications must include configuration tools including the question to request the user whether he allows the use by the application of his location data. It is required to include in the LBS the mechanisms that will allow both the protection of the user privacy and the use of the applications.

These applications can use both the current location of the user and the trail or itinerary of all his locations. The applications that use the trail of the users have more privacy requirements.

This paper is organized as follows: in Section 2, LBS are analyzed depending of the user anonymity requirements and the personal data gathered by the service provider; Section 3 covers the specific legislation for location based services; in Section 4, some representative touristic LBS services are studied, with special attention to the use of personal and location data; Section 5 resumes the concerns related to privacy and security of the LBS taking into account the previously described legislation; finally, a set of conclusions are presented in Section 6.

2. PERSONAL DATA IN TOURISTIC LOCATION-BASED SERVICES

LBS can be personalized which means adding consideration of the user's personal interest in the available service types (e.g. information about tourist attractions, detailed information, maps, transportation information, directions and pictures). This geographical information is a crucial feature of every tourism application as every user will want his/her individualised information, with latest details on such topics as traffic, weather, sights, availability of services within the town, navigation aid and historical and economic background.

Also, some tourism applications can be seen as adaptive ubiquitous information systems that have access to public and personal information and can adapt these information and services to the user and his/her current context and location. In most cases the user model acquisition is driven by monitoring the activities of users in the information space (user evaluation) or by an analysis of their connection and device characteristics (usage evaluation). But, the collection of this information can attempt to the users' privacy.

The European project "CRUMPET" focuses research on the "CReation of User-friendly Mobile services PErsonalized for Tourism" [10]. This project uses new technologies like intelligent software agents and user modelling techniques to create a user's profile. So, there is a service and content adaption to the users' individual interests by the means of user modelling (using techniques for the dynamic profiling of personal interests). So, to protect the user' privacy it is essential to balance the design between what technology can offer and what users are willing to accept in order to prevent people from bad experiences of realizing how data that was preferred to be kept private, in fact are not so.

Obviously, for any location-based service to work, the service provider will need the location from the user. The accuracy will depend on the services being provided and the location method (i.e. GPS, cell towers, Wi-Fi access point, IP address). But users need guidance to determine if the service is acceptable or not. Only by providing adequate information to the user about what location data is measured, stored and used later the user can make an informed decision of how and when to use the service.

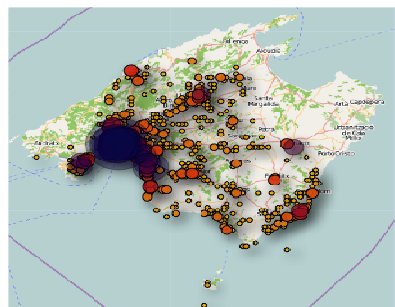


Figure 1. Map of the recording movements made by an iPhone. This is a screenshot of the iPhone Tracker application.

For instance, Google and Apple devices have different ways to communicate the location to the user. In the case of Google, the device asks for the user explicit permission when he/she chooses the option to use Wi-Fi as location method. The Google device also stores the user's location data for a limited period and this data is encrypted. However an Apple device did not explicitly ask for the permission to save this data. The device also stores the data unencrypted and for a longer period. The most immediate problem is that this data is stored in an easily-readable form on the user's machine (i.e. the location data is stored in the user's computer when the device is synchronized). For example, iPhone users can employ iPhone-Tracker [7] that is an open-source application that maps the information that the iPhone is recording about the user's movements (Figure 1). However, in this moment, we have no evidence that the location data is being transmitted beyond the user's device and any machines the user sync it with.

Another example of a different way of interacting with the user between the Google and Apple devices occurs when you download any app from the app store/marketplace. While on Android as long as the application provider asks for permission and the end users agree, the application has the authority to do anything with that data. On Apple devices the application provider has to explicitly state why location is needed by the application and has stated clearly that applications cannot use location for the sole purpose of advertising. Furthermore the user can go into the settings window and looks at applications that currently have permission to read location data and which apps are utilizing it. The Android approach has lead to some inappropriate experiences. That is the case of the Indian marketplace on Android, where applications explicitly use the location data for the sole purpose of advertising and get away with it.

Another case of dispute comes from the Europe's largest satnav manufacturer, the TomTom Company. The Dutch drivers who owned a TomTom device, their in-car satnav was spying on them and the aggregated data about cars' speed was being sold via the government to the police. Next, the police used this information to set the speed traps. The company was forced to apology (there is a video on YouTube of the public apology).

Data privacy is the adaptation to the Information Society of the fundamental right to privacy and private life. According to a recent survey conducted by Harris Interactive on behalf of TRUSTe [4] the primary concern for the 38% of the smartphones' users is privacy. This concern is larger among older users compared to younger ones. The survey also shows that only 25% of users believe that their mobile application store only offers apps that safeguard their privacy and 38% of the users are confident that the apps themselves do protect their privacy. A majority of consumers do not want to share their location with app owners/developers (77% users said they would rather not share their location with anybody, and a minor 2% agreed to share their location data with first parties and third parties).

In this survey we have a confirmation that security is a major concern (e.g. only about one third users feel that they are in control of their devices and a 74% feel that uncomfortable with the idea of data tracking for targeted advertising). Only a minority of consumers feel they have a choice about the collection and use of their location information by an application. So, consumers who get alerts when location sharing is turned on are more likely to allow location sharing, in other words when an application requires to access to location-based data, a simple pop-up confirming this will generate some sort of confidence in the user to allow sharing of location data. This confidence will help to spread the use of such applications, however the confidence by itself is not a guarantee of privacy.

3. LEGISLATION ON PRIVACY AND LOCATION-BASED SERVICES

Privacy is a special issue in the field of Location-Based Services. Smartphone owner' should know that he is transmitting his location. Besides several questions arise: Who know his location? Are he informed in a clear and comprehensible way about the use of their location data?

Location data are considered personal data. So, the legal framework applied to Location-Based Services is the Data Protection Directive (95/46/EC), applied in all cases that personal data are being processed as a result of the processing of location data. Moreover, it is applied the Electronic Privacy Directive 2002/58/EC (as revised by 2009/136/EC) that is applied in case of the processing of base station data by public electronic communication services and networks (telecom operators) [8].

Location data are defined in E-Privacy Directive as *"any data processed in an electronic communications network or by an electronic communication service, indicating the geographic position of the terminal equipment of a user of a publicly available electronic communications service"* and they are regulated in the article 9 of the Directive 2002/58/EC of the European Parliament and of the Council of 12 July 2002 concerning the processing of personal data and the protection of privacy in the electronic communications sector (Directive

on privacy and electronic communications). The Whereas 35 of this Directive establishes about this question that: “...in addition, digital mobile networks may have the capacity to process location data which are more precise than is necessary for the transmission of communications and which are used for the provision of value added services such as services providing individualized traffic information and guidance to drivers. The processing of such data for value added services should only be allowed where subscribers have given their consent. Even in cases where subscribers have given their consent, they should have a simple means to temporarily deny the processing of location data, free of charge”.

So the requirements to use the location data by the service provider are¹:

- Location data relating to users or subscribers of public communications networks or publicly available electronic communications services can be processed when they are *anonymous* or with the *consent* of the users or subscribers.
- This data can only be processed to the extent and for the duration necessary for the provision of a value added service.
- Service providers must inform the users or subscribers, prior to obtaining their consent, of the type of location data other than traffic data which will be processed, the identity of the controller, of the *purposes* and *duration* of processing and whether the data will be *transmitted to a third party* for the purpose of providing the value added service. It is necessary to provide all the information in a clear, complete and comprehensive way.
- The features of the service proposed.
- Users or subscribers shall be given the possibility to *withdraw their consent* for the processing of location data other than traffic data at any time.
- The user or subscriber must continue to have the possibility, using simple means and free of charge, of temporarily refusing the processing of such data for each connection to the network or for each transmission of a communication.

The Article 29 Working Party considers that this information should be provided by the party collecting the location data for processing, i.e. by the provider of the value-added service or, where the provider is not in direct contact with the data subject, by the electronic communications operator [13].

In the same way, the Spanish Telecommunications Act (Act 32/2003, November 3rd) in the article 38.3 establishes: location data can only be processed when it is anonymous or if the provider has the consent of the user or subscriber. Location data can only be processed to the extent and for the duration necessary for the provision of a value added service and with prior information about the purposes and duration of processing and for the added value service that will be provided Spanish Agency of Protection Data Act 160/2004 about safety measures of data location files).

In application of Data Protection Directive, the provider must fulfil all requirements to process personal data: information prior consent, purposes of the data processing, etc.

In the guide of “Best Practices and Guidelines for Location-Based Services” of the wireless association we can find some guidelines in the same way as the European or Spanish regulation [3]:

- LBS providers must inform users about how their location data will be used, disclosed and protected so that a user can make an informed decision whether or not to use the LBS or authorize disclosure.
- Once a user has chosen to use a LBS, or authorized the disclosure of location information, he should be able to choose when or whether location information can be disclosed to third parties and should have the ability to revoke such authorization.
- LBS providers must inform users about how their location data will be used, disclosed and protected.
- LBS providers may use written, electronic or oral notice so long as LBS users have an opportunity to be fully informed of the LBS provider’s information practices. Any notice must be provided in plain language and must be understandable. It must not be misleading, and if it is combined with other terms or conditions, the LBS portion must be conspicuous.

¹ Raento, M. affirms that German Data Protection Act actually states that services that act on personal data should be implemented anonymously or pseudonymously, as far as feasible. Many of the proposed location based services, e.g. location-based proactive information provision, such as special offers to nearby shops, are eminently suitable to anonymization. We could even go as far as making the whole mobile subscription anonymous as much as possible (it is already possible with pre-paid subscriptions). [11].

4. ANALYSIS OF THREE LBS MOBILE APPLICATIONS

We have installed a list of applications and we have investigated about their functions and data management that could be affect users' privacy. In order to know the list of permissions required by each selected application in an Android smartphone, we have been installed an application to do it, called PermissionDog [9], which is available to install through Android Market.

4.1 CheckMyTrip

CheckMyTrip is a service available through web access or by installing an application in an Android, iPhone or Blackberry devices. This service is owned and operated by Amadeus IP Group S.A. who is the world leading Global Distribution System (GDS) and the biggest processor of travel bookings to the travel industry, providing marketing, distribution and IT services worldwide.

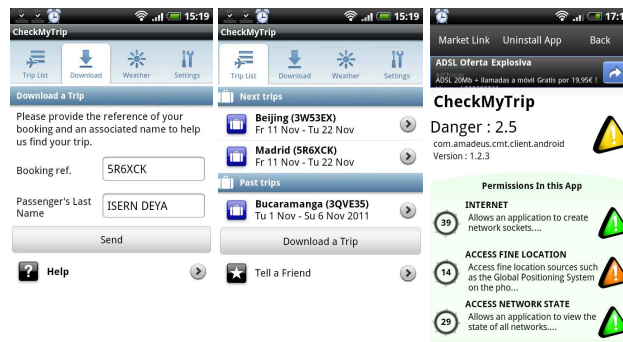


Figure 2. CheckMyTrip application screens and a list of permissions required by the Android application.

When you buy, for example, an airline ticket through a web site or agency associated with Amadeus, your reservation will be stored also in the centralized Amadeus systems and you can access to the entire itinerary through Checkmytrip. The Android application, as the other applications and also the website, requires the user just to enter the Amadeus Reservation Number (PNR) and the customer last name to download a trip. The PNR code is often sent to the customer's e-mail account that was supplied by him when he bought the ticket. When customer introduces these two data fields, the trip data is downloaded from Amadeus systems and stored in the device storage for offline access. All the available data about the trip is downloaded and stored in the phone storage: complete names of travellers, agency or website who sells the tickets, dates, times and code for each flight and destinations, seat allocations of each traveller, flight duration, etc.

The application requires few permissions and the only dangerous permission required by this application is the access to fine location (provided by the embedded GPS device), used to locate users in order to provide them information about their position inside an airport. So, according to PermissionDog, CheckMyTrip Android application presents low risk due to the access to fine location with 2.5 points over 5.

4.2 Yelp

Yelp.com is a startup dedicated to local business mainly for USA market. When the user visits Yelp.com, he can search for restaurants, cinemas and so on, where he can eat, drink, buy and fun. Also, he can read comments made by other customers and he can compare different sites. Yelp provides applications for Android, iPhone and Blackberry devices, as mobile web access to the site. When the user are connected to Yelp.com through the mobile application, he can share his current location, and Yelp responses him with a list of near points of interest with comments and valuations of each local business registered on Yelp.com. Yelp.com Android application is capable to provide augmented reality capabilities using phone's camera, fine location and phone's orientation sensors.

The Android application does not present any option in settings about privacy (like password change, settings to control the preferred location accuracy or an option to unlink the Facebook profile).

On one hand, when the user links his Yelp account with his Facebook profile or he signs up through his Facebook profile, the application redirects to Facebook site and it ask him for requested permissions by Yelp. Then, the user must accept all of them in order to link both profiles. Yelp requires to access the Facebook profile basic information (complete name, photo, sex, networks, user identification, friends list and other information made public by the user), send user an e-mail, publish on behalf the user (post state messages, notes, photos and videos), access to user data any time (even if the user do not use Yelp) and access user places (where the user and their friends have been located and Yelp can publish where the user is on behalf him).

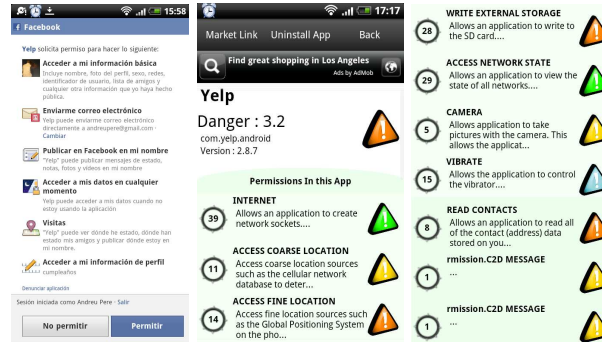


Figure 3. Yelp asking for permissions on Facebook user's account and list of permissions required by the application.

On the other hand, Yelp Android application requires ten permissions over the system and user data. For example, Yelp requires to access both coarse (based on cellular network database) and fine location (using GPS), write to external storage, requires access to the camera and the application also can read all the contacts data stored on the smartphone. So Yelp Android application has a medium danger level of 3.2/5 according to PermissionDog application.

Outside of the Android application, Yelp allows users to find friends already signed up in Yelp providing Yelp the user's email address and his email password in order to download the user's contact list. So, Yelp is asking user a private data to access his email account with the promise that the service does not store the user's email password. From a legal point of view, in this case the user is providing personal data of third parties.

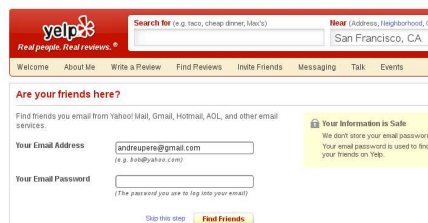


Figure 4. Yelp website asking for user's password to access his email contacts.

4.3 TripIt

TripIt is a service that automatically takes all user trip details and creates one itinerary about when and where the user will be. When the user receives a confirmation email from anywhere he books (hotels or flights companies), he forwards it to the email address plans@tripit.com and it is processed and added to his profile.

One of the services offered by TripIt is to import automatically new and past travel plans checking the user's inbox email account (for example, Gmail service). Moreover, TripIt lets users to share this information among his user's contacts list. In order to do this, TripIt asks customers to access their inbox email to check and import travel plans to their account, and access to the contact list stored on Google Contacts (Figure 5). So, it is clear that importing travel plans from his email account, TripIt.com reads all the user inbox mail whether they are personal emails or travel plans. Furthermore, all contacts from his account are read and recorded.

TripIt account can be linked to a Facebook profile. TripIt cannot access to the Facebook account's password because Facebook has an interface to authenticate users through his accounts and then, once the user is authenticated, service ask users to accept the permissions required by TripIt. The user can accept it or not, but if

he does not accept all permissions, he is not allowed to link any account to TripIt. Then, TripIt can start to request data to Facebook or read contacts and send them travel plans until the user revokes these permissions.

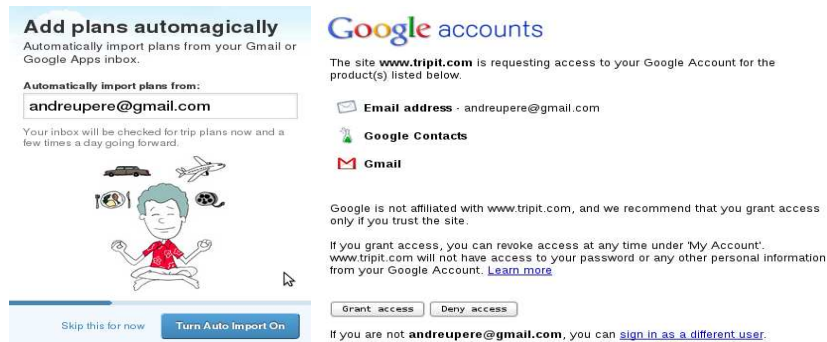


Figure 5. TripIt asking for access both the inbox and the list of contacts from a Gmail account.

In relation to the linking process, when the user signups on TripIt through Facebook account, only basic access to user data is required (first screen from Figure 6). But then, when the user links his Facebook account, another window with more permissions is presented (second screen from Figure 6): send email directly to his email; post status messages, notes, photos and videos to Facebook as himself; access his data any time even he is not using the application; and access his profile information as events, hometown and current city.

Moreover, TripIt.com also says that data collected through travel plans could be used for commercial purposes, like target recommendations and ads related to the received trip. So, it means that TripIt.com could send some data to third party publishers and they can obtain some revenue in exchange of that data.

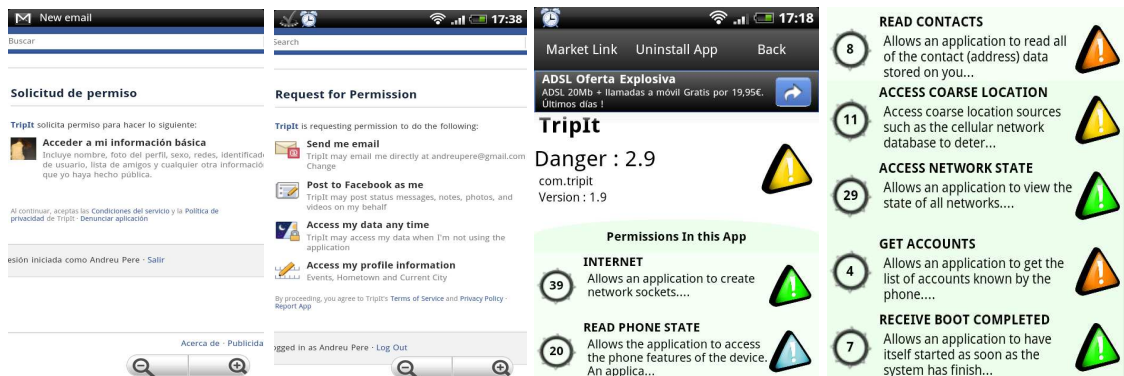


Figure 5. TripIt asking for permissions on Facebook user's account and list of permissions required by the application.

All of these items present important questions from a legal point of view. The use of personal data as location data or e-mail address requires accomplish all the requirement of the Data Protection Act: consent of the user, prior information, etc. Besides in this case the service provider can access the contents of e-mail user and his contact list, which can seriously affect user privacy. In the case that TripIt sends data of the user to third parties must be for purposes directly related with the consent of the user. Otherwise, it is not possible to obtain the consent of the user only accepting the general terms and conditions for the electronic communications service offered.

5. CONCERNS RELATED TO PRIVACY AND SECURITY

Summarizing, service providers should fulfil several requirements when they manages location data of their users in order to inform them and obtain their consent:

- It is necessary to obtain the consent of the user to process location data.

- Providers of value-added services must take appropriate measures when obtaining consent to ensure that the person to whom the location data relate is the same as the person who has given consent. It is important to avoid fraudulent uses of the data location.
- Consent must be prior informed, and specific for the different purposes that data are being processed.
- Consent cannot be obtained through general terms and conditions. A possible opt-out system does not constitute an adequate mechanism to obtain informed user consent (article 29 Working Party). Really the rules establish an opt-in system to use data location: only can use data location of users in the case where this data are used in anonymous way or with the consent of the user. Without this consent is not possible to use the data location in a legal form (article 9 Directive on privacy and electronic communications and in Spain, article 38 General Telecommunications Act). In USA, Telecommunications Act of 1996 includes protections for “Customer Proprietary Network Information,” (CPNI) a complex term used to encompass calling records, including the numbers called, numbers received, and new types of information collection, such as location of the user. The Federal Communications Commission recently restricted disclosure of CPNI; carriers must now obtain opt-in consent from customers [5].
- Working Party establishes that the service provider should regularly remind the individual about that his terminal equipment has been, will be or can be located.

6. CONCLUSION

Certainly, touristic Location-Based Services will be crucial to the development of tourist applications. This technology is able to add valuable information related to the context where the users are located. However, the service can attack the user's privacy. So, new applications must take into consideration the legal framework applied to Location-Based Services that we have examined in this paper. We have also studied how some mobile applications manage the private location data. We can conclude that it is necessary for the development of secure applications to provide satisfactory information to the user about what location data is measured, stored and used. Otherwise tourist Location-Based Services could be out of the scope of the legal framework.

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NEW APPROACH IN QUESTION ANSWERING SYSTEMS, USING THE GRAMMATICAL STRUCTURE

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ABSTRACT

An Open Domain Question Answering system is going to be introduced in this paper. This system is designed to answer the *wh-questions* that posed in English, based on the *answer patterns* technique. Answering the given questions is based on some features. Some of these features are based on *advanced IR* methods and some others use the new methods. When a question is given to the system, at first, the system builds its grammatical structure tree using a *POS-Tagger* system. After that the system uses the proposed *reduced tags* set and *answer table* to associate suitable answers to the given question. This association based on the grammatical structures of the questions and appropriate answers. Then the results would be given to the special *search engine* based on new *indexing system* to extracts the candidate answers. Each candidate answer has an importance value associated. These candidate answers and the associated values are given to the *ranking system*. The proposed ranking system uses a *special formula* based on advanced IR techniques and grammatical analyses. The ranking module sorts the candidate answers based on the resulted value of the formula in decreasing order. The answers list for the given question consists of the special range of the produced ordered list. In this step, defined threshold of the most scored sentences would be selected as the answering list. The system would be evaluated considering the mentioned answering list and the results shows good outcome of the system.

KEYWORDS

Question Answering System, Answer Extraction, Answer Patterns, Natural Language Processing, Information Retrieval

1. INTRODUCTION

Question answering system identifies and extracts answers from a large collection of text. Unlike information retrieval systems, which return whole documents or larger sections thereof, question answering systems are designed to deliver much more focused answers (Hermjakob, 2001). A question answering system is by definition a system which has this capability. One of the principal goals of Web intelligence is that of upgrading search engines to question-answering systems (A. Zadeh, 2005). The overall performance of these systems has five stages: question processing, document retrieval, extraction of useful parts of documents, extraction of useful phrases in each part as candidate answers, and ranking them. There are various techniques for implementing these operations in the QA systems that generally are classified in four categories (Carback, 2005). And one of the most important technique are classified as *question reformulation* or *answer patterns* question answering systems that belongs to NLP based techniques. This is a standard technique used in QA working on large document collections such as the Web. This technique is based on identifying various ways of expressing an answer context given a natural language question (Kosseim & Yousefi, 2008). (M. Soubbotin, 2001), (E. Brill, 2001), (M. Kaisser, 2004), (S. Cucerzan, 2005) and recently (R. Aceves-PTrez, 2005), (E. Agichtein L. G., 2000), (E. Agichtein S. L., 2001), (S. Lawrence, 1998), (D. Ravichandran, 2002) and (U. Hermjakob, 2002) were among the first to use reformulation patterns as the core of their QA system.

In this project we developed an *answer patterns* based question answering system for *wh- Questions*. This project is based on new structured *search engine* and a *POS-Tagger* system and ultimately proposed algorithm for grammatical answer extraction – based on searching among English grammatical structures - using *reduced tags* set. Regarding the structure of the proposed system, the new *ranking algorithm* has been developed. Our system is the upgraded version of our previous project that covers only three types of wh-

questions (Niknia & Sharif, 2009). To achieve new question types, some improvements on the ranking algorithms and result threshold have been done and results show the good outcome.

The rest of the paper is organized as follows: Section 2 shows an overview of the system. Section 3 presents structure of sentence processor. In section 4 retrieving component of the system will be presented. Section 5 discusses the special ranking techniques in the system. Evaluation results are presented in section 6 and section 7 concludes the paper.

2. OVERVIEW OF THE PROPOSED SYSTEM

An open domain question answering system have been designed and implemented. This system consists of three main modules, same as other QA-systems (Eshragh & Sarabi, 2006): sentence processor, the retrieving system (candidate extractor) and ranking algorithms. Implementation of the system has two steps: building the index system and answering the questions.

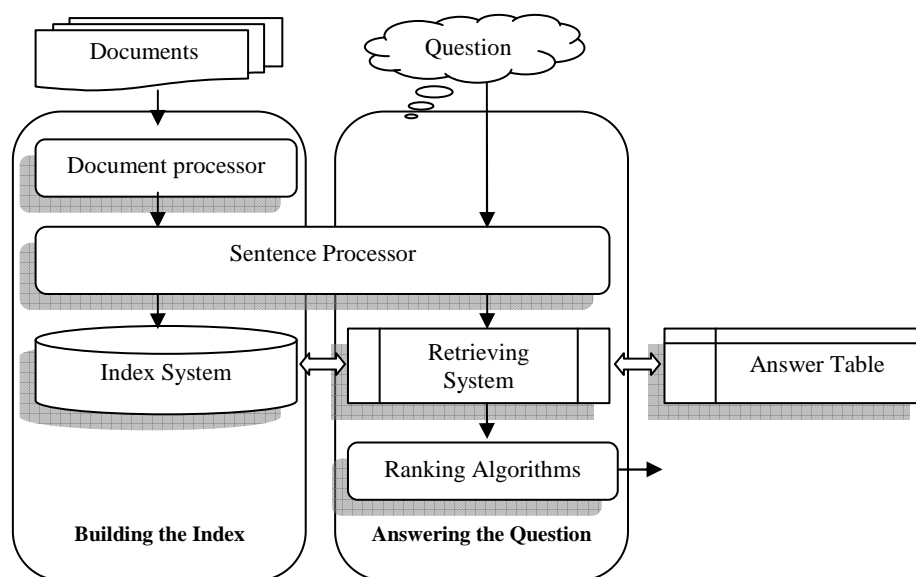


Figure 1. System architecture

To build the index system, in the first stage, structure of the input documents should be changed. The purpose of this stage is to change document sentences so that they can be easily addressed in indexing system and retrieved in answering step. After finishing this stage, we give the sentences of the modified documents to the sentence processor module. This module has responsibility for recognizing the grammar structure of the sentence and tagging on the separated words of the sentence. Then this processed sentence, which include the structure of the sentence and tags would be suitable as the input to the indexing system. The detail of the sentence processor and indexing system will be described in the following sections.

After initializing the system and completing the indexing system, system is ready to answer user questions and retrieve the best related answer. Figure 1 also shows the system architecture in the answering step. The system treats with a given question similar with an input document sentence in sentence processor, and then gives these produced results to the retrieving system. Retrieving system extracts candidate answers using the index table and the answer table. Then the ranking system calculates the scores for given candidate sentences and displays high ranked sentences in decreasing order.

The components of the system and the relationships between them are described in the next chapters.

3. THE SENTENCE PROCESSOR

Figure 2 shows components of sentence processor and relations between them. The sentence processor gets a sentence as an input - this sentence can be a document sentence in building the index step or a user question in the answering the question step - and then passes it through its components. First, sentence analyzer gives the input sentence to the POS tagger system to produce the sentence tags, and then pass the sentence and the corresponding tags to the tagged sentence processor.

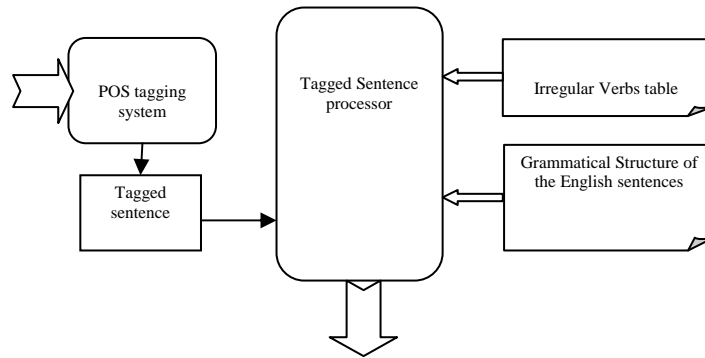


Figure 2. the Sentence Processor's Structure

Probabilistic context-free grammars (PCFGs) provide simple statistical models of natural languages. The relative frequency estimator provides a straightforward way of inducing these grammars from Treebank corpora (Penn NLP, 1999), and a broad-coverage parsing system can be obtained by using a parser to find a maximum-likelihood parse tree for the input string with respect to such a Treebank grammar. PCFG parsing systems often perform as well as other simple broad-coverage parsing system for predicting tree structure from part-of-speech (POS) tag sequences (Charniak E. , 1996). While PCFG models do not perform as well as models that are sensitive to a wider range of dependencies (Collins, 1996), their simplicity makes them straightforward to analyze both theoretically and empirically.

The first component that is used here is *POS-Tagging* system. A natural language parser is a program that works out the grammatical structure of sentences. Probabilistic parsers that based on PCFG theory use knowledge of language gained from hand-parsed sentences to produce the *most likely* analysis of new sentences. These statistical parsers still make some mistakes, but commonly work rather well. Their development was one of the biggest breakthroughs in natural language processing in the 1990s (The Stanford NLP Group, 2009). The system uses Stanford statistical parser and POS-tagger systems¹. This component parses sentences and produces their parse trees in tagged sentences. POS-tagger tags any sentence elements by their grammatical role.

3.1 Tagged Sentence Processor

After the sentences are tagged by the POS-tagger, they will pass to the next component that is called *Tagged-Sentence Processor* (TSP). This component plays an important role in this project. It performs several operations on the given tagged sentences that the most important of these operations are described below:

1. Extracting the important parts of grammatical structures such as: *names*, *verbs*, *adverbs*, *wh-words*, *modal* and *auxiliary verbs*.
2. Changing extracted elements to *simple* and *singular* form.
3. Assigning a *Grammatical Position code* (GP code) for each of the extracted elements. This is based on the grammatical role that elements play in the sentence. This code also cover tens information about verbs and complete information of nouns (before they have been changed in previous operation). answer patterns question answering system shows definition of GP code.
4. Coding sentences regarding the order of described grammatical components, *Grammatical Structure Code* (GSC). Table 2 Shows definition of GSC number.

¹ <http://nlp.stanford.edu>

Table 1. GP code definition

| <i>Element</i> | <i>Types</i> | <i>GP code</i> |
|----------------|---------------------------------------|------------------------|
| Nouns | Singular or Mass / Plural | 11 / 12 |
| Verbs | PP / Past / Present / Gerund / Simple | 22 / 24 / 26 / 21 / 20 |
| Adverb | All Types | 3 |

Table 2. GS code definition

| <i>Element</i> | <i>Types</i> | <i>GS code</i> |
|--------------------|-----------------------------|----------------|
| QW | Wh Questionnaires | 9 |
| Auxiliary verbs | Auxiliary verb / Modal Verb | 8 / 7 |
| Regular components | Noun / Verb / Adverb | 1 / 2 / 3 |

Reducing tag sets to a smaller and more important subset is one of the important operations in TSP. By investigating grammatical structures in English sentences, it seems that only some of the grammatical components play important role in sentence structures. So the tags set can be reduced to these important components and others tags can be ignored. This new subset named as *Reduced Tags Set* (RTS). This subset contains verb (VB), adverb (RB), noun (NN), wh-words (WH), modal verb (MD) and auxiliary verb (AUX). Actually by this action no information would be lost, as this action is only for recognizing the *Grammatical Structure Code*.

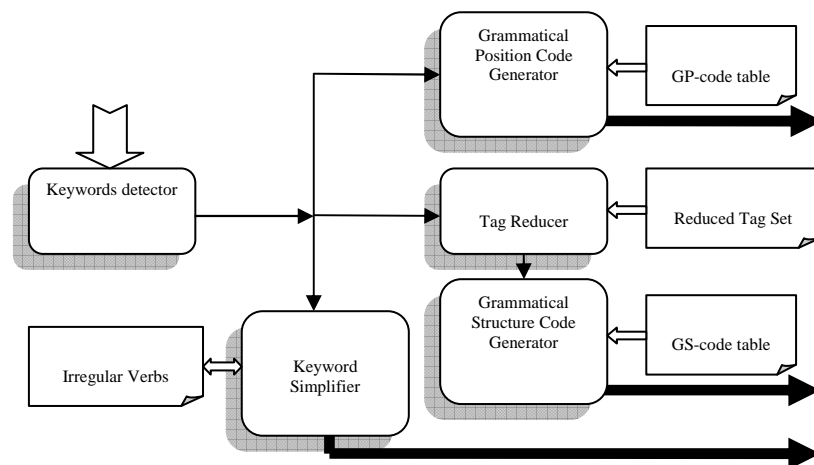


Figure 3. Tagged sentence processor

To clarify the mentioned operations, Figure 4 describes how TSP operates on a simple sentence example.

When TSP receives a sentence and its corresponding tags, then extracts important elements. These important elements defined in the system by the tags that associated to each word, these important elements known as the keywords in this system. Then system calculates GP code for them (a). Keywords and their tags go through the next step and then *simple* form of verb and *singular* form of noun can be produced (c). In the next step, tags can be reduced as mentioned before (b). TSP generates GS code for each sentence using its reduced tags set (d). After all of these steps, TSP passes the result to indexing system or retrieving system. This result consists of a set of simplified keywords and associated GP code and GS code of the entered sentence.

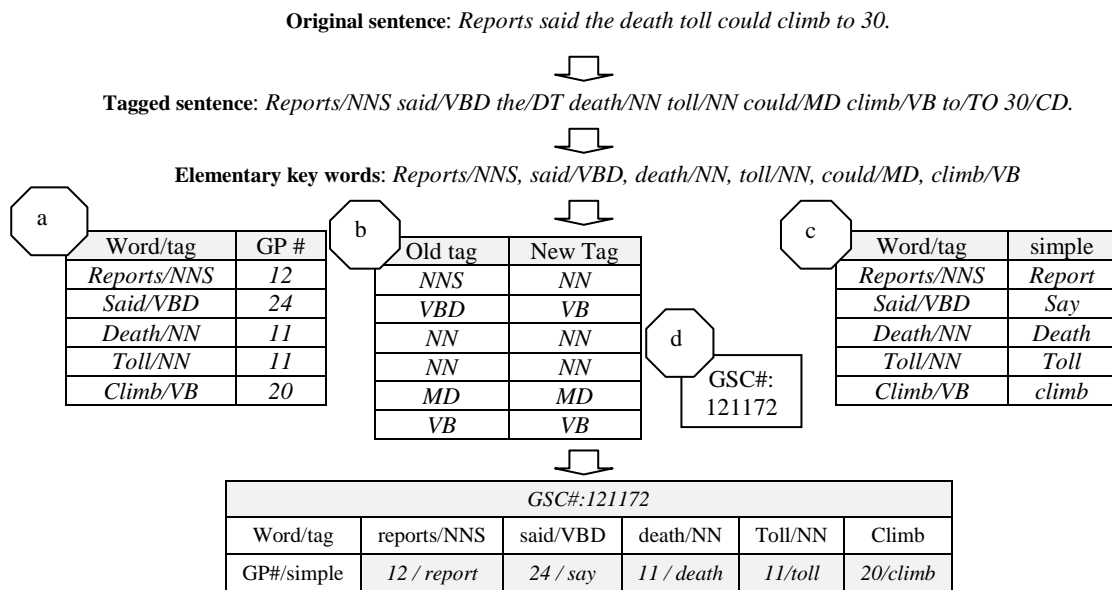


Figure 4. How STP operations work on an example

4. RETRIEVING SYSTEM

Retrieving system has three main components: indexing system, answer table and search engine. Retrieving system gets sentence analyzer results of a given question, i.e. keywords and question GS code, and then extracts keyword entries from index table as lists. Any keyword has a special list itself. These extracted lists indicate the sentences that are primary candidate answers.

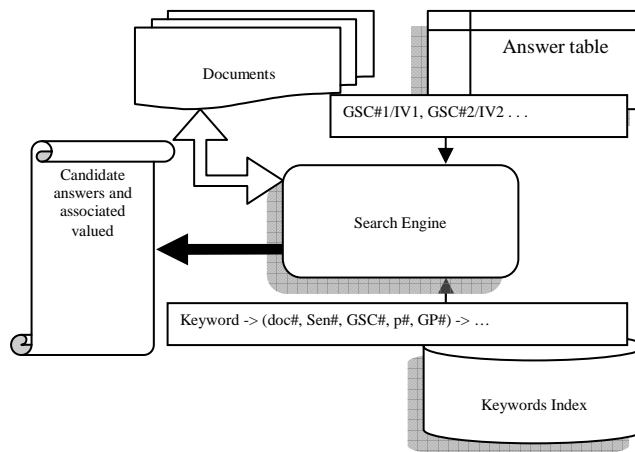


Figure 5. Retrieving system architecture

After that, the GS code of the question is given to answer table. Then answer table refers to given GS code row and returns a corresponding list. If there is not such a row, it returns a default row list. The output of answer table is a list of GS codes and associated important degrees. This list shows the GS codes with specific values that can be candidate answer to the given question. This list is passed through to the next components and will be used in ranking algorithms (as described in section 5 below).

Search engine gets index output lists and answer table output list and extracts final candidate answers of the documents. It works on index output lists and merges each list with answer table output list separately

and finally retrieves the sentences of the resulted lists. These sentences have two properties: they contain at least one of the given question keywords, and have a suitable grammatical structure regarding the given question structure. Figure 5 shows the retrieving system architecture. The structure and architecture of indexing system and data structures used in our system, completely described as (Niknia & Sharif, 2009).

5. RANKING ALGORITHMS

5.1 Ranking Parameters

The ranking procedure is based on grammatical structures (NLP) and advanced IR tools. Any sentence ranked here has some properties. Some of these properties are resulted from previous components and some other will be calculated here. Table 3 shows each sentence properties used in ranking.

Table 3. The candidate sentence properties

| <i>Property</i> | | <i>Type</i> | <i>Process time</i> |
|--|---|-------------|---------------------|
| Number of question keywords in the candidate sentence | a | IR | Calculated here |
| Frequency of each question keyword in candidate answer | b | IR | Calculated here |
| Correspondence degree of grammatical position of the question keywords with the candidate answer (sum of all fitting values) | c | NLP | Calculated here |
| Degree appropriateness of grammatical structure of the question regarding the candidate answer | d | NLP | Passed through |
| Keyword type in the candidate answer (sum of types values) | e | NLP | Passed through |

These parameters must be discussed closely before the final ranking algorithm would be proposed. At First, these parameters don't have equal importance value in ranking algorithm. As understood from expert knowledge and advanced IR theories, these parameters must be categorized regarding their importance. From this point of view, the most important parameters are the number of keywords (*a*) and the appropriateness degree of grammatical structure of the candidate answer (*d*). After that the parameter *b* has the most important rate. Finally the parameters *c* and *e* take place. These parameters has special range themselves, their definition range and declaration are described in (6 – 1).

$$\left\{ \begin{array}{ll} a \in [0, +\infty] & \text{depends on the sentence} \\ b \in [0, +\infty] & \text{depends on the sentence} \\ c = \sum_{\text{keywords}} \left(\begin{cases} 1 & \text{fit} \\ 0 & \text{o.w} \end{cases} \right) & \\ d \in \{1,2,3,4,5,6,7,8\} & \text{defined in the answer table} \\ e = \sum_{\text{keywords}} (GP \text{ code}_{/10}) = \sum_{\text{keywords}} \begin{cases} 2 & \text{if verb} \\ 1 & \text{if noun} \\ 0 & \text{if adverb} \end{cases} & \end{array} \right.$$

(6 – 1). Declaration range of ranking parameters

The second considerable topic in discussing the parameters is that when we are going to give them together in a distinct formula, there must be a balance factor because of different value range that they belongs. This balance factor presented in the ranking formula as different coefficients that each parameter gets. Thus, the coefficients appeared in the equation (6 – 2) cover two important issues. First, the importance degree of parameters and second, balancing the parameters to be able to put them together in one composed formula. Based on mentioned discussion and using confirmed parameters, the ranking formula proposed as (6–2).

$$F = 6a + 3b + c + 3d + e \quad (6 - 2)$$

After multiple execution of developed program on different type of entry documents and given questions, and regarding expert knowledge and advanced IR theories, also concerning English grammatical structures, the final ranking algorithm was proposed using the scoring formula as (6 – 2) with declared coefficients.

The system calculates (6 – 2) for each candidate answer and then rank them based on the resulted value. After ranking stage is done, the system calculates an upper bound value and the range of appropriate values of *F* for the given question. If any candidate answer couldn't achieve appropriate values, system reports a question without any appropriate answer, but suggests some of the high ranked candidates.

5.2 Candidate Answers Threshold

To calculate appropriate threshold values for candidate answers, we need to have a closer look to the proposed ranking formula (6-2). Based on the proposed formula we can define some answer types for any given question. Then based on the defined answer types, we can approximate the score that any appropriate answer can get. This score shows us the suitable threshold that we need to restrict candidate answers list.

First, we define an appropriate answer for any given question.

Appropriate answer: based on expert knowledge; an appropriate answer to the given question must satisfy the following conditions:

1. Encompass at least 60% of the keywords mentioned in question
2. The keywords of candidate answer must match with the corresponding question's key words in grammatical position, at least in 80%.
3. Degree appropriateness of grammatical structure the candidate answer must be at least 6.
4. The candidate answer includes at least a name and a verb of the question's key words.

Based on the defined conditions, we can calculate the threshold value for appropriate answers:

$$F=6(0.6a)+3(0.6a)+0.8a+3*6+e=6.2+18+e$$

Multiple execution of the system on different question types and corresponding candidate answers list answers shows that we can define the threshold value as the top 25% of ranked candidate's answer list scores.

6. EVALUATION AND COMPARISONS

To evaluate the system, we use the described threshold in previous section. The system uses the VOA corpus (VOA, 2005) with an extra document. This extra document has been developed based on similar grammatical structures containing common keywords. The evaluation of the system is based on some traditional IR evaluations such as *Precision* and *Recall* (Christopher, Raghavan, & Schütze, April 1, 2009) and some metrics of the QA systems such as *FHS*, *FARR*, *FARWR*, *TRR* and *TRWR* (Radev, Qi, Wu, & Fan, June 2002). The system has also been evaluated by another way where Precision on the correct extracted document is examined. Our system is able to answer five *wh-question's* types (*when*, *what*, *which*, *who* and *where*). To evaluate the system we selected 25 questions in a way that cover various kinds of grammatical structures (five questions for each type). The results of evaluation are shown in Table 4.

Table 4. The results of the system evaluation

| | <i>where</i> | <i>who</i> | <i>which</i> | <i>what</i> | <i>when</i> | <i>Overall</i> |
|----------------------------------|--------------|------------|--------------|-------------|-------------|----------------|
| <i>FHS</i> | 1.0000 | 0.8000 | 1.0000 | 0.8000 | 1.0000 | 0.9200 |
| <i>FARR</i> | 1.0000 | 0.9000 | 1.0000 | 0.8667 | 1.0000 | 0.9533 |
| <i>FARWR</i> | 0.3026 | 0.8200 | 0.5222 | 0.3402 | 0.6650 | 0.5300 |
| <i>TRR</i> | 1.1000 | 1.1000 | 1.2167 | 1.0000 | 1.1667 | 1.1167 |
| <i>TRWR</i> | 0.3496 | 1.0354 | 0.5423 | 0.5912 | 0.7250 | 0.6487 |
| <i>MRR</i> | 1.0000 | 0.9000 | 1.0000 | 0.8667 | 1.0000 | 0.9533 |
| <i>Precision</i> | 0.8 | 0.5833 | 0.4 | 0.6429 | 0.7 | 0.5909 |
| <i>Recall</i> | 1 | 0.7778 | 1 | 0.9 | 1.0 | 0.9286 |
| <i>Document Precision</i> | 0.8000 | 0.7500 | 0.5000 | 0.8500 | 1.0000 | 0.7424 |

These parameters are presented in (Radev, Qi, Wu, & Fan, June 2002). Their meaning in short description by examples is: *FHS*: First Hit Success. *FARR*: First Answer Reciprocal Rank. *FARWR*: represents the number of words a user has to read before reaching the correct answer. *TRR*: Total Reciprocal Rank. *TRWR*: Total Reciprocal Word Rank. Possible values for *FHS*, *FARR*, *FAR*, and *TRWR* are in the range of 0, 1 and ideal value in an errorless QA system is equal to 1. The possible values for *TRR* are from 0 to undefined upper bound. The greater *TRR* value indicates that more correct answer is extracted. Evaluation of the system using these metrics shows 0.92 for *FHS*, 0.9533 for *FARR*, 0.53 for *FARWR*, 1.1167 for *TRR* and 0.6487 for *TRWR*. These results are greater than the average and are good values. Also, the system precision and recall are great and equal to 60% and 93%, respectively. The results also show that the systems recall on documents is so good (75%). This means that the correct documents retrieved by the system are 75% of total retrieved documents.

7. CONCLUSIONS

In this paper we introduced our Question Answering system. It has two complementary components: The first one processes the document set. It has a module to recognize the grammar structure of input sentences and tagging words. Tagged sentences are then indexed in a suitable indexing structure. The second component handles input questions. A question is analyzed, and the retrieving system extracts candidate answers, ranks them and displays a limited number of them to user.

For our future works we are willing to evaluate the system on TREC QA tasks. Also a fuzzy extension seems to be useful. Such an extension empowers us to process sentences and questions that talk about fuzzy concepts like “near”, “about” and the like.

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CULTURAL IMPACT ON INFORMATION SECURITY: THE CASE OF ARAB CULTURE

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ABSTRACT

The transition to ICT (Information and Communication Technology) has had a significant influence on different aspects of society. Although the computerisation process has motivated aligning different technical and human factors with the expansion process, the technical pace of the transition surpasses human adaptation to change. Much research on ICT development has shown that ICT security is essentially a political and a managerial act and must not disregard the importance of the relevant cultural characteristics of a society. Arab culture is rather vulnerable to information security breaches primarily due to the privacy sharing attitude of Arabs. Hence, solid social knowledge and awareness are necessary for developing ICT security within Arab culture.

KEYWORDS

Arab Culture, Organisational Culture, Information Security Culture, Information and Communication Technology

1. INTRODUCTION

The implementation of ICT has taken many different aspects; many centralised IT structures and data centres are being planned and developed. This poses high demands on availability, confidentiality and integrity when extensive data sets are stored and transacted, including sensitive data remotely accessed at any time over the Internet. With information security being virtually at the heart of all core ICT (Werner, 2004), it must complement technical and organisational measures by providing new and customised security solutions to back these measures.

The Internet circumvents any time and location boundaries; this feature has intrigued a continuously growing number of online users to form online user communities and consequently constitute an extra aspect of ICT. The result is primarily a difficulty of introducing trusted online identity and the inability of setting global security standards, and eventually an increasing number of e-crimes and phishing attacks in almost every IT sector (Georgia Tech Information Center, 2008).

Setting aside the technical details of the security measures needed to protect valuable information resources, one can perceive the human factor as a major contributor to data exposure to unauthorised access. This argument is borne out by the higher number of social engineering attacks and internal threats in organisations. Social engineering is a technique that aims to crack into a system where the attacker manipulates people instead of technology to bypass the security mechanism.

Social engineering works better provided a prolific cultural platform is present. Culture has an influential impact on people's conduct and behaviour. Hence, studying culture helps the perception, interpretation and analysis of people's behaviour sharing the same culture.

1.1 Problem Definition

Adequate organisational structures are necessary for sustaining full deployment of individual, organisational and governmental information security solutions. According to Ghernouti-Hélie (2010), these structures must be based on specific needs related to local culture and ICT infrastructure development. Hence, information

security strategy and organisational structures must be developed within solid knowledge and awareness of the particular cultural traits of one country or society.

The majority of ICT security solutions suggest a set of security tools to address security issues, however they fail to present a security model that considers a particular use case including culture (Liagkou & Spirakis, 2010).

As opposed to organisational culture, national culture defines general human behaviour and is directly linked to values. Organisational cultures are highly influenced by the national culture (Robbins, 2003) and (Nosworthy, 2000); however, organisational cultures are not sufficient to establish the security of ICT systems (Chaula et al., 2006).

Arab culture has its distinguishing features characterising certain traits and behaviours of Arab people. What is relevant to this subject however is Arab culture's special regard towards privacy. Information that may be considered private and non-shareable in other cultures may be shared among family and friends. In certain circumstances, individual privacy may take second place to the needs of the community or family (Chadwick, 2002). Furthermore, Arab culture respects elders and seniority (Koocher, 2009); private details may be divulged in circumstances involving seniority requests for these details. Dire security exploits can be caused based on this knowledge of Arab culture by malicious individuals, social engineers or even by careless system users who recklessly use their obtained knowledge of some secret details. This is particularly important as technology has been mainly designed with Western culture in mind (Khushmana et al., 2009).

2. ISSUES WITH INFORMATION SECURITY

Technology is generating substantial transformations that are occurring in gradual and flexible measures. By contrast, information technology is disseminating over the entire value chain in each of its points, transforming the way activities are performed and the nature of the interconnections between them. It is also affecting the competitive landscape and reshaping the way products and services meet customer needs. These effects explain why Information and Communication Technology has acquired strategic significance and why it differs from many other technologies.

ICT is well known for being increasingly linked to technological advancement. Advances in technology, while necessary, often, need to focus on a particular area of expertise to meet the specialised needs of different industries, whereas ICT is concerned with every aspect of organisational behaviour. Moreover, this new emphasis on specialisation of different industries has led to the creation of new positions in the IT field.

As we move forward, the need for and dependence on ICT grow tremendously. This tendency toward omnipresence of ICT is elevating the necessity yet difficulty of information security. There are more threats than ever before; information systems have their main aim to be secure rather than any other functionality. Although information security is growing, the number of websites with information and tools that can be used even by novices to attack systems and their information is also increasing (Denning, 2003).

Technology has introduced complex capabilities for information sharing yet has brought complexity in protecting that information (Anderson, 2006). According to Ko and Dorantes (2006), information security breaches have been reportedly increasing in the past few years. The impact of such breaches touches different prospects of financial, reputational and private natures of an exposed organisation and may lead to further vulnerability issues (Anderson, 2006). Cavusoglu et al. (2005) suggest that there have been dramatic increases in the number of IT security breaches in recent years, making ICT security a major concern in ICT management. Consequences may be data corruption, data loss, privacy loss, downtime, fraud and loss of public confidence (ITU, 2003).

A security risk occurs when security vulnerability is associated with an exploit. For example, buffer overflow in an operating system application is a vulnerability that can be associated with a hacker's knowledge fortified by appropriate tools to generate access (i.e. an exploit to compromise a Web server) (ITU, 2003).

Regarding the growing threats, increased security measures have become the primary concern in the internal development of organisations over any other information technology related field (Luftman & McLean, 2004), triggering a set of preventive considerations that need considerable time and effort from the organisation in order to protect its assets as much as possible.

According to NIST (2002) an effective risk management process should protect not only the organisation's ICT assets but also its ability to perform its mission. Although effective risk management and security processes should involve decision makers in information security management and operations, there is little research, as well as lack of best practice, on what aspects decision makers should base their security-related decisions on (Schroeder, 2005). Accordingly, the risk management process must be treated primarily as an essential management function of the organisation rather than a technical function carried out by the IT experts who operate and manage the IT system in the organisation (Stoneburner et al., 2002).

In advanced countries, organisations resort to organisational culture to mitigate the impact of security threats and to support decision makers by providing a framework of values and customs executives can use when making their security-related decisions. Organisational culture governs the performance of businesses and individuals. Schein (2004) defines organisational culture as a set of basic shared assumptions learnt by the organisation's endeavours to solve its internal integration and external adaptation problems, which have proven to work well and have been considered valid. Hence, they are taught to new members as the correct ways to perceive, feel and think in relation to these problems.

As part of organisation culture, information security culture represents the way an organisation reacts to information security problems and the way its people act to information security. Experts have recognised different approaches based on policy, awareness, training and education to assist organisations in establishing its information security culture (Lichtenstein & Swatman, 2001), (Schlienger & Teufel, 2003) and (Furnell et al., 2000).

However, organisational culture does not often provide for the business requirements of information security reflected in confidentiality, integrity and availability. This can be related to a fundamental difference between organisational information security culture and the cultural impact on the organisation's information security. This is neatly illustrated by Glaser (2009) where he argues that security culture is a measure of security used by managers to control human behaviour in their endeavour to attain a certain security level, whereas understanding the impact of human behaviour requires analysing the impact of culture on information security. Accordingly, implementing certain organisational security culture needs suitable understanding of the particular culture as it exerts a powerful influence over information security. Sociology and cultural studies can provide further understanding of human behaviour necessary to implement effective and efficient security measures (NIST, 2002) and (Furnell et al., 2000). The mere understanding of employee behaviour and the attempt to overcome major information security threats only by cultivating organisational security culture and deploying technical measures is unlikely to yield desired results. Zhao et al. (2010) refer to studies by Leidner and Kayworth (2006) reviewing a wide range of literature on the relationship of IT and culture to point out the significant culture's impact on IT at both the organisational and national levels. Chaula et al. (2006) consider ICT security as being about people and their motivations to cause security breaches. They hence recommend examining culture as the main interpreter of people and motivations.

Therefore, profound understanding of the cultural factors and impact on information security, which are independent of the country, is necessary for achieving this security. This impact has neither been recognised in the literature nor been examined in practice. Glaser (2009) claims that there exists no security framework that intrinsically comprises cultural characteristics. As an illustration, the IT Baseline Protection Manual, a security standard for IT systems, does not refer to culture in its descriptions of security measures. BITS, the Framework for Managing Technology Risk for IT Service Provider Relationships, says little about culture's impact on information security. Even the popular ISO/IEC 27001 and ISO/IEC 27002 standards noticeably overlook the role of culture in information security.

Based on the above, consequently, managerial initiatives alone will only slightly influence employee behaviour (Rosanas & Velilla, 2005), and hence new conceptual frameworks are needed to identify and integrate complex behaviour modification and cultural change (Dojkovski et al., 2003).

3. INFORMATION SECURITY CULTURE

Numerous studies have shown that employees are the main obstacle for effective information security (Deloitte, 2005). Staff-caused risk is recognised high on the list of security risks, for example in the form of unintentional or malicious misconduct or misconfiguration of the organisation's machines (CSI, 2006).

Direct losses are usually large, in addition to immeasurable indirect damages. Consequences can range from service availability failures to leak or loss of confidential data.

Security culture combines different sociocultural attributes that support the conventional technical security measures and aims to incorporate information security in the employees' professional aspect of practising daily tasks. The definition of information security culture by Dhillon (1995) is widely accepted (Le Grand & Ozier, 2000), namely "the totality of human attributes such as behaviours, attitudes, and values that contribute to the protection of all kinds of information in a given organisation".

The holistic or totality nature of information security is stressed in the literature by several authors (Connolly, 2000), (Khalil & Seleim, 2009), (Andress, 2000), (Koocher, 2009), (Ko & Dorantes, 2006) and (Ramachandran et al., 2008).

Information Security Culture (ISC) is thus an intrinsic part of organisational culture that reflects the organisation's values and customs and includes people training, processes and communications (Ko & Dorantes, 2006), suggesting that ISC is not a definite project, but a sustained endeavour that must be constantly analysed, encouraged and adapted.

The qualitative nature of ISC yields inability to directly and precisely measure it, yet it still has a significant effect on the behaviour of the workers, management style and the technological level. Organisations hence create and develop appropriate policies and adequate human and financial resources, effective management structures and control mechanisms to undertake responsibility of establishing and sustaining ISC.

Although the positive impact of effective information security culture is hardly disputable (Da Veiga et al., 2007), Schlienger and Teufel (2003) consider that further research in the field of sociocultural security measures is still needed to improve the overall security level of an organisation, hinting at more intrinsic factors influencing information security. Woodhouse (2007) believes that achieving ISC requires more than an annual awareness training initiative but involves an overall cultural awareness.

Studies and research on the impact of culture on information security are hardly found in literature, whereas several studies have investigated the influence of culture on ICT adoption. These studies on ICT deployment have evinced significant cultural impact on innovation diffusion and IT adoption and growth.

Culture may impede IT growth whereas inappropriate consideration of cultural aspects may result in unfortunate outcomes of IT adoption (Glaser, 2009). Dutta et al. (2003) argues that IT development faces significant intangible challenges of cultural attributes. In this respect, studies have shown that countries with high information dissemination capacities are those with high uncertainty avoidance, high collectivism, high future orientation, low in-group collectivism and low gender equality practices. In addition, national culture values seem more appropriate predictors of information dissemination capacity than national culture practices (Glaser, 2009).

3.1 Arab Cultural and Impact on Information Security

If an employee who does not personally know the manager refused to disclose confidential, urgently needed information to him, should he be commended or disciplined?

The answer to the above question is highly dependent on the culture the incident takes place in. Cultures characterised by openness, such as Arab culture, are naturally vulnerable to both security leaks and privacy violations (Anderson, 2006). Straub et al. (2002) believe that the complex societal values and beliefs of Arab culture establish a rich environment to evaluate the influence of culture on information technology. Accordingly, Straub et al. (2002) stress that Arab cultural beliefs are a strong predictor of resistance to IT adoption.

One of the significant aspects of Arab culture is its tendency not to prohibit privacy sharing among peers and with superiors. According to Chadwick (2002), individual privacy may take second place to the needs of the community or family in certain circumstances. Furthermore, Arab culture respects elders and seniority (Koocher, 2009); hence, confidential information may be disclosed in circumstances involving seniority requests or elder requirements due to customs or traditions. This renders Arab culture relatively more vulnerable than the norm to information security threats that exploit the human factor, such as social engineering, internal threats, as well as the malefactors' classification and model construction, one of the most significant problems in IS security analysis. One of the main causes of this problem is information disclosure (Kotenko et al., 2011).

Social engineering, listed as one of the top 10 security breaches in 2010 (Net Security, 2010), is a set of methods of penetration into a system using psychological tricks rather than technical skills. Social engineers usually have the same goals as crackers or hackers who work with different means: to gain access to secured systems, conduct industrial espionage, financial fraud or identity theft in order to get the chance to perform on behalf of someone else.

The appeal of social engineering is mainly due to the simplicity of its techniques; instead of finding security vulnerabilities in computer systems, it can be as easy as walking into the company's building, reporting a false name at reception, going to offices and reading the password from a note a negligent employee has left stuck on a computer monitor.

Social engineering requires from an attacker particular courage, empathy, acting skills and an ability to use traditional human qualities to their advantage. Typically, the pleasure of taking opportunities to help others and also the tendency to trust the efforts of colleagues and make up to superiors are primarily self-conceit. Social engineering works even better provided it has a prolific cultural platform, such as Arab culture.

There is no simple defence against social engineering as trust is needed among employees, and colleagues who are never willing to help at work would be unbearable in the office. The only way to prevent social attacks is to systematically educate and inform employees about such threats. However, in Arab culture, educating staff to behave against their cultural tendencies and stop sharing private information may not be effective.

4. METHOD

To explore the aspects of privacy sharing in Arab culture, we used a questionnaire devised by (Olson, 2005) to capture respondents' views and how willing they are to share certain information with certain people. The choice of this questionnaire was also to compare results with those established by (Olson, 2005) in order to understand the potency of this paper's argument. The respondents were asked to rank from 1 (least likely to share) to 5 (most likely to share) information with certain people. The questionnaire was distributed to 90 people (49 male and 41 female) in different job positions and age categories in major governmental institutes based in the UAE.

The pilot testing required tailoring some questions to better fit the Arab culture as some were ambiguous and did not apply. Given the number of questions (39) and the variety of options (19) to be ranked, respondents were allowed to take the questionnaire home and complete it later. The questionnaire was given in Arabic so respondents would clearly understand the questions and the corresponding options.

We collected the answers, tabulated them, and then calculated the arithmetic mean for each question and option. The results were filled in a resultant table summarising the overall preferences of privacy sharing. The table reflects a particular visualisation colour code reflecting the likelihood of sharing information presented by respondents. For this, the arithmetic mean (2.5 out of 5) is used to evaluate the results. The information most likely to be shared (3 to 5) is coloured in white while the least likely to be shared (1 to 2) is coloured in black. Cells ranging from 2 to 3 reflect the ambiguous middle and are coloured in grey.

This paper requires no additional cluster analysis performed on the results for that it attempts to keep the user study performed within the established aim, that is, to capture somewhat the likelihood of Arabs to share information, which was achieved by simple statistical measures. Although arithmetic means might be limited in representing patterns, the results attained showed significant deviation towards privacy sharing and hence only arithmetic means were published. Further statistical analysis might be sought in a future development of this work.

| | Salesperson (live or web-based) | My personal website/blog | Potential or confirmed contacts | Corporate newsletter | People in an upcoming meeting | People I want to impress (e.g. hire, date) | Corporate lawyer | People in a project to whom it is relevant | People who work for me | Other team members | People in extended family | Young child of mine | Trusted colleague/team member | Sibling | My manager | Adult child of mine | Parent/parent-in-law | Best friend outside of work | Spouse |
|--|---------------------------------|--------------------------|---------------------------------|----------------------|-------------------------------|--|------------------|--|------------------------|--------------------|---------------------------|---------------------|-------------------------------|---------|------------|---------------------|----------------------|-----------------------------|--------|
| Transgression that is well understood to be wrong (e.g. accessing pornographic images on a work computer) | 1.15 | 1.17 | 1.53 | 1.34 | 1.14 | 1.25 | 1.68 | 1.36 | 1.34 | 1.18 | 1.86 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 |
| All of my email content | 1.10 | 1.10 | 1.10 | 1.50 | 3.50 | 3.50 | 3.50 | 4.80 | 4.80 | 4.80 | 2.00 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 |
| Credit card number | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.20 | 1.10 | 1.10 | 1.10 | 1.90 | 1.10 | 4.70 | 4.90 | 3.10 | 4.80 | 4.90 | 4.90 | 4.90 |
| Social Security Number | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.20 | 1.10 | 1.10 | 1.10 | 1.90 | 1.10 | 4.70 | 4.90 | 3.10 | 4.80 | 4.90 | 4.90 | 4.90 |
| A potential transgression -- action not universally understood as wrong, more in a grey area (e.g. using your work computer for charitable | 2.00 | 1.90 | 1.14 | 1.13 | 1.17 | 1.10 | 1.16 | 1.11 | 1.12 | 1.14 | 4.90 | 4.20 | 4.90 | 4.90 | 3.50 | 4.90 | 4.90 | 4.90 | 4.90 |
| Outside income | 2.00 | 1.90 | 1.15 | 1.15 | 1.18 | 1.17 | 1.15 | 1.17 | 1.18 | 1.30 | 4.90 | 4.20 | 4.90 | 4.90 | 3.50 | 4.90 | 4.90 | 4.90 | 4.90 |
| Salary | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.20 | 1.10 | 1.10 | 1.10 | 1.90 | 1.10 | 4.70 | 4.90 | 3.10 | 4.80 | 4.90 | 4.90 | 4.90 |
| Large personal failure (e.g. fired from previous job) | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.20 | 1.10 | 1.10 | 1.10 | 1.90 | 1.10 | 4.70 | 4.90 | 3.10 | 4.80 | 4.90 | 4.90 | 4.90 |
| Personal behaviour I feel bad about (e.g. spoke sharply to a colleague) | 2.00 | 1.90 | 1.10 | 1.10 | 1.10 | 1.10 | 1.17 | 1.10 | 1.17 | 1.28 | 4.90 | 4.20 | 4.90 | 4.90 | 1.50 | 4.90 | 4.90 | 4.90 | 4.90 |
| Buddy list (who's on my list) | 2.00 | 1.90 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.13 | 1.10 | 1.40 | 4.90 | 4.20 | 4.90 | 4.90 | 1.50 | 4.90 | 4.90 | 4.90 | 4.90 |
| Non-work related websites I've looked at at work | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.20 | 1.10 | 1.49 | 1.30 | 4.90 | 4.20 | 4.90 | 4.90 | 3.10 | 4.80 | 4.90 | 4.90 | 4.90 |
| Recent history of status (looking for trends) | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.20 | 1.10 | 1.10 | 1.90 | 1.10 | 4.70 | 4.90 | 3.10 | 4.80 | 4.90 | 4.90 | 4.90 | 4.90 |
| History of my job performance scores | 4.50 | 4.50 | 3.00 | 3.80 | 4.50 | 4.50 | 4.50 | 4.90 | 4.90 | 4.90 | 4.50 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 |
| Opinions I have about other people (assume in digital form) | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.20 | 1.10 | 1.10 | 1.90 | 1.10 | 4.70 | 4.90 | 3.10 | 4.80 | 4.90 | 4.90 | 4.90 | 4.90 |
| My application to another job/school | 4.50 | 4.50 | 3.00 | 3.80 | 4.50 | 4.50 | 4.50 | 4.90 | 4.90 | 4.90 | 4.50 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 |
| Access to my computer with personal assurance that they won't look at anything | 1.10 | 1.10 | 1.10 | 1.50 | 3.50 | 3.50 | 3.50 | 4.80 | 4.80 | 4.80 | 2.00 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 |
| Small personal failure (e.g. project misstep that led to failure) | 2.00 | 1.90 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.90 | 1.10 | 4.70 | 4.90 | 4.90 | 3.50 | 4.90 | 4.90 | 4.90 | 4.90 |
| What email groups I belong to (external to the company) | 4.50 | 4.50 | 3.00 | 3.80 | 4.50 | 4.50 | 4.50 | 4.90 | 4.90 | 4.90 | 4.50 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 |
| Record/summary of database interactions | 3.00 | 3.80 | 4.60 | 4.60 | 4.30 | 4.20 | 4.20 | 4.00 | 4.00 | 4.00 | 4.90 | 2.00 | 3.50 | 3.90 | 3.85 | 3.40 | 3.00 | 4.00 | 4.00 |
| Preferences (politics, religion, associates, etc.) (assume in digital form) | 4.50 | 4.50 | 3.00 | 3.80 | 4.50 | 4.50 | 4.50 | 4.90 | 4.90 | 4.90 | 4.50 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 |
| Work-related documents I've accessed | 3.00 | 3.80 | 4.60 | 4.60 | 4.30 | 4.20 | 4.20 | 4.00 | 4.00 | 4.00 | 4.90 | 2.00 | 3.50 | 3.90 | 3.85 | 3.40 | 3.00 | 4.00 | 4.00 |
| My health status | 4.50 | 4.50 | 3.00 | 3.80 | 4.50 | 4.50 | 4.50 | 4.90 | 4.90 | 4.90 | 4.50 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 |
| Specific calendar entries | 1.10 | 1.10 | 1.10 | 1.50 | 3.50 | 3.50 | 3.50 | 4.80 | 4.80 | 4.80 | 2.00 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 |
| Pregnancy status | 2.00 | 1.90 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.10 | 1.90 | 1.10 | 4.70 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 |
| Work in progress | 4.50 | 4.50 | 3.00 | 3.80 | 4.50 | 4.50 | 4.50 | 4.90 | 4.90 | 4.90 | 4.50 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 |
| Desktop video conference | 1.10 | 3.50 | 3.50 | 4.50 | 4.50 | 4.00 | 4.00 | 4.80 | 4.60 | 4.50 | 1.90 | 4.50 | 4.50 | 4.90 | 2.00 | 2.00 | 4.60 | 4.50 | 4.50 |
| Work-related websites I've looked at | 4.80 | 3.20 | 4.00 | 4.20 | 4.60 | 4.50 | 4.00 | 4.10 | 4.70 | 4.80 | 4.30 | 3.60 | 4.50 | 4.20 | 4.90 | 4.50 | 4.50 | 4.50 | 4.90 |
| Current location | 4.80 | 4.50 | 4.90 | 4.60 | 4.80 | 4.30 | 4.80 | 4.90 | 4.50 | 4.80 | 4.40 | 4.20 | 4.90 | 4.80 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 |
| Current status (on line, "busy") from IM (Instant Messenger) | 4.80 | 4.50 | 4.90 | 4.60 | 4.80 | 4.30 | 4.80 | 4.90 | 4.50 | 4.80 | 4.40 | 4.20 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 |
| Past finished papers, products, etc. | 3.00 | 3.80 | 4.60 | 4.60 | 4.30 | 4.20 | 4.20 | 4.00 | 4.00 | 4.00 | 4.90 | 2.00 | 3.50 | 3.90 | 3.85 | 3.40 | 3.00 | 4.00 | 4.00 |
| What email groups I belong to (internal to the company) | 4.50 | 4.50 | 3.00 | 3.80 | 4.50 | 4.50 | 4.50 | 4.90 | 4.90 | 4.90 | 4.50 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 |
| Small personal success (e.g. project chosen to demo) | 4.80 | 4.50 | 4.90 | 4.60 | 4.80 | 4.30 | 4.80 | 4.90 | 4.50 | 4.80 | 4.40 | 4.20 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 |
| When available (on a shared calendar) | 4.80 | 4.50 | 4.90 | 4.60 | 4.80 | 4.30 | 4.80 | 4.90 | 4.50 | 4.80 | 4.40 | 4.20 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 |
| Home phone number | 4.50 | 4.80 | 4.80 | 4.20 | 4.50 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 |
| Large personal success (e.g. big promotion) | 4.80 | 4.50 | 4.90 | 4.60 | 4.80 | 4.30 | 4.80 | 4.90 | 4.50 | 4.80 | 4.40 | 4.20 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 |
| Age | 3.00 | 3.80 | 4.60 | 4.60 | 4.30 | 4.20 | 4.20 | 4.00 | 4.00 | 4.00 | 4.90 | 2.00 | 3.50 | 3.90 | 3.85 | 3.40 | 3.00 | 4.00 | 4.00 |
| Mobile number | 4.50 | 4.80 | 4.80 | 4.20 | 4.50 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 |
| Work desk phone number | 4.50 | 4.50 | 3.00 | 3.80 | 4.50 | 4.50 | 4.50 | 4.90 | 4.90 | 4.90 | 4.50 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 | 4.90 |
| Work email address | 4.30 | 4.90 | 3.50 | 3.90 | 4.90 | 4.50 | 4.90 | 4.90 | 4.90 | 4.90 | 4.70 | 4.50 | 4.70 | 4.70 | 4.70 | 4.23 | 4.01 | 4.12 | 3.96 |

Figure 1. Arabs are willing to share a large amount of information with other people (white) and keep a small amount private (black). They are not sure about a little information whether to share or not (grey)

Based on the calculated arithmetic means of the 90 participants, the above table (Figure 1) shows that Arabs are willing to share (in white) 73.5% of their information with certain people, while they preserve (in black) 24.3% to themselves. They are not sure about either sharing or conserving (grey) 2.2% of their information.

Transgression is the only piece of information Arabs are refrained from sharing with absolutely anyone. Other presumably critical information Arabs may share with their family and close friends, such as email content, credit card number or even a potential transgression. They are not sure however if they would share certain information, for example about salary or large personal failure with extend family members. This can be visually depicted as the small black region is concentrated in the upper-left corner and diminishes in the right and bottom, with very few grey cells in the middle.

However, Arabs may share most of the information regarded private and non-sharable in other cultures (Olson, 2005) with almost anyone. These results reinforce an important point raised by this paper yet reflect a genuine vulnerability to be considered in information security measures applied in organisations operating in an environment where Arab culture prevails.

5. CONCLUSION

The dissemination of information technology has rendered information restriction very difficult. The Arab world has not yet arrived at the same level of maturity of information technology as the developed world and yet this technology has led Arab leaders to step down. This fact hints at the potential and current impact of the advanced information technology on information security in the developed countries, and its relationship to Arab society whose culture is marked by sharing confidential information and ignoring its actual value.

What information technology witnesses in the modern age has a maximal effect in destabilising national security. Therefore, everyone should know the value of information and not to share it with others.

The technological expansion in the Arab world requires developing security policies in information technology based on a specific infrastructure that inhibits the cultural factor from granting individuals the freedom to share confidential information.

Although international information security standards have an active role in seeking to reach an acceptable level of security, they overlook the cultural factor which may have a significant role in security

threats. The process of encoding information has helped maintain confidentiality of information; however, Arab culture has managed to circumvent these conventions.

The pursuit of an optimal solution to this cultural phenomenon is more effective than policies based on global standards.

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SOURCES OF DISSATISFACTION IN MOBILE INTERACTION WITH THE REAL WORLD: A PRELIMINARY STUDY

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ABSTRACT

Consumers can interact with real-world objects and places with mobile applications that link digital information with the physical world. However, the relatively novel area of mobile interaction with the real world involves numerous potential sources of consumer dissatisfaction. To form categories of dissatisfaction sources, we combined context-specific previous studies that examined satisfaction and dissatisfaction in the field of mobile applications. Further, we applied the categories to analyze negative critical incidents described by actual users. We propose that potential sources of dissatisfaction include technical functionality, interaction, content, customer service, privacy, compatibility, overall usefulness, consumer, and context.

KEYWORDS

Dissatisfaction, satisfaction, mobile applications, consumer behavior

1. INTRODUCTION

Still in their relatively early stages, consumer-level mobile applications involve many potential sources of user dissatisfaction. It seems that, the more novel the applications are, the more susceptible they are to dissatisfaction and the more important it is to understand satisfaction and dissatisfaction. One of the novel areas of consumer-level mobile applications is mobile interaction with the real world. Through mobile interaction, individuals can use their mobile devices to receive, create, or share information related to everyday objects and places in close proximity.

The two application types considered in this study represent the main consumer-level types of camera-based mobile interaction with the real world: see-through displays and recognition-based applications. Whereas see-through displays act as real-world browsers that add contextual digital information to the camera view of the mobile device (Bier et al, 1993; Fröhlich et al, 2011), recognition-based applications link digital information and perform actions by pointing mobile devices toward objects or places using image recognition; visual tags, such as two-dimensional, QR, and product barcodes; or other techniques, such as RFID (Barthel et al, 2010; Karpischek & Michahelles, 2010). Researchers have examined prototypes, demonstrations, and concepts of both application types for nearly two decades to gain knowledge on technical, usability, and decision-support issues. However, real user experiences and user perceptions of consumer-level applications have received little attention.

Various researchers have emphasized the importance of understanding satisfaction and dissatisfaction in the context of products and services. Satisfaction reportedly affects competitive advantage, customer loyalty, and economic success (Deng et al, 2010; Vargo et al, 2007). Specifically, researchers have stated that consumer dissatisfaction affects product- or service-related use continuance, switching behavior, complaints, and negative word-of-mouth (Bhattacharjee, 2001; Ahn et al, 2006). Therefore, understanding consumer dissatisfaction can help an application provider to maintain success by preventing user losses and negative reputation.

There is no consensus in the literature regarding the sources or determinants of satisfaction nor whether satisfaction and dissatisfaction should be distinguished from each other (Giese & Cote, 2000). In this paper, dissatisfaction is assumed to be a separate, context-specific dimension, rather than the opposite of satisfaction. In addition, it is assumed that the sources of dissatisfaction and their weightings might differ from those of satisfaction. Consequently, abstracted sources of dissatisfaction should be amplified further with context-specific sources of dissatisfaction.

This paper contributes to the research on dissatisfaction by examining its sources in the mobile context. Based on earlier context-specific research and propositions, we categorized sources of dissatisfaction. To locate real-world use experiences reflecting each source, we analyzed data on consumer perceptions on dissatisfying critical incidents involving mobile interaction with the real world. Our aim was to (1) determine which sources caused dissatisfaction in mobile interaction with the real world and (2) describe how these sources created dissatisfaction.

2. SOURCES OF DISSATISFACTION

2.1 Satisfaction and Dissatisfaction

Conceptual discussions about satisfaction, dissatisfaction, and other relevant concepts have taken place in the scientific community in recent decades. In information systems science, expectation-confirmation theory (ECT) has been used widely to study satisfaction and use continuity of a product or a service. Introduced by Oliver (1977, 1980), ECT holds that consumers form expectations prior to using a product or a service, evaluate its actual performance, and compare expectations with evaluations to obtain confirmation. Confirmation is assumed to be determinant of satisfaction, which determines use continuance of a product or a service. In ECT, it is assumed that meeting expectations causes greater confirmation, resulting in higher satisfaction and continuance of use (Bhattacharjee, 2001). Thus, when a product or service fails to meet expectations, consumers experience dissatisfaction and discontinue use of the product or service. ECT has been further developed for the contexts of information systems and mobile applications on the basis of technology adoption models (see Bhattacharjee, 2001; Hung et al, 2007; Lin et al, 2005; Thong et al, 2006).

However, the theory has spurred some critical discussion. Some scholars argue that comparing expectations and perceived performance is not the only determinant of satisfaction. Bhattacharjee (2001) highlighted several shortcomings of ECT. For example, the theory holds that expectations cannot change over time and that both satisfaction and expectations are ambiguous concepts. Based on Locke's work, Westbrook and Reilly (1983) argued that satisfaction and dissatisfaction resulted from comparing perceptions about a product and values, such as needs, wants, and desires. Additionally, Oliver (1997) later stated that, in addition to expectations, needs, quality, values, equity, and remorse could affect satisfaction. Therefore, we need to examine the sources and determinants of satisfaction and dissatisfaction more closely.

Further, the conceptual discussions about the detailed sources and determinants of satisfaction in the scientific community seem to be unending. For example, Gallarza et al (2011) highlighted the complexity of satisfaction, values, and quality, as well as the relationships among them based on their relatively extensive literature review. Without examining the relationships among various concepts, we aimed to investigate the sources of dissatisfaction. Many researchers have presented specific sources and determinants of consumer satisfaction or dissatisfaction, varying from comparing monetary sacrifices with gained benefits all the way to the users' background information (Goode et al, 2005). Whereas some researchers understand dissatisfaction as the opposite of satisfaction, others perceive both concepts as separate dimensions (Giese & Cote, 2000). For example, Meuter et al (2000) have found with self-service technologies that satisfaction and dissatisfaction are affected by different factors. Also, Oliver (1993) stated that there were different sources of satisfaction and dissatisfaction on the abstract level. Vargo et al (2007) report that there were factors that "increase dissatisfaction when absent but do not increase satisfaction when present" and vice versa. Thus, we believe that dissatisfaction is not the exact opposite of satisfaction, so the two must be distinguished.

2.2 Context-specific Sources

Satisfaction and dissatisfaction depend upon the context of the researched phenomenon, and researchers should adopt context-relevant definitions and measures (Giese & Cote 2000; Vargo et al, 2007). Given that we sought to study the mobile application context, we chose to specify Oliver's (1993) abstract sources of dissatisfaction by applying a specific view based on the premises of the context. Therefore, we combined seven views from previous research on the sources and determinants of satisfaction and dissatisfaction. According to Oliver (1993), dissatisfaction might increase generally from external (other-oriented), internal (consumer mistakes), or situational sources. He stated that, even though external sources have been prioritized, internal and situational sources should not be overlooked. With self-service technologies, a context that is relatively similar to the one in this study, context-specific sources of dissatisfaction have been investigated in a relatively widely cited study by Meuter et al (2000). In the mobile domain, there is a research stream on the topic of consumer satisfaction, yet the sources and determinants in a large proportion of that stream are abstract, rather than context-specific in nature. Additionally, with advanced mobile applications, research that distinguishes dissatisfaction from satisfaction and focuses specifically on the sources of dissatisfaction is scant. Thus, we considered studies that examined context-specific sources and determinants of both satisfaction and dissatisfaction in the mobile application domain.

Given that the sources and determinants seem to be recurrent based on the presented definitions and measurement items in previous studies, we combined them to form categories of sources of dissatisfaction. The sources proposed by previous studies are combined in Table 1. External sources of dissatisfaction include technical functionality, interaction, content, customer service, privacy, and overall usefulness, internal sources include consumers, and situational sources include context (Koivumäki et al, 2008; Kuo et al, 2009; Meuter et al, 2000; Oliver, 1993; Park et al, 2008; Vlachos & Vrechopoulos, 2008; Salo et al, in press). Most of these studies highlight the role of perceived experience of product quality, which has been found to be the most important determinant of dissatisfaction (Goode et al, 2005). Below are brief descriptions of each proposed source:

- Technical functionality: technology is not working as intended
- Interaction: complexity of application or device use
- Content: content is not matching user needs
- Customer service: weaknesses in customer or developer support
- Privacy: privacy concerns
- Overall usefulness: user perceives no utilitarian value
- Consumer: consumer-driven failure
- Context: inability to function whenever and wherever

In our approach, we followed one of the data analysis approach suggestions by Paré (2004). We adopted initial categories from previous research and supplemented them with additional categories based on the data, if needed.

3. METHOD

3.1 Critical Incident Technique

To investigate the sources of dissatisfaction, we applied the critical incident technique (CIT). CIT has been mentioned as one of the three primary methods for studying satisfaction and dissatisfaction (Vargo et al, 2007). Previously, it was applied to study dissatisfaction in various contexts, such as self-service technology (Meuter et al, 2000); the airline, hotel, and restaurant industries (Bitner et al, 1990); and transportation (Edvardsson, 1998). Generally, in service research, the most frequent CIT research topics include satisfaction, quality, service encounters, and service failure and recovery (Edvardsson, 1998; Gremler, 2004).

Table 1. Sources of dissatisfaction and satisfaction in previous studies

| Dissatisfaction: Consuming in general (<i>Oliver, 1993</i>) | Dissatisfaction: Self- service technology (<i>Meuter et al, 2000</i>) | Satisfaction: Mobile information applications (<i>Kotvumäki et al, 2008</i>) | Satisfaction: Mobile music service (<i>Vlachos & Vrechopoulos, 2008</i>) | Satisfaction: Mobile value-added services (<i>Kuo et al, 2009</i>) | Satisfaction: RFID mobile applications (<i>Park et al, 2008</i>) | External weaknesses: Mobile interaction with the real world (<i>Salo et al, in press</i>) |
|---|---|---|--|--|--|--|
| External | Technology failure | Connection | Connection, device | System reliability and connection | Connection, tag recognition | Technology and hardware |
| | Poor design | Interaction | Interaction | Navigation and visual design | Interaction | General complexity |
| | | Content | Content | Content | Content | Content |
| | Process failure | | Customer service | Management and customer service | Service | |
| | | | Perceived value | Perceived value | | Concept |
| | | | Privacy | | | |
| Internal | Consumer-driven failure | | | | | |
| Situational | | Context | Contextual | | | |

As a qualitative technique, CIT aims to promote understanding of the research phenomenon, rather than yielding generalizable results (Meuter et al, 2000). Thus, we used CIT to map and describe various sources of dissatisfaction in mobile interaction with the real world.

CIT is a way to “collect, content analyze, and classify observations of human behavior” in a qualitative manner (Gremler, 2004). When using this technique, researchers can ask respondents to describe their significantly positive or negative experiences. Such experiences are easy for the respondent to remember and describe in their own words. However, there are certain weaknesses associated with the technique (Gremler, 2004; Vargo et al, 2007). First, CIT captures only the extremes of dissatisfying experiences. Second, the descriptions might have been reconstructed and retold, as time has passed since the actual events. Third, the analyzing process is susceptible to subjectivity. Although little can be done to overcome the first weakness, we minimized the effect of the second weakness by instructing the respondents to recall and describe their experiences as truthfully and in as much detail as possible. To address the third weakness, we measured the interrater reliability to reduce subjectivity.

3.2 Questionnaire, Respondents, and Analysis

Our study primarily followed a checklist by Gremler (2004) for applying CIT in content analytic studies. During the spring of 2011, we conducted an international online survey of mobile users. The requirements to participate in the survey included previous practical experience with applications related to mobile interaction with the real world. For this paper, we asked respondents to describe their most dissatisfying experiences with their most frequently used relevant mobile application. Respondents were instructed to take a few moments to select the most crucial experience before answering an open-ended question, which allowed the respondents to describe their experiences in as diverse a manner as possible. The respondents were instructed to explain the overall situation, describe their feelings and reactions, and specify the aspects of the application that caused these feelings and reactions. Before administering the questionnaire, we asked 10 fellow researchers to provide comments about it and recruited pilot study respondents to test the instrument.

The link for the questionnaire was circulated by several application providers, including Layar, Junaio, Wikitude, and Stickybits, mobile blogs, open mobile community groups, and email lists consisting of information technology students and university staff members. We would like to highlight that these messengers were not involved in and did not affect the study. To motivate individuals to respond to the survey, 10 Amazon gift cards valued at 50 euros each were raffled off among the respondents.

There were 95 respondents. However, given that the questionnaire included other sections that were excluded from this paper, 65 respondents provided acceptable answers to the optional open-ended question about dissatisfying incidents. Twenty-two respondents left the answer field blank. Moreover, eight answers were excluded from the analysis, as they were invalid or insufficient for the analysis. As the questionnaire page was visited 2,277 times, a large number of visitors did not complete the questionnaire, presumably due to their limited use experience or willingness to put effort into the 15- to 20-minute survey.

The group of respondents consisted primarily of technologically oriented individuals and early adopters of technology, based on their background information and agreement with statements reflecting technology use. Although the respondents represented 17 nationalities and ranged in age from 16 to 55 years, the majority of them were male, under the age of 35 years, and well-educated. Because we did not aim for generalizability, collecting experiences from early adopters fits well with our research scheme. However, limitations regarding the group of respondents are discussed in section 5. Overall, the responses were related to 10 different applications, with the most frequent ones being Layar, Google Goggles, and Junaio.

By following the coding guidelines recommended by Paré (2004), 91 reflections of dissatisfaction sources from 65 respondents were analyzed and classified into categories that were formed on the basis of previous studies. Given that the categories of the coding scheme did not cover all sources of dissatisfaction, we found the need for forming one additional category. The data showed that some of the critical incident descriptions reflected more than just one source of dissatisfaction, so we decided to categorize each description into one or more categories. To enhance the objectivity of the analysis, two researchers, who were blind to each other's codings, conducted the analysis. As suggested by Stemler (2004), we measured the consensus estimate of interrater reliability. A percent-agreement figure of 84.6 % was calculated by dividing the amount of identically placed codings by the total number of codings. Our measure showed that the interrater

agreement was adequate, as analysis in service research CIT studies is considered informally to be reliable when the percentage is 80 % or higher (Gremler, 2004).

4. RESULTS

Our data reflected each of the three abstract sources of dissatisfaction: external, internal, and situational. Also, all of the proposed context-specified sources, except privacy, were found in the data. The most common sources of dissatisfaction were technical functionality and content. The relatively few codings in some of the sources might be explained by the fact that CIT focuses purely on the most extreme experiences. Some of the sources might be more susceptible to mid-level dissatisfaction than to extreme dissatisfaction and, consequently, less apparent in our data. In addition to the proposed sources, a new source, compatibility, was noted. Each potential source of dissatisfaction is briefly described below.

4.1 External Sources

Technical functionality (35 codings). The most frequently cited source in our data arose from technology that did not perform as expected. Whether it was about the application, device, or connection, it came down to a lack of functionality. A pplication crashes, errors and bugs, slowness, instability of the connection, and failures in image recognition, compass functions, or receiving global positioning system (GPS) coordinates were mentioned by respondents. At times, technical functionality overlapped with the category of *context*, given that technical inaccuracy or malfunctions might occur due to situational factors. For example, tall buildings might prevent individuals from receiving GPS coordinates and low-light conditions might block image recognition.

Interaction (7 codings). Interaction is a source of dissatisfaction when the application is complex or difficult to use and interact with. Relatively few respondents reported that user interfaces were not convenient, understandable, or intuitive. Also, it was mentioned that an application might not always interpret user interaction in the desired way.

Content (30 codings). The second most frequently cited source in our data reflected situations when something was wrong with the content. According to the respondents, there were cases in which content was misplaced, flawed, useless, irrelevant, absent, or confusing. Failures in content occasionally overlapped with *technical functionality*. Even though respondents might have believed that the source of dissatisfaction was content, the actual cause might have been in failures of technology. That is, content might have been misplaced or flawed because of inaccurate GPS coordinates or inaccurate image recognition.

Customer service (2 codings). Only two responses reflected weaknesses in customer support in our data. According to both of the responses, the shortages of customer service hindered users from creating content and combining other existing data sources with the applications.

Privacy (0 codings). In our data, no descriptions of dissatisfying experiences reflected privacy concerns.

Compatibility (5 codings). Five descriptions reflected a source that was not present in the coding scheme based on previous studies. Thus, we had to create a new source category called compatibility. Although some technology adoption researchers recognize that compatibility influences behavioral intentions (e.g., Rogers 1995), it seems it has not been linked to satisfaction or dissatisfaction in relevant mobile studies. According to the respondents, dissatisfaction can arise from applications that are not compatible with user's life, earlier technology, such as a device, or other data sources. In particular, the aspect related to integrating data sources seems to be relatively new. Applications might create dissatisfaction if they are not capable of being integrated with other data sources or applications, such as point-of-interest databases or personal calendars.

Overall usefulness (3 codings). Three responses were related to overall usefulness. The respondents simply stated that the applications currently lacked utility or failed to harness the potential of such applications.

4.2 Internal Sources

Consumer (2 codings). Consumer-driven failure was reported by only two respondents, who reportedly made mistakes or had difficulties with learning to understand the application. These cases included descriptions of

clicking the wrong button and not understanding the actions of an application. Both of the descriptions were linked with *interaction* as well. The small number of reported consumer-driven failures might be partially explained by the assumption that consumers are usually unwilling to blame themselves for failures.

4.3 Situational Sources

Context (7 codings). Context-dependent failures relate to the surrounding physical environment. They have the potential to cause applications not to function wherever or whenever. According to our data, there were several context issues. First, context-related factors, such as an enclosed space, might cause failures in *technical functionality*. Second, uncommon conditions, such as bright sunlight, might interfere with the proper use of the device. Third, dissatisfaction might be related to social acceptance in the physical environment: according to one respondent, shop staff had harassed him because he was trying out an image recognition application on products on the shelf.

The findings of our study and proposed categories for the sources of dissatisfaction in a mobile context are presented in Table 2.

Table 2. Sources of dissatisfaction based on previous studies and our results

| Source of dissatisfaction | Description and <i>exemplar quotation</i> |
|--------------------------------|--|
| External | |
| TECHNICAL FUNCTIONALITY | Technology is not working as intended: instability, errors, and slowness of the application, connection, device, or their functions, such as location-based or camera-based recognition <i>"The software didn't recognize anything from well-known scenery."</i> |
| INTERACTION | Complexity of application or device use: inconvenient interaction, weaknesses in user interface and design, lack of clarity of presentation or instructions, confusing in-app navigation <i>"These apps are fun, but the interface is inconvenient."</i> |
| CONTENT | Content is not matching user needs: useless, irrelevant, non-preferred, unwanted, skewed or incomprehensible content, excessive content, absence of content <i>"App didn't find any information that I expected."</i> |
| CUSTOMER SERVICE | Weaknesses in customer or developer support: lack of or delay in customer service, unhelpful service, incomplete or limited instructions and support documentation, such as FAQs <i>"I was frustrated that the [content creation] process wasn't clearly documented yet."</i> |
| PRIVACY | Privacy concerns (<i>no instances in our data</i>) |
| COMPATIBILITY | Lack of adaptability to earlier conditions of the user: incompatibility with earlier technology or state-of-mind of the user, incapable of being integrated with other applications or data sources <i>"The lack of deep integration, i.e. my calendar and [to-do-list], cannot interact with [the application]."</i> |
| OVERALL USEFULNESS | User perceives no utilitarian value: not useful, insufficient benefits compared to sacrifices, application does not harness its potential <i>"In general, the lack of utility."</i> |
| Internal | |
| CONSUMER | Consumer-driven failure: negative experience caused by the user due to the user's actions or mistakes <i>"I used to click the wrong button each time and started a layer, although I just wanted to read more information about it."</i> |

Situational
CONTEXT

Inability to function whenever and wherever: uncommon conditions, interference from the physical environment, other unfortunate situational events

"The amount of light was not enough for the camera to see anything."

5. DISCUSSION AND CONCLUSIONS

This study contributes to the literature on consumer dissatisfaction by merging previous studies with relevant data in the context of mobile interaction with the real world. After we formed categories for sources of dissatisfaction by combining abstract sources with context-relevant sources, our findings showed that all of the sources from previous studies were present in our data, except privacy. However, privacy should still be viewed as a potential source of dissatisfaction, given that the lack of reflections might have occurred because of the relatively small number of responses. Hence, all the aforementioned sources should be considered as potential sources of dissatisfaction.

Additionally, we recognized the need to form an additional category, compatibility, based on the data. Even though the inclusion of compatibility is already supported by the technology adoption literature to a certain degree, the need for such a category was further emphasized not only by our data, but also by the fact that mobile applications have become more advanced and multifunctional. We believe that the growing trend of open application programming interfaces and mash-ups from different data sources will make combining applications and data sources even more relevant in the near future. Thus, we propose that compatibility should also be considered when investigating dissatisfaction in the mobile context.

Although the primary aim of this paper was not to take sides in the conceptual discussion on the satisfaction-dissatisfaction continuum, we share the view of several researchers (e.g., Meuter et al., 2000; Oliver, 1993) who stated that there were different sources of satisfaction and dissatisfaction. It seems that there are sources that affect dissatisfaction when present, but do not necessarily promote satisfaction when absent. Thus, dissatisfaction should be distinguished from satisfaction, and the concept of satisfaction should perhaps not be understood or applied as a unidimensional or symmetrical concept.

At the practical level, application providers should notice that dissatisfaction might result from a whole variety of sources. Understanding and considering several sources of dissatisfaction might help application providers to avoid having user losses and gaining a negative reputation. For example, providers could use a checklist of the sources in different phases of the application development process. Although providers are aware of certain sources of dissatisfaction, such as technical functionality, not all potential sources are obvious. Additionally, not all aspects of individual sources are apparent. For example, context-relevant dissatisfaction might not arise only from unfavorable conditions that impede technical functions or uncommon situations that obstruct device usage, but also from social acceptance.

This study has three primary limitations. First, CIT concentrates only on extreme experiences. The technique might highlight the sources that can cause the greatest amount of dissatisfaction from the perspective of the user and understate those sources that more typically cause mid-level dissatisfaction. For example, privacy concerns, which were not found in our data, might cause mid-level dissatisfaction, but not necessarily the most extreme dissatisfaction, at least before they actualize. Second, the sample size was relatively small. Consequently, one should not draw any additional conclusions about the frequency of the sources. Third, the group of respondents was relatively specific and did not reflect any larger population. This might have resulted in some of the sources being emphasized to a greater degree than they were in the general population. However, these three limitations are not critical, as we aimed only to find and describe the potential sources of dissatisfaction, rather than generalize or quantify our results.

In the future, the proposed sources should be validated with a quantitative study employing a user questionnaire to include Likert-type statements as construct items. A quantitative study would also provide

knowledge on the priority and frequency of each source. Additionally, in-depth qualitative user interviews would provide further and more thorough understanding about the personal perceptions related to the sources of dissatisfaction.

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REAL-TIME WHEELCHAIR CONTROL SYSTEM USING SURFACE ELECTROMYOGRAPHIC SIGNAL ANALYSIS

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ABSTRACT

In this research, a novel end-to-end system for real-time identification of finger gestures was investigated. In first stage, surface electromyography signals from the forearm are used during muscle onset activation for an extraction of frequency/time domain features. For achieving this, the volume conduction model is applied. In the second stage, a multilayer perceptron artificial neural network (ANN) is applied for feature classification. This method of Gesture identification can be used to, e.g., control a wheelchair (modeled here in miniature) on base of finger movements. The combination of wavelet decomposition singularities in conjunction with an ANN classifier is found to successfully discriminate between individual finger contractions with a high degree of sensitivity, which makes the system suitable for real world applications. The project is especially targeted towards amputees, who can benefit from controlling the movements of a wheel chair. This new method would require less effort than the usual chin operated joystick control.

KEYWORDS

Gesture Identification, Surface Electromyogram, Wavelet analysis, Artificial Neural Network, Bio-signal Processing.

1. INTRODUCTION AND BACKGROUND

Bio-signals refer to the kind of signals, which are attained from any living being that give us an idea about the electrical activity of a certain tissue, organ or cell system. Surface electromyography (sEMG) refers to the study of bio-signals obtained from the skeletal muscles non-invasively. Detailed analysis of these signals helps us to identify their innate properties and thereby assist in precisely classifying them into different gestures. In particular for controlling the motors of a wheelchair, this is the most critical stage according to the subtle changes in the myoelectric patterns. Although there are systems available for executing basic grasping and relaxing movements of all fingers together, real-time classification of distinct finger gestures is essential to develop a control system that has true real world applications. The proposed wheel chair control system evolved through different stages of research. First, various signal processing algorithms for identification and classification of SEMG signals were simulated in Mathworks' Simulink. Next, the processing was realized in National Instruments LabView. In the particular application here, the classified finger Gestures could be used to maneuver a powered wheel chair in real-time.

According to Carlo J De Luca [3], starting from 1666, when Francesco Redi first observed that the electrical current produced by the electric eel originated within a specific muscle, a number of experiments have been conducted to study the electrical properties of bio-signals. A group of muscle fibers, called a motor unit, is innervated by a motor neuron which gets activated during a muscle contraction due to transmission of electrical impulses. This produces a slight voltage called action potential in the motor unit. When a series of adjacent motor neurons get activated, there is a train of electrical impulses resulting, which consequently creates a motor unit action potential (MUAP) train. Addition of several such MUAP trains comprises an EMG signal. Typically, EMG signals are noted to have voltage strengths generally up to between 50 microvolts to 20 millivolts and a frequency range of 20 to 500 Hz.

Farrell and Weir have proven, that a system can be ideally considered real-time if a time window less than 350 ms is chosen for acquiring and analyzing the data [4]. A balance between classification error and the

controller delay needs to be established by a suitable selection of the window length. It has therefore been found by Smith et al., who studied the effect of time windows on classifying multiple hand gestures, that a window length ranging between 150 – 250ms is optimal for best results [12]. In accordance to that, a data frame length of 256 samples has been chosen to perform all the analysis in the experiments reported here.

SEMG has been analyzed by a number of researchers in order to study its properties and use it in development of various prosthetic controls. Khadivi et al. applied in 2005 higher order statistics on sEMG signals with a multilayer perceptron (MLP) as the classifier for elbow and wrist gestures with a considerable accuracy [6]. Khokhar et al. reported 2010 similar experiments applying three feature extraction techniques - namely root-mean-square, auto-regression model coefficients, and Waveform Length and Support Vector Machine classifier on four channel sEMG data for real-time classification of wrist gestures [7].

Naik et al. developed a system to recognize three gestures by separating the sEMG signals by principles of temporal de-correlation source separation (TDSEP) BSS [10]. The input signals constituted of four channels of the sEMG recordings and four muscles related to the hand movement. The classification was implemented by applying a neural network using the back-propagation algorithm. Although the system achieves accuracy in the order of %, it does not work continuously in a real-time mode and needs automation of the semi-blind operation.

However, end-to-end control systems with real-time gesture identification and – in particular – its implementation by a wheel chair with commendable accuracy are very limited. There is an obvious demand for such systems to be used also in the field of prosthesis and robotic industry.

2. METHODOLOGY

The system developed in this investigation comprises of five key stages for processing of the sEMG data (Fig. 1): signal acquisition, muscle onset activation detection, feature extraction, gesture classification, finally a wheel chair control system.

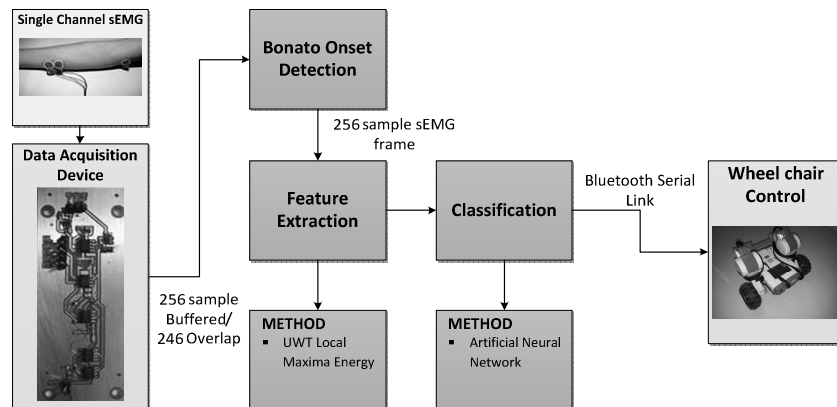


Figure 1. System block diagram of the real-time sEMG gesture classification system

In the processing flow, the first 256 samples are analyzed by calculating the baseline variance and capturing the wavelet decomposed noise profile. Preceding data frames are then evaluated, one after another, for a set of conditions which – when met a dynamic muscle contraction – is identified and the frame is passed onto later stages for further analysis. The next step is to classify the most prominent characteristic features using a supervised pattern recognition stage. Following this stage, the system is reverted back to its initial phase and the process repeats until an application abort command is issued.

2.1 SEMG Data Acquisition

In order to acquire sEMG signals generated by muscle activity, Ambu Blue Sensor Electrodes were sited on the forearm of the hand near to the elbow (as can be seen in the top left corner of Fig. 1). A bio-amplifier with a gain of 1000V/V was designed (shown in bottom left corner of Fig. 1) to amplify the recorded

potential, whose magnitude is inherently small, such that the signal occupies the polar range of the A/D converter ± 1 V. An instrumentation amplifier, which is used as the input stage, provides adequate input impedance when combined with the high impedance of the human skin, resulting in best SNR. The amplified signal is then fed through a simple band-pass filter, designed to eliminate any out-of-band noise prior to digitization. Butterworth coefficients were chosen due to their smooth pass band response, which suppresses artifacts in frequency domain analysis.

2.2 Muscle Onset Detection

2.2.1 State Machine Mechanism for Detecting Muscle Activity

In this phase, the system decides upon the “fate” of the sample frame under question. If the flag for previous muscle onset detection is not found, the data frame is investigated for any muscle activity. Otherwise, the onset flag is changed to a true state and the corresponding data frame is directed to the feature extraction stage. Meanwhile, subsequent frames are constantly tested to find the instant at which the muscle activation ceases to exist, until the onset found flag is set true. The extension (or relaxation) flag is then set true, resetting the onset found flag false and the classifier gesture flags are examined assuming the inverse gesture to have occurred. The flag is reset to false when the extension operation is passed to the classifier. In simpler terms, this stage involves finding the data frame comprising the initial point of muscle contraction, and passing this frame onto further stages for analysis. This can be accomplished either by determining a threshold or by a statistically optimal decision. G. Staude et al. compared these two approaches, concluding that a statistical method, whilst extremely robust, exhibits significantly greater computational burden [13]. Out of the tested threshold-based methods, the approach of Bonato et al. [2] outperformed both, the Hodges and Bui [5], as also the Lidieth [8] methods. Based on this, Bonato processing was chosen for this project.

2.2.2 Detection Method of Bonato

In the Bonato method an adaptive whitening filter is generated from the current frame of sEMG samples. On assessing the baseline variance from the first 200 samples, a test function then adds the squares of two consecutive time samples, and then divides this summation by the estimated baseline variance:

$$g_k = \frac{1}{\sigma^2} (y_{k-1}^2 + y_k^2) \quad (1)$$

where σ^2 = base line variance, and y_k = sEMG data samples.

The initial muscle onset index t_0 is found by implementing a decision rule:

$$t_a = \min\{k = 1, 3, 5, \dots : g_k \geq h\} \quad (2)$$

where h = user defined threshold value.

t_a accepts the onset detection has occurred, only if the following two rules apply:

- When n out of m successive samples must exceed the threshold h , and this active state lasts for at least TI samples.
- The raw EMG signal must exceed the previously estimated baseline variance in successive samples for a designated time period, for a muscle activation to be considered to have occurred.

2.3 Feature Extraction

Feature extraction is a dimensionality reduction technique to recognize the essential characteristics of a particular set of data ideally by eliminating redundant features. In this case, appropriately identifying and pre-defining those features, which can be used to categorize different gestures, is of utmost importance. Here, the feature taken into account is wavelet singularity.

2.3.1 Empirical Noise Reduction Method

It has to be noted in this context that noise and artifacts may be incorrectly identified as a singularity point. Therefore, it is essential to diminish this noise and background activity due to the recording equipment or resting muscle activity. Andrade et al. proposed an empirical method as capturing a background activity profile and subtracting this profile from the relevant sub-frequency band [1]. When the system initializes and

captures the baseline variance used in the onset detection stage, this identical data frame is then passed to the noise reduction stage and the wavelet coefficients are calculated. When the onset stage deems to have detected muscle activation, the relevant data frame is also decomposed into wavelet coefficients. This returns five noise profiles that are calculated from the separate frequency sub-bands and five dynamic contraction data frames that are calculated from the relevant sub-bands. The noise profile coefficients are then simply removed using a threshold calculated from the noise profile and subtracted from the sEMG decomposition. When a finger extension is detected, the noise profile is once again calculated to be ready for the next onset processing, while regarding any change in noise profile due to fatigue over time is accounted for.

2.3.2 Wavelet Singularity

Use of wavelets for feature extraction and analysis purposes is meanwhile a standard in many research fields. Owing to their ability of analyzing non-stationary and random signals such as sEMG, wavelets are simultaneously used to isolate signal energy in both, the time and frequency domain. Discrete wavelet transform converts the original time domain signal into a wavelet base space. The signal is repetitively filtered with a high pass (D_j) and low pass filter (A_j), split down the center in the frequency domain and then down sampled by 2. This splitting effect is referred to as approximation and detail of a signal. Mathematically, it can be expressed as:

$$A_j = H \langle A_{j-1}[n] \rangle = \sum_{k=0}^{L-1} h[k] A_{j-1}[2n-k] \quad (3)$$

$$D_j[n] = G \langle D_{j-1}[n] \rangle = \sum_{k=0}^{L-1} g[k] A_{j-1}[2n-k] \quad (4)$$

where $A_0[n]$, $n=1,2,3,\dots,L-1$ is the original time domain signal whilst $g[n]$ and $h[n]$ are associated with the wavelet function $\psi(t)$ (detail) and scaling function $\varphi(t)$ (approximation) through the inner products resp.:

$$h[n] = \langle \varphi(t), \sqrt{2} \varphi(2t-n) \rangle \quad (5)$$

$$g[n] = \langle \psi(t), \sqrt{2} \psi(2t-n) \rangle \quad (6)$$

The most useful information of the MUAPs, which are located at a greater distance from the recording electrode, will lie in lower frequency components of the sEMG, while the most significant information of MUAPs closer to the detection electrode would lie in comparatively higher frequency spectrum and have higher amplitude. The distinct MUAP, out of which the SEMG signals are composed, be detected from the presence of singularities. The wavelet transform detects a singularity points as local maxima, $Wf(s, x_n)$, at finest scale, which can be described mathematically as follows:

$$Wf(s, x_{n-1}) \langle Wf(s, x_n) \rangle Wf(s, x_{n+1}) \quad (7)$$

Singularity, in broad sense, may be defined as a point at which the properties of the pertaining function tend to show exceptional (or unusual) values. Wavelet singularities are defined by Mallat et al. [9] as points, where maxima can be seen to have occurred in all scales of the wavelet decomposition. In other words, for a singularity to be accepted by the system, a peak must be observed in all wavelet scales – ranging from the finest to the coarsest – at the same instant in time. The algorithm developed by the SECE biosignals laboratory at RMIT University [11] calculates over the dyadic scales given by 2^S , where $S = 1, 2, 3, 4, 5$.

2.4 Artificial Neural Network as Classifier Stage

From an engineering perspective, neural networks have two key objectives. These can function as nonlinear adaptive filters and as pattern classifiers. Just like its biological counterpart, an artificial neural network is a very robust system in the sense that every parameter is altered through its processing and it is implemented to solve the problem in a fashion. This stage is termed as the training stage. An artificial neural network is constructed by an organized step-by-step process that achieves a condition generally called the learning rule. The input/output training information is essential for these networks as it transmits the data that is required to determine the most favorable working point. Furthermore, its nonlinear nature makes neural network processing components a very adaptable method.

The ANN implemented in this real-time system here is composed of 5 input nodes, 36 hidden nodes, and further 26 hidden nodes, which are finally connected to the 4 output neurons. The training and testing was performed using a momentum with a learning rate of 0.05 to reduce the likelihood of local minima.

2.5 Wheelchair Control System

For the experimental realization of the last building block in the end-to-end bio-signal application here, a miniature wheel chair system was built by using LEGO Mindstorms NXT kit (shown on the right side corner of Fig. 1). This hardware unit is controlled through a Bluetooth (BT) serial link. After initialization, direct commands are issued according to the output state of the classifier stage. The BT telegrams take the form of:

- Byte 0, Length LSB (Length of the telegram)
- Byte 1, Length MSB (Always 0x00)
- Byte 2, Command type
- Byte 3: Command issued
- Byte 4 → N, Command or Reply
- The maximum command telegram size is 64 bytes

3. EXPERIMENTAL REALIZATION

Several aspects may alter the collected sEMG recordings. For example, it is essential for muscle contractions to have an optimal level as an insufficient contraction may be difficult to recognize. The electrodes need to be placed at certain spots where there is a fairly thin layer of body tissue to exclude tempering of higher frequency signal data. Additionally, any hair on skin or sweat could influence the signal fidelity. Therefore, the site of the placement of electrodes has to be shaved and scrubbed in order to get rid of any hair or dead skin layers, followed by elimination of any moisture content using an alcohol solution.



Figure 2. Five hand gestures used as system input as control

The experiments on recognition reliability were carried out on one able-limbed subject representing a best case scenario for an amputee, using only a single channel of sEMG data (sampled at 1024Hz, pre-filtered between 20-500Hz). The electrodes were placed on the inner side of the upper forearm. The patient was asked to perform 5 basic hand gestures corresponding to the contraction of all fingers, thumb, index, and ring respectively and opening the fist as shown in Fig. 2. The training set included 45 repetitions of each gesture totaling 225 individual dynamic contraction frames. These frames split into sub groups, 70% used for training, 15% verification, the final 15% used in testing the training within Matlab.

Once trained the subject was asked to perform the finger gestures 30 times each, totaling 150 gesture inputs, cycling through them one at a time, having a small rest between contractions to lessen the impact of background activity due to fatigue.

Finally, for the wheel chair control, the gestures shown in Fig. 2 correspond to the certain movements:

- Gesture 1: All fingers → Reverse
- Gesture 2: Thumb → Right
- Gesture 3: Index → Left
- Gesture 4: Pinky → Forward
- Relax state → Brake all motors

4. RESULTS

The standard metric for the analysis of classification systems' binary performance is to calculate the system sensitivity and specificity. Sensitivity is defined as measure of performance to identify positive results. If a thumb gesture input is classified as a thumb, a true positive is registered in the table of confusion seen in Table 1. A test with a high sensitivity has a low type II error (otherwise known as false negative) rate:

$$\text{sensitivity} = \frac{\text{number of true positives}}{\text{number of true positives} + \text{number of false negatives}} \quad (8)$$

Another important attribute of a classifier is its ability to correctly identify negative results. This is referred to as a systems specificity rating. A system with high specificity is characterized by its low type I error rate:

$$\text{specificity} = \frac{\text{number of true negatives}}{\text{number of true negatives} + \text{number of false positives}} \quad (8)$$

True positives refer to “gesture A” correctly being identified by training the system as “gesture A”. False positives refer to “gesture B” incorrectly being identified as “gesture A” by training the system. True negatives refer to “gesture B” correctly being identified by training the system with only “gesture B”. False negatives refer to “gesture A” incorrectly being identified as “gesture B” by the system.

Statistical analyses of the experimental results obtained are tabulated in Tables 1 and 2 below. It can be observed that the best classified gestures are the “index finger” and “all fingers” gestures, followed by “thumb” and “pinky” contractions which have been misinterpreted once each during the overall experimentation. The overall classification accuracy is calculated to be approximately 99%.

Table 1. Confusion Matrix of raw experimental data collected from one able limbed patient

| | | output class | | | | | |
|-------------|--------------|--------------|-----------------|--------------|----------------|-------------|-----------------|
| | | <i>thumb</i> | <i>index</i> | <i>pinky</i> | <i>all</i> | <i>open</i> | mean |
| input class | <i>thumb</i> | 29 24.17% | 1 0.83% | 0 0.0% | 0 0.0% | 0 0.0% | 96.67% 3.33% |
| | <i>index</i> | 0 0.0% | 30 25% | 0 0.0% | 0 0.0% | 0 0.0% | 100% 0.0% |
| | <i>pinky</i> | 0 0.0% | 0 0.0% | 29 24.17% | 1 0.83% | 0 0.0% | 96.67% 3.33% |
| | <i>all</i> | 0 0.0% | 0 0.0% | 0 0.0% | 30 25% | 0 0.0% | 100% 0.0% |
| | <i>open</i> | 0 0.0% | 0 0.0% | 0 0.0% | 0 0.0% | 30 25% | 100% 0.0% |
| | mean | 100% 0% | 96.78% 3.23% | 100% 0% | 96.78% 3.3% | 100% 0% | 98.67% 1.33% |

Table 2. Overall classification results in %

| Sensitivity | Specificity | Mean accuracy |
|-------------|-------------|---------------|
| 98.67 | 98.35 | 98.67 |

Fig. 3 shows the user interface displaying the operation of the real-time classification. Herein, various sections are included: the raw EMG recording signal, the EMG window frame currently being analyzed, graphical representation of the ANN, a scalogram to denote the scale of wavelet decomposition, and a photo corresponding to the gesture identified. Fig. 4 finally shows the operation in the wheelchair application.

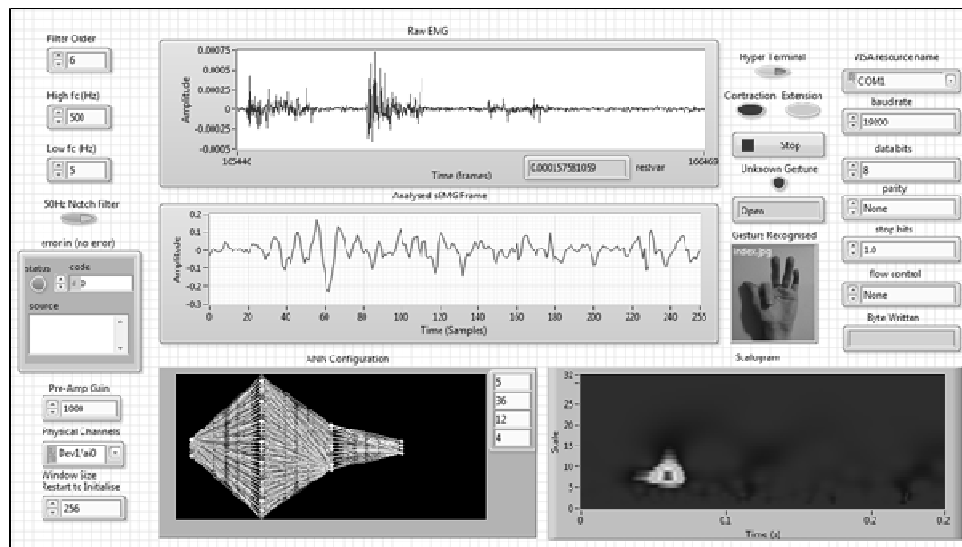


Figure 3. Graphical user interface of the real-time sEMG classification system

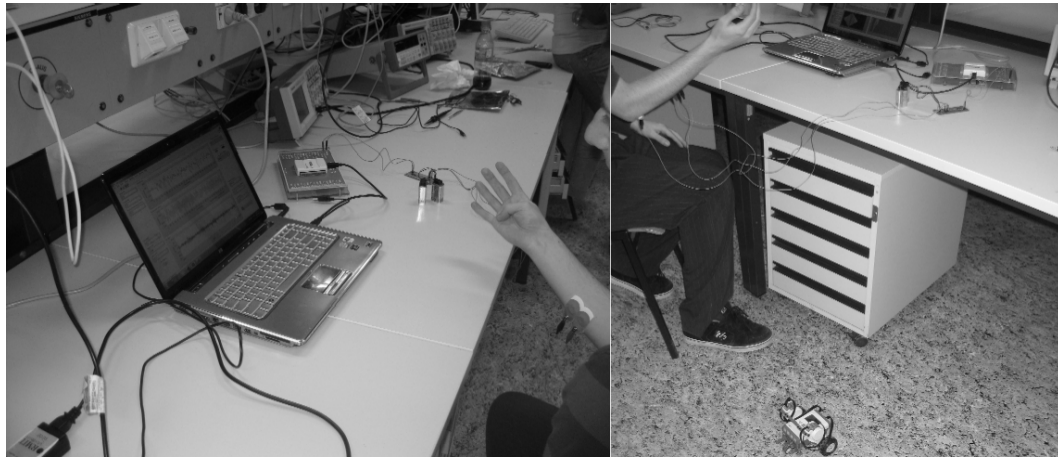


Figure 4. System under operation with miniature wheelchair: left picture shows training phase, right picture shows wheelchair under real-time control by finger gestures

5. DISCUSSION

Experimental results have not only proven the validity of the real-time system with successfully implemented algorithms, but also tested the efficiency of the bio-amplifier built for the purpose of acquiring sEMG signals. This research reports the novel use of wavelet singularities in order to estimate the spectral and amplitude characteristics of a MUAP during dynamic muscle contraction. The authors would like to further improve the system, in the next stage, by conducting more experiments on a multitude of subjects in order to verify expected inter-subject variability. The target users of this system are amputees, who can independently control the operations of their wheel chair by themselves, typically through the use of a chin joystick control. The wheel chair control system works on single channel myoelectric data enhancing its ease of use reducing electrode placement complications. This concept can therefore be used as a Universal control system in various applications of robotics, prosthesis and human computer interfacing.

6. CONCLUSION

Numerous papers exist in literature, which have attempted to identify hand and body gestures from sEMG recordings, but all come with low reliability, presumably due to low SNR and substantial cross-talk between different, simultaneously active muscles. However, the experiments performed here on a sufficiently large set of data confirm a successful classification of various individual finger gestures. Furthermore – unlike most analogous systems – this approach presents an end-to-end solution from amplifier hardware for sEMG signal acquisition to analysis software for a wheel chair control that is optimized towards real-time performance and sensitivity. The scope of this system could be further extended for a wider range of precise finger and wrist movements in order to be used, e. g., to control prosthetic limbs to help the disabled or in application as alternative HCI devices. Furthermore, the concept can also be used to retrieve feedback from the robotic limbs and support online learning capability to make it more suitable for real-world applications.

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MINING AND FILTERING HIDDEN ASSOCIATION RULES

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ABSTRACT

Traditional association rules are useful to discover potentially interesting patterns in databases, but the discovery of infrequent/rare patterns is difficult (if not impossible) because in most cases infrequent patterns are hidden from the traditional definition of association rule (AR). The anomalous association rules (anomalous rules) are association rules representing a rare and uncommon behavior that deviates from a frequent common pattern. In this paper, we develop filtering techniques, to discover compact and significant anomalous rule-sets. Moreover, in addition to reduce the number of anomalous rules obtained, the approach proposed can be parallelized immediately. Furthermore, the rules obtained can be found useful in Web Mining, social networks mining, bio-surveillance, credit screening, and any application that requires the identification of rare and significant patterns. This approach substantially reduces the number of rules obtained in about 97%. In addition to reducing the obtained rules, the approach can be applied to knowledge discovery of full-correlated rare patterns.

KEYWORDS

Association, patterns, rules, anomalous, filter, databases.

1. INTRODUCTION

The association rules mining (Agrawal, et al. 1993, Ceglar & Rodick 2006) is an active research topic, the range of applications are from market basket analysis (Ashoka, et al. 1995) to early warnings in the food's supply networks (Beulens, et al. 2006). Traditional association rules are useful to discover potentially interesting patterns in databases, but in some cases there are millions of rules to be analyzed, and the discovery of infrequent/rare patterns is difficult (if not impossible) because in most cases infrequent patterns are hidden from the traditional definition of association rule (AR).

The infrequent patterns remains hidden to the traditional ARs, because the very nature of a rare pattern. That is, occurs sparsely, and in a few transactions in a database. Since the ARs discard rare items a-priori, then becomes impossible to detect it.

Many approaches has been proposed to discover infrequent patterns (Balderas 2010, Bezerra, et al. 2009, Das & Schneider 2007, Koh & Rountree 2005). To discover infrequent patterns, a method needs to consider items that are present in a very low percentage of the database transactions, and thus implies the generation of bigger data structures and many false-positive, that is, items that appear together in a database only by chance.

In this paper, we develop filtering techniques, to discover compact and significant anomalous rule-sets. Moreover, in addition to reduce the number of anomalous rules obtained, the approach proposed can be parallelized immediately. Furthermore, the rules obtained can be found useful in Web Mining, bio-surveillance, credit screening, and any application that requires the identification of rare and significant patterns.

The anomalous association rules (anomalous rules) are association rules representing a rare and uncommon behavior that deviates from a frequent common pattern. Anomalous rules are found useful to detect rare patterns in real databases from the agriculture and clinical domain (Balderas 2010).

The paper is organized as follows; a brief revision of related work is presented in Section 2. Definitions of anomalous rules, filters and constraints are presented in Section 3. The algorithms are described in Section 4.

Experimental results using datasets from UCI Machine Learning are illustrated in Section 5. Finally, we present the conclusions in Section 6.

2. RELATED WORK

Recently, different approaches related to rare pattern detection have been presented. The work of Das & Schneider (2007) present the detection of anomalous records in databases, the approach uses marginal distributions at attributes subsets. The research work of Koh & Rountree (2005) defines sporadic rules as association rules with low support and high confidence. The work of Yun, et al. (2003) defines a measure of relative support to identify significant rare patterns. The research of Nguyen, et al. (2009) presents the detection of rare patterns in multidimensional datasets.

On the ruleset reduction topic, the work of Goethals, et al. (2005) present non-derivable association rules, to avoid redundant/derivable rules. They show that 99% (depending the case) of the traditional association rules are redundant/derivable. The work of Webb (2006) illustrates the extraction of significant rules and shows the importance of statistical tests to avoid false discoveries.

Through the next sections we will define our proposal and in a later section we discuss the experimental results of the proposed combination of filters.

3. DEFINITIONS

Let $I = I_1, I_2, \dots, I_m$ be a set of binary attributes called items. Let T be a database of transactions. Each transaction t is represented as a binary vector, with $t[k] = 1$ if t contains the item I_k and $t[k] = 0$ otherwise. The database contains one tuple for each transaction, therefore a transaction t contains X (a set of some items in I) if for all items I_k in X , $t[k] = 1$.

A canonical anomalous association rule (CAAR), it is an associative and implicative pattern of the form $X \Rightarrow A_j | Y_i$, where X is a set of some items in I , and A_j and Y_i are single items in I that are not present in X . The confidence factor of rule $X \Rightarrow A_j | Y_i$ is obtained by the percentage of transactions in T that contains $X \neg Y_i$ and also contains A_j . Then, the support and confidence of a rule is given by $conf(X \Rightarrow A_j | Y_i) = Pr(A_j | X \neg Y_i)$, $supp(X \Rightarrow A_j | Y_i) = Pr(A_j X \neg Y_i)$.

The support of an itemset X is the number of transactions in T that contains X . The support corresponds to a measure of statistical significance, while confidence corresponds with the strength of the implication.

Let X be an itemset, $X + H$ is an extension of X iff $X \cap H = \emptyset$, and we write it XH .

A general filter over CAARs is defined to preserve general rules, let a rule be $X \Rightarrow A_j | Y_i$, therefore every rule with antecedent extensions is pruned, that is, every rule $XH \Rightarrow A_j | Y_i$, this filter will be called AP.

A significance filter is defined using the conditional probability, let a rule be $X \Rightarrow A_j | Y_i$, then the rule's significance is given by the percentage of transactions that contains A_j and also contains $X \neg Y_i$, this filter will be called SIG.

$$SIG(X \Rightarrow A_j | Y_i) = Pr(A_j X \neg Y_i) / Pr(X \neg Y_i)$$

A certainty filter is defined adapting the certainty factor interest measure to the case of CAARs, this filter will be called CF.

$$CF(X \Rightarrow A_j | Y_i) = \frac{conf(X \neg Y_i \Rightarrow A_j) - supp(A_j)}{1 - supp(A_j)}, \text{ iff } conf(X \neg Y_i \Rightarrow A_j) > supp(A_j)$$

$$CF(X \Rightarrow A_j | Y_i) = \frac{conf(X \neg Y_i \Rightarrow A_j) - supp(A_j)}{supp(A_j)}, \text{ iff } conf(X \neg Y_i \Rightarrow A_j) < supp(A_j)$$

$$CF(X \Rightarrow A_j | Y_i) = 0, \text{ iff } conf(X \neg Y_i \Rightarrow A_j) = supp(A_j)$$

Finally, to identify CAARs supported in the same transactions in T , we define a filter that we will call IDENT, this definition is as follows; let two CAARs be $X \Rightarrow A_j | Y_i$ and $V \Rightarrow A_j | Y_i$, if $supp(A_j VX) = supp(A_j X \neg Y_i)$ and $supp(A_j VX) = supp(A_j X)$, and the support of both rules is the same value. Then those rules relates to the same transactions, that is, they are correlated.

3.1 Constraints

To provide a concise anomalous ruleset, we use minimum thresholds as follows; a minimum confidence threshold provides a measure of the strength of the association, a minimum support threshold provides statistical significance to the obtained pattern, an absolute minimum threshold avoids the extraction of very low support patterns (supported by one or two transactions in T), a minimum attribute domain threshold (in the case of relational databases) provides a hidden pattern and avoids to obtain a binary election, and a minimum significance threshold that provides a measure of the strength of the anomalous pattern obtained.

$$\begin{aligned} \text{conf}(X \Rightarrow A_j | Y_i) &\geq \theta \\ \text{conf}(XY_i \Rightarrow \neg A_j) &\geq \theta \\ \text{minSupp}(X \Rightarrow A_j | Y_i) &\geq \epsilon \\ \text{absMinSupp}(X \Rightarrow A_j | Y_i) &\geq \omega \\ \text{minDom}(X \Rightarrow A_j | Y_i) &\geq \beta \\ \text{minSig}(X \Rightarrow A_j | Y_i) &\geq \gamma \end{aligned}$$

4. ALGORITHM

To obtain CAARs an association rule algorithm can be modified. We use a vertical mining approach, in which every itemset of level k (k -itemset) is stored in a tree-like structure. Within each k -itemset we stored a bitset representation of the transactions in which they appear.

We divide the process of extraction of CAARs in three stages; in the first stage, we obtain the k -itemsets using the minSupp threshold and the absMinSupp threshold. At this stage the tree-like structure is constructed as is shown in the figure 1. In stage two we obtain association rules and canonical anomalous association rules, at this stage some filters (SIG, CF) can be applied. In stage three we perform the filtering, grouping and ranking.

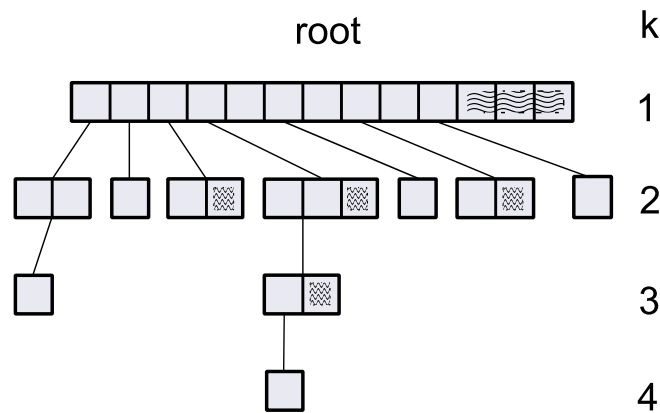


Figure 1. Tree-like data structure to store k -itemsets.

The computational most intensive stage is the first one. In this stage the algorithm must obtain the support of every k -itemset, this process is in general described as follows;

```
supportEx{
  tree.start(minSupp,absMinSupp, minDom)
  tree.generateRoot()           // generate the 1-itemset
  while(k <= userLimit && LB!=empty){
    tree.reorderLB()           //reorder-prune last branches using absMinSupp
    tree.copyLB()              //copy last branches one level down
  }
}
```

The process described in the above pseudo-code, can be interpreted as follows; first, with a database scan generate the 1-itemset. Second, prune patterns using the minSupp threshold and the absMinSupp threshold, then put the k-itemsets under minSupp at the end of each branch (re-order). Third, copy items in the last branches to generate (k+1)-itemsets. The transactions in T are stored using a bitset representation, therefore the support count of every k-itemset is obtained using bit-wise operations.

The stage two is performed to obtain canonical association rules and canonical anomalous association rules. To perform this task we use a traditional approach, that is, evaluate each k-itemset with the confidence measures and using the respective thresholds.

The third stage performs the filtering process, in the case of the SIG and CF filters, we evaluate for each rule. In the case of the AP and IDENT filters the process iterates through the groups (cores) formed by the consequent parts of each rule.

In the next section we provide further information about the order in which the filters are applied, and we present general results and discussion.

5. EXPERIMENTAL RESULTS

We perform the tests using a laptop with a Turion II Ultra processor (M600) and 4GB RAM. We implement the algorithm in Java, and we use several datasets from the UCI Machine Learning Repository to perform the tests. Two private datasets (disc_bdst, disc_cornhv1) are from the Agriculture Research domain and one dataset is from the Medical domain (surgeries).

We perform the tests using the following minimum thresholds; minDom = 4, absMinSupp = 3, minSig=1/4, minSupp = 1% and 10%, minConf= 75% and 90%. The figures 1 and 2 shows the results of the tests, we encoded the minSupp and minConf thresholds within the dataset name, and we indicates with the “disc” prefix where a dataset has been discretized (five bins equi-depth) into categorical values.

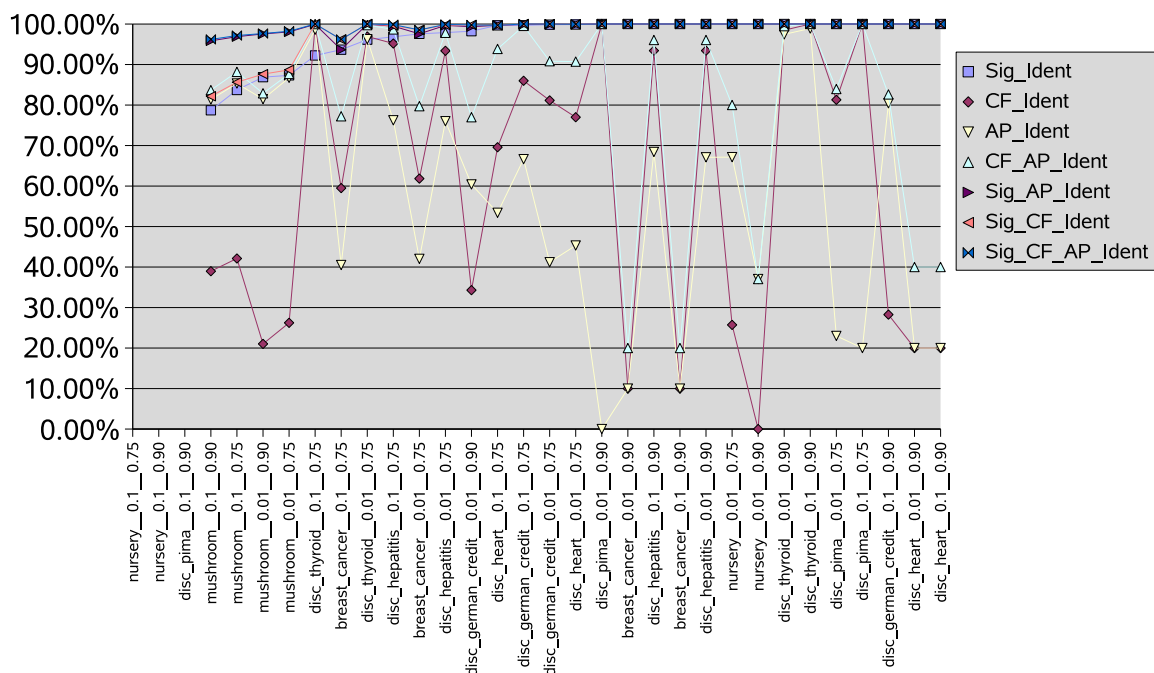


Figure 2. Percentage of reduction of CAARs, applying filter combinations. Vertical axis corresponds with the reduction percentage.

The figure 2 and 3 illustrates the ruleset reduction percentages we obtain related to different filter combinations. In general, we observe that the SIG and IDENT filter combination is effective in all cases, and as expected with the combination of the four filters we obtain the maximum reduction percentage.

The results indicates that many of the obtained CAARs are uninteresting rare patterns, since the SIG filter contributes to the strength of the mined rule, and the IDENT filter avoids duplicated rules (supported by the same transactions), the CF filter provides that the obtained pattern is certain and interesting, and with the AP filter we keep the most general rules. Therefore, with the use of the four filters we obtain a concise and significant ruleset.

Moreover, the SIG and CF filters can be applied in the rule generation process, and the overhead is minimal because the required values are stored in the tree structure. Then the overhead is caused by the evaluation of the respective formulae.

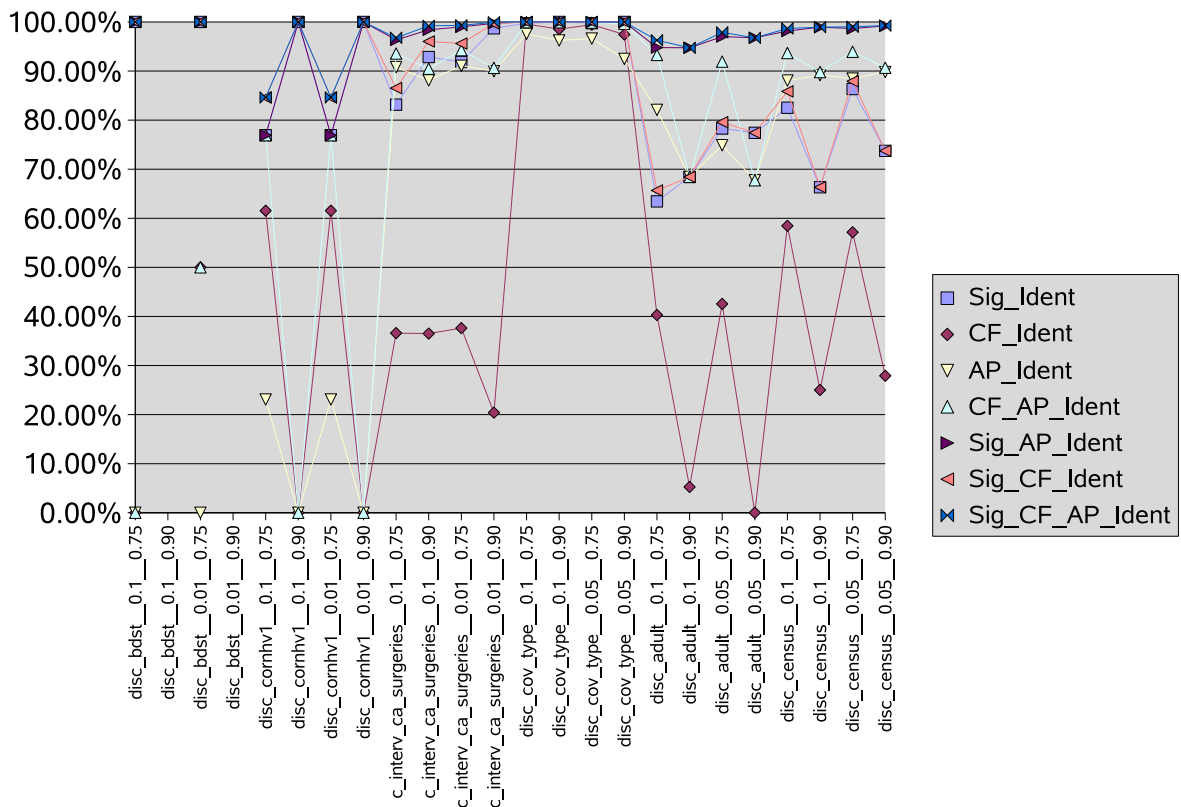


Figure 3. Percentage of reduction of CAARs, applying filter combinations (cont.). Vertical axis corresponds with the reduction percentage.

The AP and IDENT filters are applied in the last stage of the CAARs extraction process. These filters works through groups of rules, and such groups (that we will call cores) are formed naturally by the consequents of the rules. Therefore, a core is a set of CAARs that share the same consequent items. Then, an expert can work with cores and rules, the overhead caused by processing cores is reduced is we use parallelism (cores are independent from each other).

The IDENT filter provides with pruning of overlapped rules, but this fact indicates a correlation between CAARs and therefore the correlated rare patterns can be found useful; to build long rare patterns, to provide insight and so on.

In the table 1, we present the filter combination related to the datasets in which the rule reduction was high. The table is presented for information resuming purposes.

Table 1. Datasets grouped by filter's combinations (high reduction).

| SIG and IDENT | CF and IDENT | AP and IDENT |
|---|------------------------------|---|
| Mushroom, thyroid, german credit, heart, pima, hepatitis, breast cancer, cov_tupe, Census | Thyroid, hepatitis, cov_type | Thyroid, mushroom, surgeries, cov_type, census, adult |

The table 1 indicates that quantitative rule reduction is achieved by the SIG filter, whose threshold was set to 0.25 for all tests. The AP and IDENT filters contributes effectively to the reduction of the rulesets, the SIG_IDENT filter combination is better on dense dataset like Mushroom and big datasets like Census or Cov_Type, the AP_IDENT filter combination is better on datasets like Adult, Census and Cov_Type. Finally with the use of the four filters we achieve a ruleset reduction percentage of about 97% in almost all cases.

6. CONCLUSION AND FUTURE WORK

We investigated the problem of filtering Canonical Anomalous Association Rules, to obtain a compact, interesting and significant ruleset. Our approach uses the adaption of interest measures like Certainty Factors and Confidence Factors together with the Occam's razor (AP filter) and the identification of overlapped (IDENT filter) canonical anomalous association rules. This approach substantially reduces the number of rules obtained in the small and big datasets in about 97%. In addition to reducing the obtained rules, the approach can be applied to knowledge discovery of full-correlated rare patterns. Our approach, provides ease of parallelization of the filtering process. The obtained rules can be used in credit screening, network intrusion detection, bio surveillance, and any application that takes advantage of infrequent and rare patterns.

There are many issues to further study; the development of an interactive filtering system, the development of efficient parallel algorithms for extraction and filtering, the development of overlap/correlation measures among the obtained anomalous rules, are some topics for future research.

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Short Papers

EXPERIMENTAL STUDY ON EDUCATION METHODS IN EHEALTH

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ABSTRACT

The article presents author's experimental study on the desires and motivations of students in choosing educational standard – in physical environment or in unconventional (electronic distance format) version, both offered in Department of “Biomedical Sciences” at NBU.

Its purpose is to prove that teaching in the lecture hall can be enriched, diversified and improved mainly through electronic forms of communication such as email, Skype, video-conference, video telephones and other web-based solutions. For the purpose of the study we have surveyed 38 students from the Department's Programs. In order to make juxtaposition with the subject area, where our students are taught we would present an authorship comparative analysis between eStudent and ePatient.

KEYWORDS

eLearning, ePatient, experiment, IP videophone, survey.

1. INTRODUCTION

There are known over 15 definitions, including the Ordinance on state requirements concerning the organization and implementation of distance learning (DL) in higher schools in BG. It reflects the need of society, the achievements of communication technology, requirements and specifications of methods of training and some national traditions.

The English term “on-line learning” is translated as “training using various technical means for transferring information from teacher to student and vice versa.”

Generally, distance education can be described as training in which students are in a different location than the teacher and communicate with each other via computer or other communication means. In order to clearly define the term, we have performed a detailed literature review of definitions and principles for distance learning and extracted the following definitions as general:

"Distance education is set of instructions, performed through print or electronic media to the person who is trained in a different place and time from the teacher or other learners".

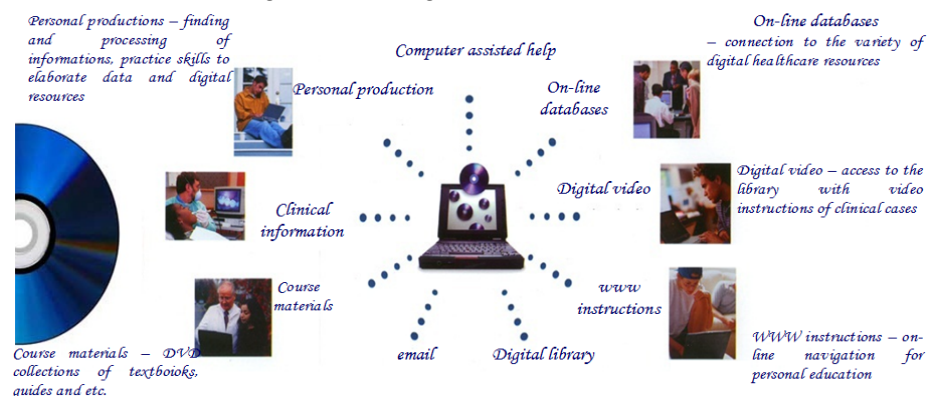


Figure 1. Digital versions of eHealth education

"We have distance education and teacher, when students are physically separated and communicate through technology (sound, picture, print media, etc.), but often in combination with direct communication". It can be realized through:

Synchronous Technology

- Telephone
- Videoconferencing and IP video phones
- Web conferencing

Asynchronous technologies

- Audiotapes
- E-mail
- Forums
- Printed materials
- Voice Mail / Fax
- Video
- Electronic Media - CD, DVD, flash drive

Under electronic training devices we mean audio and video materials, electronic mail, network calls, teleconference and the Internet.

2. BODY OF PAPER

New Bulgarian University was established on September 18, 1991 by decision of the Grand National Assembly. On July 5, 2001 NBU received institutional accreditation from the National Agency for Assessment and Accreditation for a maximum 5-year period and in December 2006 received institutional accreditation for a maximum period. In 2004, the NBU is accredited by The Open University in Great Britain. The University in Bulgaria introduces first credit system, the teaching of professional degrees, bachelor's and master's degree, distance and continuing education.

Biomedical Sciences Department was established on 27th October 1994 at the Constituent Assembly of the initiators'. In the beginning the department developed courses for a two-semester and short-term intensified training, for post-graduate specializations and qualification. Later it introduced the Bachelor Program "Health Care Strategies and Management" and the Master Program "New Public Health Care", and afterwards the Bachelor Program "Natural Sciences". In 2003, the department introduced Bachelors Degree Program "Computer Technologies in Medicine", Masters Degree Program "Computer Technologies in Biomedicine" and Doctoral Degree Program "Computer Systems and Technologies in Medicine".

During the summer of 2011 in NBU was organized Workshop with several type of participants and purposes:

1. Didactic experiment "on-line learning" in synchronous and asynchronous version
2. Survey
3. Discussion on prophylactic telemedicine with the participation of "EAD Electron Progress"
4. Competition with prizes between participants, who presented selected "case studies"
5. Producing a new didactic tool CD "Preventive telemedicine"

The experimental setup included the following steps:

- I. Presentation of three lectures - on selected interdisciplinary topics - in front of the audience during the term or public presentations of a single author – lecturer
- II. Pre provided electronic versions at three different locations and with different media as indicated per each lecture:
 - a) In eLearning environment MOODLE NBU, located at <http://e-edu.nbu.bg>, where selected students had access to the same lectures as well as group support and relevant materials
 - b) <http://eprints.nbu.bg> - scientific electronic archive of NBU
 - c) target – thec. group - the same products were sent to a special ad hoc
 - d) e-mail - experiment_nbu@abv.bg
- III. Repeated physical presentation - directly re-teaching during the experiment, after being read by students in their own selected distance mode.



Figure 2. IP video telephone

IV. IP video telephones - firstly presented as a method of teaching in NBU)

IP is a high tech videophone communications service next generation, providing opportunities for high quality calls at low cost through Internet Protocol. It combines the advantages of traditional telephone service and Internet technology to provide new features and competitive price.

Voice over IP, or so called IP phones are intelligent devices with their own processor and memory and most of them can open multiple Fig.2. IP video telephone connection on 27.07.2011 in NBU.

Independent connections to the IP phone server that allows for conference calls with more than two people, and acceptance / transfer of several pending calls.

For optimal performance of the various presented electronic methods during the experiment, the students had been demonstrated a lecture and IP video telephones. The lecturer was situated in his office at the computer whose screen presentation ran and passed the microphone to lecture videophone, shot from his camera. The other two videophones were placed in two separate classrooms, where students only hear and see the speaker, without presenting the material.

The experimental IP video telephones were installed and provided from "Electron Progress" EAD. The company currently is a shared capital and is registered under the Bulgarian legislation, with the following main activities:

Research, project, design, manufacturing, engineering, development, implementation, maintenance, system analysis, system integration and project management in the areas of: computer technology and systems, radio, telecommunications and information systems, electronic, radar, aerospace, radio navigation systems and automation technology systems; monitoring systems.

V. Survey to determine the most preferred education method.

Academic classes that participated in experimental design are:

(1.) Theoretical and practical aspects of information management - specialized in medicine - pdf + ppt

In electronic version is available in:

- CD "Information management in medicine and health", ISBN -13: 978-954-535-345-7, ed. NBU, 2008, prof.d-r Jivka Vinarova, PhD, DMSc
- DVD Film discography "eHealth" ISBN 13: 978-954-516-910-6, Sofia, 2009, the first movie from lecture presentation CD "Round Table on Information Management"

(2.) Standards for composition of scientific papers along with the "Standard Rules for writing theses and doctoral these"- word + pdf + ppt, prof.d-r Jivka Vinarova, PhD, DMSc

In electronic version is available in:

- At our website - <http://www.nbu.bg/index.php?l=558>, presented in the scientific seminar of our Department.
- In Annual Book IV, 2009, ISBN 978-954-535-344-9

(3.) Profession Medical Informatics – ppt

In electronic version is available in:

- DVD Film discography "eHealth" ISBN 13: 978-954-516-910-6, Sofia, 2009.12-th film – scientific seminar "Profession Medical Informatics" - Prof.d-r J.Vinarova, PhD, DMSC, as.prof. P.Mihova, PhD

Students who participated in the experiment are from 4 different courses, both in theme and in direction - involving colleagues from the Bachelors degree program "Natural Sciences" - II course, students in "Medical cybernetics" - III course, colleagues from 2 Masters degree Programs "Regulations and standards and "Management of health care "

The aim was to report which of the options and remote real teaching - at the workshop - was the most sought after and effective for listeners and how they prefer to study - compared to one speaker presenting (physical contact) or collective pre-lecture presenting (in virtual versions and editions).

The total number of selected for excellent outstanding performance was 38 students. We have developed an authorship questionnaire, in which some of the staging questionnaires were adapted from the Evaluation questionnaire for users of the distance learning module, Consumers and Standards: partnership for a better world and a survey of Concordia University. In order to clarify selected and pre-organized groups of questions, we present some general concepts related to the development of the survey. Author's questionnaire consisted of 27 questions: - 11 menu questions, 14 direct questions and 2 opened.

At the beginning of the project, students were informed electronically about the requirements and design of the investigation, and also about the necessary steps to carry out during the experiment.

If we try to make a sort of parallel between e-learning and e-health - as an option to offer such training, as a kind of health service, we will find a complete matching objectives and technological means.

This finding is sufficient to consider eHealth as a methodology for electronic health education, because the position ePatient (eHealthinsured) can be dynamically turned into eStudent with a personal healthcare self management.

Web-based distance learning and health education both use information and communication technologies, Internet, electronic libraries, databases and knowledge bases. These technologies change the way that health is measured - as a temporary condition that requires investment - expert, financial and educational time.

eStudent and ePatient are in dynamic interaction, because the so called ePatient is actually a health internet user, who searches the web to collect, process and apply findings to his own health. ePatients describe two effects of secure online health advice: more secure health information and services, as well as different (but not always better) relationships with the doctors treating them.

ePatients are extremely active in their own care and display information acquired force, strongly involved in the market for medical services and activities. They are equipped to train the involved, demonstrating a new partnership with medical experts close to the level equals, emancipated and acquire self-confidence "uneducated, but informed and trained for their own health and medical topics." The differences are visible, when comparing to the "classic patient".

ePatients are:

- Informed and motivated to make choices for self-care or to entrust in the hands of selected experts. This is a new model of "individual health management";
- Empowered and mobilized to meet the health attacks and other events;
- Dedicated to own healthcare and invest in it;
- Equal partners with trusted doctors, but always looking for alternative views and methods;
- Sorority citizens who have health attitudes, opinions, expectations and planning their health behavior with the years;
- Trust in social groups of people with their problems and diseases;
- Following developments and believe in rapid progress of medical science, but primarily technical medicine.

Studies show that an increasing number of people describe the Internet as a tool, played a crucial role for their health and medical behavior and fate, helping them at critical moments. The advent of the Internet as a tool for mass health education through training leads to two very important moments - on the one hand many clinicians have underestimated the other - benefits and risks of online resources are overvalued. These social changes are part of life in "digital" or rather "cyber" society. Medical groups and online discussion forums and support posts are a major resource in eHealth and training for large unknown "target groups". This is one of the most important cultural revolutions, driven by technological innovation and solutions in the modern world. Introducing a differentiated characteristic of online users in both their dynamic roles: as a student and patient /or health insured is presented below at Table 1. ePatient vs. eEducation

Table 1. ePatient vs. eEducation

| eStudent | ePatient |
|--|---|
| General parameters | |
| <ul style="list-style-type: none"> • Benefits: students can satisfy their intellectual needs and to improve methods and schemes for decision making, and other technical skills. Change their language skills, have a new virtual community and new authorities for stimulating and studying. • eInformed, who expects to become eKnowing • time management • availability of training resources, additional materials • Quality: the attractiveness of the learning environment - an incentive for learning prestige of modern technology as a teaching tool • changes that accompany it: for the declared purpose of the training, students acquire additional skills such as management web surfing, computer literacy, language and dialogue interactivity, social networking and new partnerships - supporters and colleagues in education • equal access • unconventional and unregulated traffic to specialized training and support materials • individual pace of learning • Government information | <ul style="list-style-type: none"> • Benefits: patients have access to your existing medical and health information, improving the way and quality of life to optimize their health. Monitor and report changes in their health indicators and seek Depending upon the behavior and treatment • eInformed, who is strongly motivated to become more healthy • eInformed, who agrees with the medical decisions • time management • availability of additional sources of specialized medical information • Quality: the attractiveness of electronic environment - an incentive to qualify. Medicine is an attractive area - a new place and occasion for meeting and sharing virtual world has a social role "Agora" - public and not confined • improved PC skills • equal access; reduced inequality in healthcare • unconventional and unregulated traffic access to specialized information, clarity and sense of control over their personal health and its changes, informed consent • individual rate of planned and random information and learning • Government of the personal health and medical information |
| Specialized parameters | |
| Input: unique ID number and password | Log in: |
| Output: evaluation and examination based on knowledge | Output: electronic records, medical records in various forms, medical documents. Opportunity for new advice to new experts and financial transactions remotely initiated by the patient |
| Participants: teachers, students of the course | Participants: other patients with similar problems, other experts |
| Access: anytime, anywhere | Access: anytime, anywhere |
| Discussion forums and groups: create a desired, but important and necessary | Discussion forums and groups: possible participant in the initiative and desire |
| Contact an expert (speaker)-current, very important, regulated | Contact an expert (MD) - possible, planning, often easier than physical |

3. RESULTS

By conducting this experiment, the first of its kind in Department "Biomedical Sciences", we can make the following conclusions:

- a) a new form of preliminary feedback from students who have demonstrated their desire to exploit all available online resources at the expense of attendance hours
- b) first teaching with video telephones with speaker and 2 remote classrooms with audience - students, faculty and guests
- c) inquiry and analysis of excellent working students who were pre-necessarily familiar with the online version of lectures, comparing perceptions with actual classroom offering of the same subjects from the same speaker.

Some statistics: Participated – 38 students; Sample question: Which resource and mode of education you prefer most? - MOODLE - 23%; Scientific Electronic Archive of NBU - 0%; Teleconference - 45%; Mail - 10% and Face to face contact - 22%. 72 % agreed that feel comfortable to communicate electronically; 61% agreed that they can successfully. Manage time, workload and other activities; half of the surveyed students like to work independently – 50% and 56% agreed like communication, interaction and personal contact with their teachers; 50 % agreed that training is the same in the classroom and via the Internet and decisions, but in the same time the same percentage believe that re-referring to material in electronic format will be benefit.

4. CONCLUSION

This experiment allows us to consider that currently we have creative potential, technological equipment and qualified employees with sufficient electronic media - our "electronic library", that allows us to offer to the motivated students better alternatives for modern teaching - classroom and in selected online versions.

We believe that the partnership between the presented two models is an excellent environment for education bachelors and masters degree students and is consistent with the standards of our department and NBU.

Commitment today, the immediate opportunity to access the Web from anywhere in the city and the competence of students ensure that whenever there is desire and need - learning could be achieved with reduced time in the lecture hall. With different technological assistance and committing to visits as much as they choose to acquire, we propose a new trajectory of Education - enriching and expanding the standards and practices utilized to the current moment.

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On-line resources

- <http://bglog.net/Obrazovanie/13374>
- http://doe.concordia.ca/cslp/Downloads/PDF/OnlineInstrument_23Aug04.pdf
- <http://www.nbu.bg/index.php?l=558>, <http://e-edu.nbu.bg> & <http://eprints.nbu.bg>

A DELPHI INVESTIGATION INTO THE FUTURE OF DISTANCE EDUCATION

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ABSTRACT

The purpose of this study is to investigate the views and opinions of distance education experts regarding the replacement of traditional education with distance education settings and the advantages that the application of social and mobile technologies can bring to distance education methods. The Delphi technique was chosen as a method of study. This technique is an efficient and effective group communication process designed to systematically elicit judgments from experts in their selected area of expertise. The 35 experts that participated in the study were asked to rate 16 statements according to what they think will probably happen (probability) and what they would like to see happen (desirability). Findings show that the majority of experts foresee that the use of new technologies will change current educational theories and methodologies, and will have impact on instructor's skills, efforts, feedback and interaction as well as on the process of learning assessment. However, concerning the future of distance learning, participants view a future tendency towards the provision of full online degrees, yet, they are skeptical; stating that distance education setting will not completely replace the traditional educational setting. In addition, findings reveal that experts view the role of social and mobile technologies as facilitators in sharing information in distance education settings, creating an atmosphere of cooperation and easy interaction among users. They assume that the assimilation of social and mobile technologies will influence distance education methods and pedagogies.

KEYWORDS

Distance learning, collaborative learning, Delphi technique, social technologies, mobile technologies

1. INTRODUCTION

The quick and massive development of technology in the last twenty years has caused many changes in the education field. Kim and Bonk (2006) assert that opinions are mixed about the benefits of online teaching and learning in higher education, suggesting that during the past decade there were mixed feelings about e-learning. The purpose of this study is to investigate the views and opinions of distance education experts regarding the following aspects: Will distance education methods replace traditional education? Is there a need to modify distance education methodologies to adapt them to new technological environments? What advantages will the application of Web 2.0 technologies bring to distance education methods? What role social networking sites play in transforming distance education methods? Will the use of mobile communications be effective in distance education methods?

2. BODY OF PAPER

2.1 Literature Survey

The term "distance education," offers instructors and students a flexible learning environment in terms of location and time. The current study deals with two main themes. The first theme investigated several general issues regarding distance education methods. The first issue is the instructor's role in distance education, the skills needed and the nature and frequency of their feedback to students. Sammons (2003) posits that teachers have a different role when they teach online courses that requires a different training and support. Other

scholars suggest that online instructors should base their teaching on constructivist principles, emphasizing that the teaching materials should be relevant, interactive, and collaborative, and providing learners with some control over their learning (Partlow & Gibbs, 2003). Instructor's feedback has also been recognized as critical to the learning process in many studies (Moore, 2002; Russo & Campbell, 2004). Online instructors often grapple with the question of how much and in what way to intervene in student discussions in order to aid learning. The instructor's role can vary from being "the sage on stage" to the "guide on the side" or "the ghost in the wings" (Mazzolini & Maddison, 2003).

The second general issue examined in the study is the assessment in distance education. It is known that assessment is a critical aspect of the learning and teaching environment (Benson, 2003), and that effective assessment techniques can improve an instructor's understanding of students' needs (Beebe, Vonderwell & Boboc, 2010). The question which arises is whether we should implement the same assessment tools in traditional and in distance education settings (Benson, 2003). Beebe, Vonderwell and Boboc (2010) propose that the instructor's role in e-learning requires rethinking and reconstructing of assessment practices.

The last general issue is the future of distance education. A number of studies propose different future scenarios. Attwell (2007) claims that personal learning environment is the future of e-learning. Aranda (2007) asserts that there is a trend towards the development of a Virtual Learning Environment (VLE), a concept that relates to the implementation of various electronic enhancements into the classroom environment.

The second theme investigated in the study is the impact social and mobile technologies have on distance education methods. Social media tools may improve e-learning experience as they create an atmosphere of cooperation and easy interaction among users (Rodrigues, Sabino & Zhou, 2010). In addition, students no longer have the passive role in the process of learning as they may edit, posit new content and participate in discussions with other learners and teachers (Vassieleva, 2008). Regarding the use of mobile technologies in distance education or m-learning, one recurring theme in different works on m-learning, is that m-learning should not replace traditional learning, but should support both students and teachers by providing them services that facilitate learning, teaching and administration (Houser, Thornton, & Kluge, 2002; Shepherd, 2001).

2.2 Methodology

The purpose of this study is to review experts' opinions and views on the several issues in distance education. The experts' were asked to rate 16 statements in a 1-5 likert scale according to two variables: (1) what they think will probably happen (probability); (2) what they would like to see happen (desirability). The Delphi technique was chosen as a method of study. This technique is an efficient and effective group communication process designed to systematically elicit judgments from experts in their selected area of expertise (Ono & Wedemeyer, 1994). The panel of experts in the current study included Israeli academic experts at all levels who are directly involved in the design and development of distance education technologies as well as university teachers that teach distance education courses on a regular basis. Of the seventy experts that were invited to participate, 35 experts responded to the first round of the survey resulting in 50% response rate. An online survey was specifically design and built for the present study (<https://docs.google.com/spreadsheets/viewform?formkey=dFBOUIRjV2pzTFhqWjEwY2ZmQ1NGQ2c6MQ>). A consensus amongst the experts was reached in the first round for most statements; however, twenty participants' answers fell out of the group consensus. The second round was limited to those twenty participants and they were asked (via e-mail) to explain their answers. Twelve participants responded to the e-mail and provided explanations to their answers.

2.3 Results

Findings on the first theme present experts' views on general issues regarding distance education methods. When asked their opinion about whether they think the development and usage of distance education technologies will change the current educational theories and methodologies, the experts foresee this development as highly probable (91.4%, $n = 32$ $m = 4.3$) and highly desirable (71.4% $n = 25$ $m = 3.8$). These views are shared by Sammons (2003) who alleged that instructors have a different role when they teach online, a role that requires a different training in order to shift from teaching in a face-to-face to an online

setting. The role and skills of the instructors is the second general issue examined in the research. Concerning instructor's feedback, participants were asked whether they think that the lack of immediate feedback from the instructor is one of the major drawbacks of distance education; hence there is a need for solutions that will improve the interaction channels between instructor and learner. Findings show that a large percentage of participants view the opportunity of a new solution as mostly probable (71.4% $n=25$ $m=3.9$) and mostly desirable (71.4% $n=25$ $m=3.6$). However, several experts present a different view on the importance of the instructor's feedback. One of the experts proposes that other forms of feedback such as peer learning are valid and can replace the traditional instructor's feedback. This idea is also shared by Maor (2003) who concludes that since distance education is a student-centered setting the instructor should play the role of facilitator; thus the role of peer learning is enhanced.

The next general issue is the assessment process which takes place in distance education. Experts were asked whether they believe that the assessment process of a distant course should be different from a frontal course. Findings show that the majority of experts agree on the need to develop different assessment measures for a distance course: 88.5% ($n=31$ $m=4.2$) found this change highly probable and 68.5% ($n=24$ $m=3.7$) found it highly desirable. These findings are in accordance with Beebe, Vonderwell and Boboc's findings (2010), who state that the instructor's role in e-learning requires rethinking and reconstructing of assessment practices.

The last general issue focuses on the future of distance education. Experts were asked their opinion on the tendency towards the provision of full distance education degrees in the future. Findings show that almost half of the experts (48.5% $n=17$ $m=3.5$) view the provision of full distance education degrees as highly probable and 71.4% ($n=25$ $m=4$) of experts see it as highly desirable. In another question that is associated with the future of distance education, experts were asked whether they believed that distance education methods would completely replace traditional education methods in the future. Findings show that 62.8% ($n=22$ $m=2.2$) of experts foresee that it is highly improbable that distance education methods will completely replace traditional education methods and 60% ($n=21$ $m=2.3$) believe this development will be highly undesirable. The analysis of the last two findings is intriguing, suggesting that on one hand experts assume that the tendency towards the provision of full online degrees will increase in the future, but on the other hand, they do not believe that distance education methods will completely replace traditional education methods in the future, and furthermore, they think that this development is undesirable.

The second theme examined in the study is the impact that social and mobile technologies have on distance education methods. When asked whether social networks such as Facebook and Twitter will have a great impact on distance education, the majority of experts foresee as improbable (62.8% $n=22$ $m=3.3$) that social networks will have a significant impact on distance education methods. Yet, about half of them (57.1% $n=20$ $m=3.6$) saw this impact as desirable. A difference between the probability and the desirability of the issue is also revealed in the next statement which proposes that the use of social technologies in distance education should be based on new and different pedagogical theories. Findings show that although the majority of experts believe that the implementation of social technologies into distance education methods should be based on new pedagogical theories (80% $n=28$ $m=4.2$), only half of the (51.4% $n=18$ $m=3.4$) experts saw this theoretical change as desirable. Experts' answers to this statement are interesting and reflect an ambiguous attitude towards the development of new pedagogical theories. On one hand there is a general understanding (80%) that the use of social technologies in distance education should be based on new pedagogical theories, however, only half of the participants believe it is desirable, maybe understanding that it will be difficult to begin working and assimilating new pedagogical theories.

Experts were also asked about the possibility that social technologies may enhance deep independent learning. The majority of experts (77.1% $n=27$ $m=4.1$) believe that this development is highly probable and only half of the experts believed it is desirable (54.2% $n=19$ $m=3.4$). These findings echo Vassieleva' (2008) assumption that as using Web 2.0 tools in e-learning, students may be involved in a collaborative atmosphere which may enrich their learning process. However, it is quite strange that only about half of the experts view this possibility as desirable. Perhaps those experts understand that the new technological environment may develop a new process of learning, however, the findings present experts' lack of confidence that they would like to have more active, deep students in their classes.

The last issue examined on the second theme is the impact that mobile technologies might have on distance education methods. Results show that the majority of experts see as highly probable (80% $n=28$ $m=4$) and highly desirable (71.4% $n=25$ $m=4$) that mobile technologies will greatly impact distance education methods. These findings concur with studies that highlight the convenience and flexibility of

distance learning offered by the “anytime, anywhere” concept (Matthews, 1999; Simonson, Smaldino, Albright, & Zvacek, 2000), which is particularly true in mobile technologies that allow learners to access the course content practically anywhere and at any time. In addition, these findings are in accordance with those of Houser, Thornton, and Kluge (2002) and Shepherd (2001), who suggested that m-learning shouldn't replace traditional learning, but rather facilitates learning, teaching and administration.

3. CONCLUSION

The experts that participated in this study believe that the use of new technologies will change current educational theories and methodologies, and will have impact on instructor's skills, efforts, feedback and interaction as well as on the process of learning assessment. However, concerning the future of distance learning, participants view a future tendency towards the provision of full online degrees, yet, they are skeptical; stating that distance education setting will not completely replace the traditional educational setting. In addition, findings reveal that experts view the role of social and mobile technologies as facilitators in the transfer and sharing of information in distance education settings, creating an atmosphere of cooperation and easy interaction among users. They assume that the assimilation of social and mobile technologies will influence distance education methods and pedagogies, yet, they do not think that this change is desirable. This finding can be associated with fact that experts did not like the notion that social technologies can enhance neither deep, independent learning, nor an independent, motivated learner. These surprising findings may reflect experts' attitude and understanding, that it will be difficult and complicated to begin working according to new theories and pedagogies.

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USING ONLINE SOCIAL NETWORKS FOR E-LEARNING: A CASE ABOUT TRAINING AND SMALL ENTERPRISE SUSTENANCE

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ABSTRACT

Most successful enterprises tend to have a culture of continued learning. While learning and training are interrelated, small enterprises seem not to put more emphasis on learning in their organizations. This paper illustrates the necessity of training in small enterprises, and determines how online social networking sites can be used to expand organizational learning and training. A case study involving two South African small enterprises was conducted. The study was underpinned by organizational learning theory and the virtual communities of practice theory. In South Africa small enterprises are classified as organizations with employees less than 50 and with an annual turnover less than 13 million rand, as well as total gross assets less than 5 million rand. Empirical evidence collected during the study showed that small enterprises tend not to put much emphasis on learning and up-skilling their human resource, thus hindering a smooth operation, growth and development. This paper argues that these small enterprises could address the preceding challenges by practicing e-learning as a method for continually training employees. The paper concludes with a framework on how online social networking sites can be used as a platform for an improved e-learning and training.

KEYWORDS

Training, e-Learning, Online Social Networking, Communities of Practice, Small enterprise

1. INTRODUCTION

Since the existence of online social networks, people have embraced a virtual collaborative relationship. People meet, talk, and inform each other through posted online messages in real and non-real time. This research study aims at understanding how online social networking sites can expand e-learning and provide better training to enhance and sustain small enterprises (SEs). Greswell (2007) indicates that the operational levels in some organizations are categorized into three, the day-to-day business activities, business process innovation, and business strategic operational change. This study focuses on day-to-day business activities in small enterprises.

It is assumed that, for any successful organization, training is one of the key aspects to focus on. Conversely any enterprise that does not provide training may bear the brunt of sustenance instability.

Training may enable better performance in a lot of other areas in day-to-day operational business activities. Training can offer benefits like improved innovation, improved service delivery, increase on talent and skills, health and safety, enhanced products, and other business training needs not mentioned. Lack of training can cause complete business failure in an enterprise, whether it is a small or large enterprise. Panagiotakopoulos (2011) indicates that business failure can be caused by lack of skilled laborers, management style, management issues, financial implications, environmental influences, and other unanticipated influences.

Considering the above factors this paper assumes that lack of skilled labor is the main cause of business failure in small enterprises. To help address this issue, a conceptual framework is designed informed by two underpinning theories - the organizational learning theory and the virtual communities of practice theory.

There are varied information systems that support learning, specifically so as to help small enterprises beat the challenge of financial constraints, time, expertise, and facilities (Sambrook, 2003). The next section gives a brief on literature supporting the study.

2. BACKGROUND TO THE RESEARCH PROBLEM

“SMMEs represent an important vehicle to address the challenges of job creation, economic growth and equity in South Africa” (DTI, 2005). However, SMME’s in South Africa are deemed to be the most non-proficient in 38 countries in terms of business (Ladzani, 2009). SMME’s do not really make it in most cases, and this is a worldwide common occurrence (Brink et al, 2003). It has been perceived over a number of research articles that SMMEs in South Africa really need a boost in industrial performance.

The current study argues that the main impediment in small enterprise success is training. However, research indicates that small enterprises tend to overlook this fact (Panagiotakopoulos, 2011). Small enterprises do not believe in up-skilling personnel. They tend to look at business as a money-making scheme with a perception of short term profits (Ettinger et al, 2006). In this paper such perceptions are believed to be a drawback in business.

SMMEs are classified into three categories in the South African context, as stated below (KPM, 2008), and as derived from the South African National Small Business Act of 1996 Schedule: **Medium sized enterprises** are those that have a total number of not more than two hundred employees, total annual turnover less than fifty one million rand, and total gross assets of less than nineteen million rand. **Small sized enterprises** are those that have a total number of not more than fifty employees, total annual turnover less than thirteen million rand, and total gross assets of less than five million rand. **Very small sized enterprises** are those that have a total number of not more than twenty employees, total annual turnover less than five million rand, and total gross assets of less than two million rand. **Micro sized enterprises** are those that have a total number of not more than five employees, total annual turnover less than two hundred thousand rand, and total gross assets of less than one hundred thousand rand.

Small enterprises in South Africa do not always provide adequate training to their personnel, and this may be one of influences that may lead to enterprise failure. From the two small enterprises studied, empirical evidence suggests that service delivery is a major impediment in their growth. Literature reveals that small enterprises tend to be more concerned with the ‘now’ moment of making money. Small enterprises tend to not acquire time to look at future investments, especially human resource development. Thus the imbalance between customer service and employee skills is neglected.

The next section gives a brief description about the research methodology used.

3. METHODOLOGY

A case study involving two case units was conducted. East-Thorne Entertainment (pseudonym) and K1 Training and Business Consultancy (pseudonym) are both South African small enterprises observed in this study. An interpretive approach was followed in the study. A case study involving two case units was conducted in order to understand the training and e-Learning phenomenon, within SMMEs. Open-ended questionnaires and semi structured face-to-face interviews were used as data collection methods. While this section gives an overview of the methodology followed to address the problem, the subsequent section illustrates the analysis of data collected during the study.

4. DISCUSSION ON ONLINE SOCIAL NETWORKS FOR E-LEARNING

The interviewed candidates in both observed small enterprises, indicated that most of their training is on-the-job training, and based on experienced personnel teaching novices how to do the job. It was realized that the observed small enterprises do not either practice e-learning. However most of the employees still think e-learning is an effective method for training employees.

The observed small enterprises appoint personnel with short computer skills. This shortage in computer skills applies mostly to the older generation, those with more experience and older in age according to the collected data. However looking at the younger generation, it is realised that most are already familiar with technology. It is further realized the younger generation at the observed enterprises can hardly be separated from technology in their daily life.

The two observed small enterprises have been in existence for a number of years, and are moving from traditional ways (using pen and papers, etc) of doing business to using technology as a way of doing business. For example, cashiers at East-Thorne entertainment lounge now use computerized cash register programs, while at K1 training and business consultancy use computers to type documents and business proposals. Personnel at both small enterprises use cell phones and other handheld devices for communication.

Most of the participants indicated that they are aware of online social networks, like *Facebook* and *Twitter*, though not all are actively using them. Some do know about *blogs*, though they do not have a solid experience about them. After interviewing the managers of the two small enterprises, both of them highlighted that e-learning is a far investment for small enterprises that they have not yet anticipated to implement.

The observed small enterprise managers believe in sustaining their organisations through other methods, like marketing, branding and rapid production. They do not necessarily look at training as one of the core contributors to sustenance.

Findings show that e-learning is not a farfetched phenomenon, while online social networking is a massive practice in today's lifetime. It is realized that the observed small enterprises do not understand the concept of e-learning. However some individual in the small enterprises do understand and individually practice e-learning. Though most small enterprises do have training in their enterprises, they do not put plans in place to invest in human resource development (HRD). Most personnel tend to realize that training is an imperative need in their day-to-day activities at work. However, they do not realize that, if they are socially related to each other, they may just get answers to questions from their peers just in time. This is social networking. If participants collaborate on an online social network, the chances of learning from each other are much higher than traditionally. It is also realized that most small enterprises look at enterprise sustenance as a marketing strategy, as productivity strategy and as a market niche strategy.

While the current section gives a brief interpretation of the collected data, it becomes necessary to further expand with proposed a possible solution. The next section illustrates a framework as a conceptual layout of this possible solution.

5. A CONCEPTUALIZED FRAMEWORK FOR E-LEARNING ON SOCIAL NETWORKS

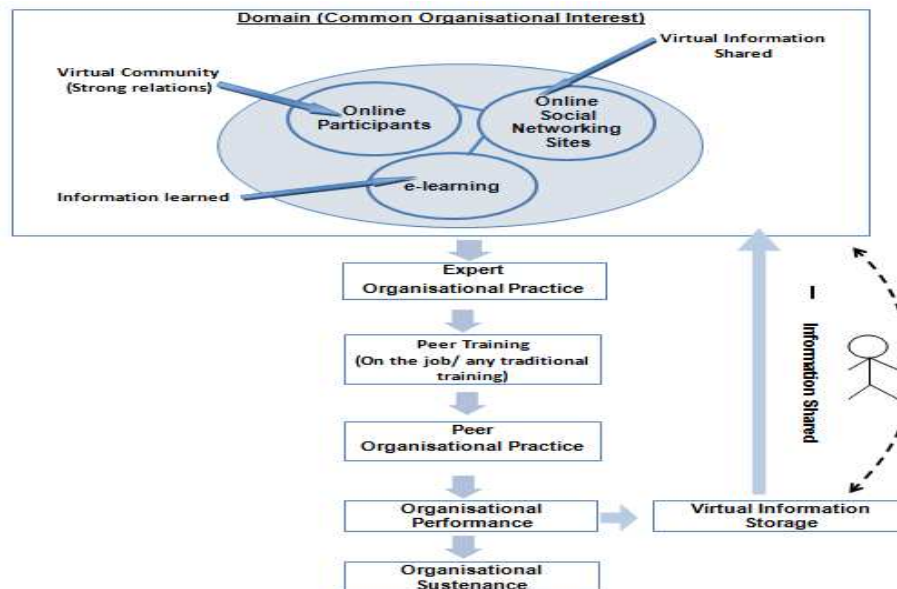


Figure 1. A conceptualized framework for e-learning on social networks

The framework above shows how e-learning may take place in a social environment where participants meet virtually online, and share ideas on common day-to-day work to create skills. A participant will enter a virtual social environment (online social website), interact with other participants and then share and learn new information. The participant that has learned such information will then apply it in the organization as an exercise to create new skills. After the practice has been done, the participant may then be called an expert to that specific skill gained.

The expert will then do a skills transfer to his/her peers through either over-the-shoulder training, or any traditional method of training used in the enterprise. The trained peer will then also practice the same skill learned thereby increasing organizational performance. At this stage, once the framework has proven to be effective in performance proliferation, then the expert information is now stored into a virtual database. At this stage organizational performance may be measured using any traditional performance measurement methods. In most cases assessment tools may be used. Assessments may be in a form of tests, quizzes, or exams.

The process of information sharing from here will now repeat itself. Other participants will then go through the same process. They will absorb information from the virtual data store, enter the domain, socialize and then share the information with others. In this way expert personnel may increase, performance may also increase and organizational sustenance may now be achieved through personnel training.

6. CONCLUSION

Small enterprises seem not to put much emphasis on learning while most successful enterprises tend to have a culture of learning. Small enterprises also tend to be reluctant to human resource development. Augmenting training with learning can enhance personnel skills more quickly and effectively, hence an increase in production. Extending learning to e-learning can produce an even more rapid approach of skill injection. With a little computer literacy given to personnel in small enterprises, e-learning can start to manifest and create a way for online social interaction. This means employees can start learning from each other through social interaction on an online website, either by posting intellectual skills and learning asynchronously, or by collaborating through chats and learning synchronously. Personnel who have fear of raising ideas verbally, may do so on the online social networking site. A virtual community of practice may be realized in using online social networks.

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INTERNET EXAMINATION – A NEW TOOL IN E-LEARNING

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ABSTRACT

The Internet has been widely used as a powerful educational tool. It gives the possibility to deliver the educational material widely all over the world without the need of the students or the teachers to travel and be present at the same location. For this we have developed the e-learning portal EVICAB (European Virtual Campus for Biomedical engineering). We have extended the use of EVICAB to offer the examination service. When using the EVICAB portal the students may take the examination at their home university or anywhere in the world provided that controlled circumstances are ensured. Because the examination is offered via the Internet, the students also have all the material from the Internet available. This makes certain requirements for the style of the questions. Typically, the questions should not ask “What is ...” but instead “Why is .., which one is better and why .., design a system which ...”. The students seem to appreciate this kind of examination, because it better reflects the situation of the real working life.

KEYWORDS

Internet education, e-learning, Internet examination.

1. INTRODUCTION

Internet education has reached a strong and stable position (Buffardi, 2011). It has several benefits over the traditional classroom education, e.g., increased accessibility to information, ease of updating, standardizing and distributing content, accountability, interactivity, self-paced speed, usefulness for international students and also for disabled students, etc., (Ruiz et al, 2006). However, it is generally agreed that Internet education does not fully replace the classroom education but serves as a strong supporting method. Distant learning is nowadays widely acknowledged by students (Kian-Sam et al. 2003) and teachers (Smakola, 2008) all over the world.

There exist many different portals for Internet supported education. These include, e.g., Yovisto (<http://www.yovisto.com/>), Webcast Berkeley (<http://webcast.berkeley.edu/>), MIT Open Course Ware (<http://ocw.mit.edu/>), Videlectures. NET (<http://videlectures.net/>), Connexions (<http://cnx.org/>) or various course management systems, e.g., Moodle, Blackboard, WebCT, Ilias (Romero et al, 2008), etc.

We have developed a free access e-learning portal EVICAB, which is the acronym from European Virtual Campus for Biomedical Engineering (<http://www.evicab.eu>). Its basic development was funded as an EU project (Malmivuo, 2007). Despite that EVICAB was developed particularly for biomedical engineering field, its application is not limited only to this field but it may be equally well applied to any other discipline.

To enlarge the educational properties provided by EVICAB we have developed and included the Internet examination service to the portal. The Internet examination serves both to the students who have made their studies with the aid of the EVICAB portal as well as to the students who have attended classroom education. The internet examination is very well accepted by the students, because, on one hand, it better evaluates the students' ability to understand the issues in the course rather than remembering small details, and on the other hand, it makes it possible for the students to take the examination at their home university and there is no need to travel to the university, which has provided the course either as an Internet course or as an intensive classroom course.

2. MATERIALS AND METHODS

2.1 EVICAB Portal

EVICAB is a free access portal for e-learning. It offers high-quality video lectures including associated lecture slides and additional teaching materials, e.g., textbooks, exercises, laboratory works. The material is primarily recorded during classroom lectures. Educational institutes outside the EVICAB community may also propose courses to be included to the portal, as well as other educational institutions may take EVICAB courses to their curriculum. Their students may take the examination, and thus earn credits for the studies. The video lectures are provided in various formats: videos for a computer screen, i.e., in a flash format implemented as web pages, for iPods, and for mobile phones. Detailed instructions about the courses and introductions of the teachers are available. The portal also includes a large number of publications concerning e-learning in general and especially this virtual campus.

The EVICAB portal is written in Hypertext Markup Language (HTML) and the code can be used as an open source. Other teaching institutes of any other discipline may build their own version of the portal because the programming is relatively simple.

We combined recorded lectures, accompanying narrations and synchronized presentations when developing video lectures. Lectures were recorded in a traditional classroom environment. The process was divided into five steps: 1) technological setting, 2) video, audio recording and screen capturing, 3) audio and video data editing, 4) rendering files for personal computers, iPods and mobile phones, and 5) developing system for shearing video lectures via the Internet (Kybartaitė et al, 2010).

Video lectures were segmented into time intervals based on the topics. The lectures were rendered in a very common flash file format and implemented as web pages, Figure 1. The resolution was selected so that it fits different computer screens without excessive scrolling or scaling of the contents, i.e., totally 1040x595 pixels. All the files were placed on the server so that the lectures are accessible via the Internet by anyone and anytime. The minimum bandwidth is 350 kilobits per second (Kb/s) but 1 Mb/s is recommended in order to watch the lectures without buffering pauses. Video file converting software was used to obtain file formats for audio, video players and mobile phones. It became possible to access files with freely available software, i.e., iTunes and Quick Time player and then upload them to personal gadgets.

WordPress blog tool and publishing platform was implemented as the asynchronous communication and rating system. It is the open source project, which was downloaded and installed as a software script. Users all over the world have the possibility to leave their comments, messages and suggestions in the system. A rating system was included so that users could evaluate each lecture and express how interesting is a certain topic.

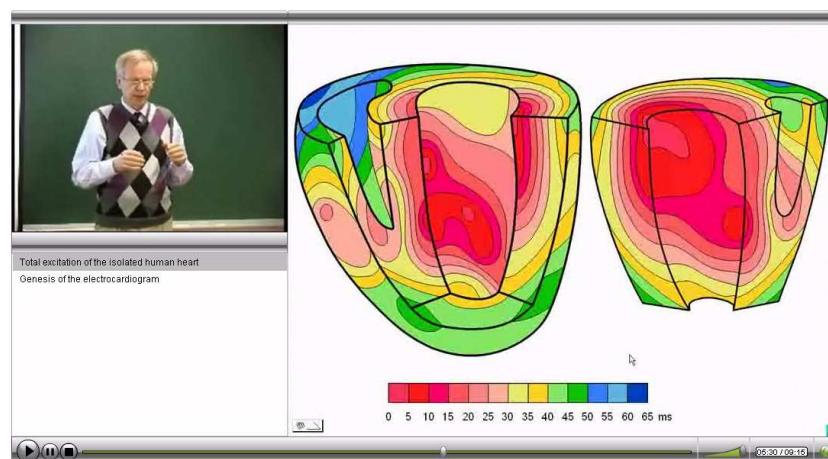


Figure 1. Example of a video lecture in Flash format. It can be accessed using PC.

2.2 Internet Examination

2.2.1 Taking the Examination

After attending classroom lectures or following video lectures students may take part in the examination. During the examination the students may use all the material available on the Internet, including the course book. The only thing which is not allowed is communicating by e-mails or other direct means, e.g., talking, and sharing books or lecture notes with other persons. This approach changes the style of the questions. In ordinary examinations, where the students are not allowed to use any material, it is more tested whether the students remember certain details from the course. In the Internet examination, where all material is at hand, the examination aims to test whether the students have fully understood the concepts and have the ability to combine various issues and to give rationales for their conclusions. This approach is relevant for developing professional skills that the students need when they move to the working life.

Depending on whether the course is a part of a degree programme or a supplementary course, the students participate in the examination in different ways.

In the degree programme the students take the examination in a computer classroom of a university. Their identity is checked and the supervising assistant controls that the students log on the examination with their own names. It is also important to have a list of the participating students so that no student outside the classroom may participate in the controlled examination. An additional method to confirm that only those students who are in the classroom participate in the examination is to give a password in the classroom, which the students write to the examination form. If the students are from several universities, the examination may be arranged at their home university at the same time provided that the aforementioned conditions are ensured.

In supplementary education course the students may take the examination anywhere because there is no need to control their identity. This is one important feature of the Internet examination. In supplementary courses, arranged, e.g., in connection with international scientific seminars, the students may be from several countries and different cities, and universities. The examination is usually arranged a couple of weeks after the course as it would be impossible for the students to take part in the examination without preparation.

2.2.2 Examination Style

The Internet examination may include questions with multiple choice answers, calculation tasks or essays. There may be questions of several parts, e.g., the question having part a) and b), where part a) requires a short answer, e.g., definition or explanation of a phenomenon and part b) requires more detailed analysis and explanation of the phenomenon.

Based on the experience of the authors, a multiple choice examination is more suitable for the formative assessment, i.e., for tests performed during the course. The calculation tasks or essays are more appropriate for the final summative examination. The Internet examination has the problem that writing equations with the computer is more difficult and time consuming, and therefore calculation tasks may be used only where the correct result is sufficient. Deriving equations on the digital examination form is practically impossible. The students find that writing essays is the most practical way to express ideas. Also the teachers and assistants find the essays preferable because they describe more effectively the students' understanding of the issues of the questions though the essays are more time consuming to check.

2.2.3 Examination Classroom

The students take part in the examination in the computer classroom. They open the Examination web page in the EVICAB portal, Figure 2. There is a symbol indicating that the examination time is approaching. At the beginning of the examination the assistant uploads another version of the Examination page to the Internet. It indicates that the examination has started and through this page it is possible to download the examination form. The form is a Microsoft Office Word file including the questions. The students write their personal data and the password given by the assistant supervising the examination to the form. The password is important to control that the examination is attended only by the students in the classroom.

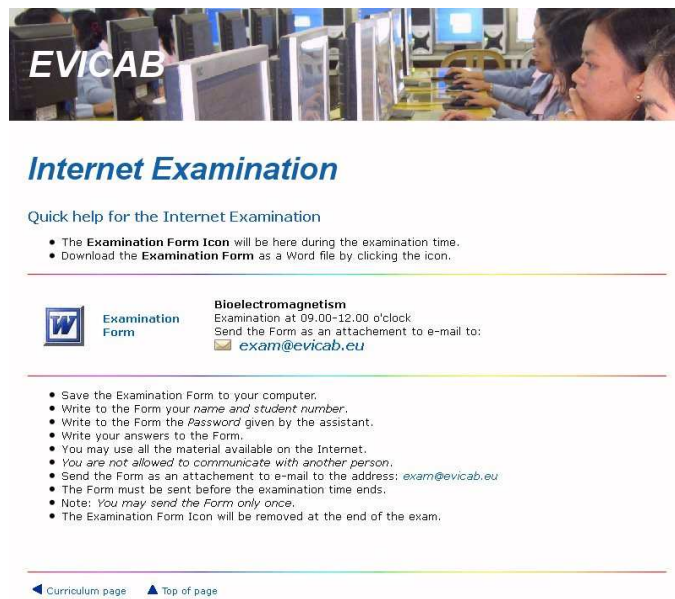


Figure 2. Screenshot of the Internet examination on the web page.

The students are free to use all the material available on the Internet. So they do not need to remember all details of the topic. It is more important that they understand it and are able to make conclusions. We tested the Internet examination first on our course on Bioelectromagnetism (Kybartaitė et al, 2009). The textbook for this course is available on the Internet (Malmivuo and Plonsey, 1995). At the end of the examination the students send the examination form as an attachment by an e-mail to the assistant to the address given on the Examination page.

2.2.4 Operations of the Teacher

Because the students have the Internet available during the examination, the teachers should not prepare questions of the style: “What is ...?” but rather of the style “Why ...?” or “For what purpose ...?”. Such questions measure the students’ understanding of the topic of the question and ability to make conclusions. The teachers/ examiners have to consider suitable and pedagogically sound questions.

Unfortunately, some students, who apparently have not fully understood the topic of the question, may copy and paste even several pages directly from the Internet. It is clear that such answers may not be accepted.

Internet examination requires educational institutions to provide computers with the Internet connection and ensure their proper functioning during the whole examination time.

2.2.5 Pros and Cons of using the Internet Examination

The teacher may store the students’ answers from the e-mail attachments and print them out after the examination. It is easier for the teacher to review the answers written on the Word document than by hand. One more benefit is that all the documentation from the examination may be easily archived to the computer.

Important is that the teacher/ assistant administering the examination does not need to be at the examination location during the examination but all the administration may be performed from any location in the world where the Internet connection is available.

In addition to the advantages the Internet examination includes several disadvantages, e.g., plagiarism, copying and pasting, collaboration via digital or mobile devices, incorrect attendance information, and exceeding deadline for submitting the examination forms. These issues should be carefully considered by teachers, examiners, supervisors and following consequences well explained since the Internet examination is still quite a new endeavor for the students.

3. CONCLUSION

The Internet examination has the same aim as the traditional examination, i.e., it allows examiners to assess learning outcomes and performance of the students. Meanwhile, the students have the possibility to demonstrate their individual knowledge within particular subject and under certain circumstances, i.e., the students should have confidence in using information communication technologies (ICT) and be able to express their ideas in digital format.

The Internet examination is a modern way to perform the examination. It seems that the students and the teachers appreciate the advantages it can offer. One reason is that all information for finding small details on the topic of the questions is available on the Internet. The teachers and the students appreciate that the Internet examination allows not to be tied to one location but may be arranged in several different locations at the same time.

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ANALYSIS OF THE BENEFITS OF WIKI PLATFORMS IN UNIVERSITY EDUCATION

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ABSTRACT

The implementation of the Bologna Process has brought a significant change to the university educational system, requiring changes in the core of the degrees themselves as well as in the way in which students are taught, including the means for accessing information. One of its objectives is also to help to increase the compatibility between the different educational programs in the countries of the EU. But the most important changes require the implementation of systems to support the development of the collaborative techniques that students need to learn to be competitive, alongside with better interaction between them and the teachers. These requirements have opened up the way for new multimedia and collaborative tools that can be incorporated to the classroom to fulfill these requirements. Among all these tools, there is one in particular that arises above the rest because of its potential and that has also gained a lot of popularity in the last few years: the wiki platform. It constitutes the main focus of this article, as the tool is currently being researched and studied to improve its adaptability and positive impact in the students' learning process.

KEYWORDS

Wikis, EHEA, Wiki Engine, E-learning, web services.

1. INTRODUCTION

The appearance of the Bologna Process, proposed by the EU members of EHEA, meant a great deal of change for universities, and their teaching staff as it is a new approach to education, that implicitly requires that most degrees have to be redesigned and teaching techniques need to be updated. Apart from this, it also represents a challenge for students that see their traditional learning process altered, and improved.

This new approach is also heavily influenced by the appearance of new technologies like the Internet that are becoming everyday a more common part of our occupations and lifestyle. There are many technologies that are being implemented and studied for its possible applications in the classrooms, and one in particular is becoming considerably popular in recent years: *the wiki platforms*.

The Wiki platform is a tool designed to be simple and user-friendly, and its main objective is to provide a simple means of collaborative work among different users. A really good example of this kind of interaction is the online encyclopedia Wikipedia, which has already received hundreds of millions of articles, revisions and visits in more than 255 languages. Together with blogs and social networks, wikis are considered to be part of web 2.0 (Hinchcliffe, 2006), as they share part of the concept of full interaction between users and web services.

Wikis present a new distributed system in which information is no longer centralized in a single node (*or cluster*), with full interaction as its base, and that allows users to collaborate by sharing without restraint their knowledge and experience, which directly benefits the user community, as the more contributions are made the more complete the system becomes (Benkler, 2006).

For universities, this tool presented itself as a great opportunity to incorporate collaborative tasks in their courses without much difficulty. The main advantages of this platform are that it allows collaborative editions through a simple user-friendly interface, it keeps a complete history of editions made to each article and it is highly customizable, allowing all kinds of multimedia content and integration with other systems such as blogs, webs, intranet portals or office suites.

There have been already several studies in universities worldwide regarding the implementation of wiki platforms in a subject as part of a degree (Ortega and Reinoso, 2011) (Reinoso, 2009) (Cordoba and Cuesta, 2009) (Freire, 2005), as well as the online initiative “wikiversity.org”, and in all these studies we can observe that their results were satisfactory, so much that further studies and tests have been appointed in many cases. A good example of this is the Spanish magazine “*Revista de Docencia Universitaria*” (Area, 2009) (Barberá, 2009) which published on November 2009 a special issue dedicated entirely to the use and implementation of wikis in university environments. This ties in together with other studies (Celaya, 2008) (Ebersbach, 2005) (Carlin, 2007) that explain the application of wikis in corporate environments, where wikis take both the role of knowledge management tools and learning tools.

More importantly, these studies have been taken in subjects of degrees not only from computer-related degrees, but from those of varied nature such as biology, arts, architecture or law; in addition to different corporate environments. Furthermore the results in these case studies were quite positive, encouraging researchers to continue with the implementation of the platform and its use in the courses. This shows that despite some limitations found, which can be solved easily either with design changes or implementation changes, the benefits obtained are great, and that further improvements will certainly augment the positive impact that wikis can have in learning environments.

The purpose of the following paper is to present the method followed to implement the wiki platform in a single subject from the degree in Computer Engineering at “*Alfonso X el Sabio*” university and how the positive results obtained have motivated the researchers to further implement the wiki to the whole university. Unfortunately, due to the limited size of the sample the results presented are preliminary, but they already allow us to glimpse the true impact that wikis can have once fully implemented.

2. IMPLEMENTATION OF A WIKI IN THE UNIVERSITY

2.1 Background

Before designing and implementing a new wiki, it was imperative that a study was made to analyze the implementation of wikis done by other educational centers and universities. This study took place mostly regarding Spanish universities, due to the proximity to our study case. The degrees in which wikis had been implemented ranged from the expected degrees in engineering to art, biology, architecture and law, amongst others, as it can be seen in the papers published in monographs IV and V of “*Revista de Docencia Universitaria*” referenced in (Area, 2009) and (Barberá, 2009).

In all these cases, the wikis were used to implement team assignments, alongside some individual assignments, and students had to use the platform as their main communication and work tool. Teachers had greater interaction with the students, especially thanks to the edition history maintained by the wiki, which allows teachers to evaluate better both the team and the individual students. Additionally, this feature also allowed the teacher to help those teams that went astray much more efficiently.

2.2 Case Study

The study was taken in a subject part of the 4th year of the Computer Engineering degree in “*Alfonso X el Sabio*” university, where the assignments that students usually had to complete were modified in order to encourage the usage of the wiki platform. The students were given the choice of using the new wiki platform to complete their tasks. A total of 35 students agreed to take part in this study. Their task was simple; they had to use the wiki platform, which acted as a support tool, to complete the 3 assignments that were progressively handed by the teacher. The students had to complete them working collaboratively in teams of 4 or 5 members. This way it was possible to evaluate the use of the wiki, whether it was useful or not for the students and the impact it had in the quality of the assignments made by the students.

As any other iterative process, the results obtained in each study help develop better the platform for the next year and, although not perfect, the tool is ready for implementation in courses with only minor details to improve but that will not affect the positive outcome of the experience. The platform enabled the teacher full

monitoring capabilities so that he could help more efficiently those students that needed and later to better evaluate their efforts.

2.3 Results

The main source of the results are the own statistics and databases of the wiki, which offer information about the usage given, the data contained, the complete history of each article and statistics about user access. Once processed, this data can give us complex statistics such as usage profiles or frequency and continuity of editions. In the data shown on “Table 1” we can observe that while only a few pages were made in this case study, the amount of editions was considerable, exceeding an average of 34 editions per article.

This follows the same tendency found in other important wikis (*such as Wikipedia*), but in this case we determined that students accessed the articles sometimes just to re-read them and check for mistakes on the unfinished content and to review editions made by other members of their group. Another point of interest is the high number of discussion pages used by the students during the course to communicate and discuss the next steps to do on their respective assignments.

Table 1. Wiki Statistics

| | |
|--|--------|
| Content pages | 57 |
| All pages (<i>including discussions</i>) | 424 |
| Uploaded files | 176 |
| Registered users | 65 |
| Total page editions | 1.938 |
| Average edits per page | 4,57 |
| Total Visits | 20.757 |
| Total visits per edition | 10,71 |

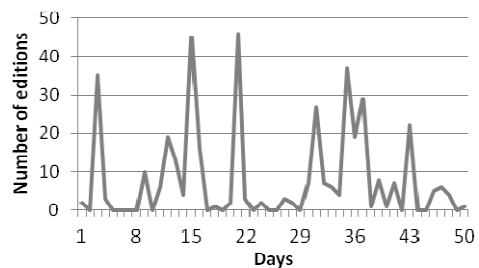


Figure 1. Average revisions during case study

In “Figure 1” is represented the amount of revisions made during the first months by the students. It is clear that there is no continuity, and there are obvious spikes both during the start and end of each of the assignments, especially in the first two, being less steep on the last one mainly because students were more accustomed to the way the wiki platform works and contributions were each made with more content.

The assignments handled by the 35 students that participated in the study were slightly better than those presented by the students that did not participate and those of previous years, proving that the platform had a positive effect, even if it is still in a test phase. Apart from this, students were given at the end of the subject a questionnaire to obtain their experience about the use of the wiki and its application to the subject, as well as to get any recommendations that they may have had. Their answers were positive in general, indicating that 72% found the wiki very useful and appropriate for collaborative assignments; but on the other hand when asked about implementing a wiki for the whole university 48% suggested that a more progressive implementation would be preferred to ensure that the students get accustomed to it appropriately.

After this evaluation several changes were made to the platform to fix the flaws detected during the analysis of the data obtained from the case study. The 4 most relevant features added were:

- A simple access control system was added to allow users already registered in the university’s web portal to be able to use the same credentials to access the wiki.
- Instant notifications to users regarding editions made to any article they choose.
- Categories were added to better classify contents of the wiki depending on their area/degree.
- WYSIWYG editor to avoid users the need to learn the wiki’s own markup language (*wikitext*).

3. CONCLUSIONS

Wikis represent a new way of working collaboratively towards a common goal and are especially attractive to university environment because of it. They have become highly popular in many areas, as nowadays we can see wikis almost everywhere, from schools, learning centers, fan-based wikis, and online encyclopedias. We can find them even at the workplace, where internal private wikis are commonplace.

On the other hand, the application of the Bologna Process has given focus again to these collaborative tools, and to their potential educational benefits, as their collaborative approach fits with some of the requirements specified by the EHEA in this process. Therefore mimicking the same success shown in other areas, wikis are proving that they can be beneficial for both teachers and students, in some cases allowing teachers and students to get more accustomed to the use of new technologies in the classroom.

The initiative presented, codenamed “Alfonso X el Sabio” (<http://wiki.uax.es>), is a wiki to be used by all the university, not only in computer-related subjects, and has so far achieved good results and good acceptance from the students that have already had the chance to use it as part of their everyday routine. While the results shown only represent a small fraction of the university, they are very promising and inspire us to develop it further. There is always room for improvement but so far the results are satisfactory and, more importantly, students have expressed their interest in its usage on subjects.

However, even after it was upgraded, this wiki platform still presents a challenge, as teachers and students must get accustomed to this technology and, while not all 100% of subjects will get active use of the wiki, it is clear that a large amount of them will definitely benefit from it, in particular those that heavily rely on collaborative work.

But this challenge is also affected by the fact that as it is a new technology and requires some adaptation to it, teachers become reluctant to use it due to them being intimidated by these new technologies. For this reason, among others, small presentations and demonstrations are planned to take place in the university to show other teachers that wikis are in fact quite easy to use and implement into courses, hoping to reduce their reluctance to adopt new technologies.

In conclusion, this wiki not only presents a new opportunity to enrich the classroom’s experience, but to improve the whole learning process of the students and give teachers new tools with which to enrich their own subjects and ultimately improve the whole university learning experience itself.

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THE ROLE OF LIVELONG LEARNING IN THE DEVELOPMENT OF INFORMATION SOCIETY ON THE EXAMPLE OF COUNTRIES OF CENTRAL AND EASTERN EUROPE

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ABSTRACT

The majority of existing empirical studies concerning the information society (IS) have focused on three fields: infrastructure, its use and indispensable skills. The latter is most commonly measured by participation in formal educational structures. Hence, the continuous improvement of skills throughout the period of one's professional activity is crucial in the IS. This area has been under-researched. This article attempts to analyze the relationship between IS development and lifelong learning (LLL) using the example of the countries of Central and Eastern Europe (CEE).

KEYWORDS

Information society, information society measurement, lifelong learning, CEE countries, ICT

1. INTRODUCTION

After the collapse of the bipolar division of the world into East and West, CEE countries have made serious effort to catch up with Western Europe. This process gained momentum after the EU enlargement in 2004. The achievements are significant, although much remains to be done. Among many challenges that the new member states have faced is the realization of the IS. Technological, financial, legal and organizational barriers can be overcome relatively easily. The CEE countries have access to the latest technology (previously restricted by COCOM), economic development and the EU's financial aid allowing the development of the information infrastructure. Moreover, the legal framework is systematically harmonized to the challenges of the information age. However, it may be harder to overcome social and cultural limitations. One of the limitations is the low level of continuing education. The paper describes the relationship between the development of the IS and the level of LLL in the CEE, particularly considering the situation in Poland.

2. DILEMMAS OF MEASURING THE INFORMATION SOCIETY

The problem of measurement is the Achilles heel and a „Grand Challenge” (Menou, Taylor 2006) of the information society research. None of the IS theories have managed to deal with two fundamental and interrelated (possibly insurmountable) problems: definition and measurement. There is no satisfying and widely accepted definition of the IS (Webster 2006 and Goliński 2009). It entails a subsequent problem: it is difficult to decide which characteristics to measure of an indefinable concept.

Contemporary quantitative IS studies are derived from traditional telecommunications statistics. They concentrated on development of telecommunication infrastructure, marginalizing quality and skipping social aspects. Disadvantages of such approach became increasingly apparent. An analysis limited to the technical infrastructure was getting worse in explaining the IS phenomenon. The use of ICT is inextricably linked with the capabilities, skills and motivations of people using these technologies. The role of the information in the society is an economic, social, technological, political and cultural phenomenon (Oleński 2003: 36). If the research topic is the IS, the sphere of social and human factors cannot be ignored. This growing

interdependence of ICT and the social sphere is increasingly forced to incorporate new tools, allowing assessment not only the access to ICT but also its use and its impact as well as barriers of its adoption.

One of the possible models of IS statistics was suggested by OECD (2009:12). It describes the complex and wide field of potential research areas. Complexity is even greater because of rapid nature of these issues. The phenomena associated with the use of ICT and their social, economic and cultural contexts are characterized by high dynamics of the occurring changes. Such a dynamic set of investigated developments cannot be analyzed using established methods since research objects and testing tools are subject to constant change. The model by the OECD (2009:12-13) can be applied to describe the stages of the IS advance.

However, it seems that this model was created based on the experience of highly developed Western countries. These countries have built their IS infrastructure first and then used it to change their social and economic structures. In the last two decades, the CEE countries were forced to intensive effort to build the IS. The described sequence of steps was not always possible. Moreover, the CEE countries were forced to do it all at once. The rapid development of ICT has often allowed leapfrogging certain stages of development. CEE countries building the ICT infrastructure concurrently used it to make structural changes. This process was iterative in nature (Golinski 2011: 227-231). Inspired by the OECD, the conceptual model of the development phases and measurements of the IS is shown in Figure 1.

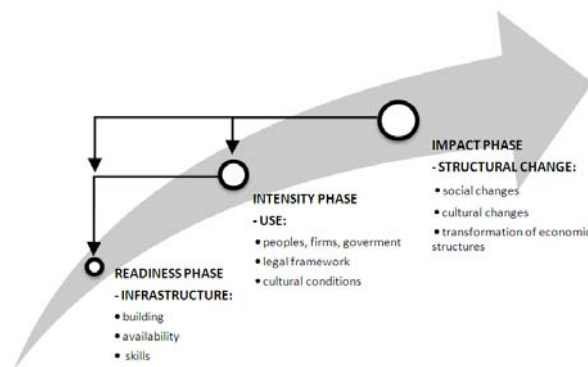


Figure 1. The iterative model of the development phases and measurements of the IS

The readiness phase involves building the technical, business and social infrastructures required for development of IS. Appropriate statistical tools - indicators of readiness allow measuring the level of infrastructure development which enables the transition to the next stage. The intensity phase uses existing infrastructure to support activities typical for the information society; the use of ICT (its type, volume, frequency and value) is examined as well. The intensity indicators allow assessment of who is and is not using the ICT and how. The latter allows identification of jeopardized parts of the society or the economy. During the impact phase the use of ICT leads to significant social and economic changes. The new social realities, cultural phenomena and forms of economic activity significantly alter the pre-existing structures. Intensity indicators should allow the location, definition and evaluation of the scale of these effects.

In the case of CEE countries a simultaneous analysis of all three phases seems to be the most desirable solution. This is not an easy task and not possible in such a short paper. Therefore, only selected elements of the readiness phase will be analyzed below. Particular attention will be paid to the skills issues.

3. READINESS PHASE

During the readiness phase the necessary technical, economic and social infrastructures are created. The decisive at this stage is the infrastructure: its availability and skills enable people to use it. It is one of the favorite topics of research for most authors interested in quantitative analysis of IS issues. This is due to the relative ease of constructing appropriate indicators and the availability of the necessary data. Numerous studies exhaustively inform about numbers and percentages of the users of information products and services. This is a significant weakness of current IS research, resulting also from the historical legacy. Statistics related to infrastructure are extremely important, and most likely will always be used in IS studies. Their

main disadvantage is that they do not explain many important aspects of IS. Information concerning the technological infrastructure is widely available and will not be further discussed in this paper.

Equally important is another area analyzed in the readiness phase – skills and education, which can be characterized by the prevalence and level of:

- general education as a result of participation in formal educational structures,
- skills needed to use information products and services,
- dedicated skills to develop and create ICT solutions,
- lifelong learning.

Areas mentioned above are represented in quantitative IS studies to varying degrees. Most frequently the level of education, represented by the percentage of residents who have completed various stages of formal education, is examined. ICT skills are represented by the percentage of residents who are able to perform certain tasks using a computer (vast range of data can be found in the Eurostat). Specialized skills are often represented by the percentage of students / graduates of science faculties. Lifelong learning is under-represented. According to the author's subjective assessment, the two most fundamental areas are: the overall level of education and participation in lifelong learning.

Ability to use information technology is probably the problem of decreasing importance. This is so for two reasons. The first is, characteristic for the whole ICT, trend to simplify handling and moving to more and more intuitive forms of interaction with the user. The second are the demographic processes that replace the generation of *digital immigrants* with the generation of *digital natives* (Prensky 2001, 2001b).

Professional ICT skills are important and allow participation in the IS, not only as user and consumer on the demand side but also as creator and producer on the supply side. One can say that the active participation as a consumer and as a producer of ICT is an optimal situation. However, one can imagine a country that practically does not create ICT but is an intensive consumer of information goods and services.

Crucial for the readiness phase is the level of general education of population. The higher it is, the greater the information needs of its members, resulting in more frequent and more intensive use of information services and goods. Better educated individuals have a wider scope of interest, actively participate in cultural events and more easily reach the information they need. According to the author, the quality of education is more important than the direction of education. The eminent humanist will be more active consumer of information goods than the poorly educated electronics engineer.

In previous IS studies, the participation of residents in the subsequent stages of schooling in formal educational structures is most commonly applied. The risk of such comparisons is related to the varying degree of forms and quality of educational structures in different countries. A better solution is to apply a more objectified measure, allowing direct comparisons of well-defined skills. An example of such research is PISA program conducted since 1997 and coordinated by the OECD. It assesses the skills of the high school students in three main areas: reading, mathematical and scientific literacy. The level of general education of the CEE population, estimated on the basis of PISA, does not raise much concern (see PISA 2009). The results oscillate around the average for OECD countries. It seems that the skills obtained in the formal educational structures do not constitute a barrier to the IS development in CEE countries.

4. LIVELONG LEARNING AND INFORMATION SOCIETY

An inherent attribute of modernity is Castells' constant change practically in all areas of human activity. Especially profound changes take place in the economy and implies to a constantly changing expectations of employers in relation to the employees. The previous model of career, in which the knowledge gained during a dozen or so years of education can be continuously used without major upgrades for the next three or more decades is away in the past. Changes in economic structures will induce changes in skills of employees. Thus the importance of education - after leaving formal education structures- substantially increases.

The relationship between LLL and ICT is a bi-directional. The changes caused by ICT evoke the need of continuous education. At the same time only ICT is able to provide implementation of the concept of LLL for a significant number of peoples. The number of those who will require training will likely significantly exceed the capabilities of traditional educational structures. The only possible solution from a technical and organizational point of view is the use of e-learning techniques.

The importance of LLL issues for the development of information society justifies, according to the author, incorporation of these issues to quantitative analysis of IS. Further discussion and consideration may require the choice of appropriate indicators and solutions.

Selected characteristics of LLL issues correlated with the development of IS presents table 1 and figures 2 -5. The following characteristics may serve as important indicators:

- participation of adults aged 25 -64 in any learning activities – table 1, column 4,
- participation of adults aged 25 -64 in formal education - table 1, column 5,
- participation of adults aged 25 -64 in non formal education - table 1, column 6,
- participation of adults aged 25 -64 in informal learning – table 1, column 7.

IS development can be measured by ICT Development Index (henceforth IDI) scores (ITU 2009) - table 1, column 8. Table 1 contains the values for the EU countries for which data is available.

Table 1. Values of characteristics describing the LLL and development of IS. Data source: ITU 2009 and Eurostat

| | Country | ccTLD | Participation in any learning activities | Participation in formal education | Participation in non formal education | Participation in informal learning | IDI 2007 |
|-----|-------------|-------|---|---|---|--|----------|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| 1 | Austria | at | 89,2 | 3 | 25,3 | 85,6 | 6,32 |
| 2 | Belgium | be | 41,9 | 4 | 19,5 | 32,3 | 6,14 |
| 3 | Bulgaria | bg | 16,1 | 1,2 | 1,7 | 15,4 | 4,37 |
| 4 | Czech Rep. | cz | 28,7 | 1,4 | 12,9 | 21,4 | 4,88 |
| 5 | Germany | de | 41,9 | 3,4 | 12,7 | 37,3 | 6,61 |
| 6 | Denmark | dk | 79,7 | 7,7 | 47,1 | 65,6 | 7,22 |
| 7 | Estonia | ee | 31,4 | 3,7 | 14,8 | 25,1 | 5,97 |
| 8 | Finland | fi | 77,3 | 9,3 | 41,3 | 69,5 | 6,79 |
| 9 | France | fr | 51 | 0,9 | 20,1 | 45,9 | 6,16 |
| 10 | Greece | gr | 17,4 | 1,3 | 4,9 | 14,2 | 5,25 |
| 11 | Hungary | hu | 11,7 | 2,9 | 4,8 | 6 | 5,19 |
| 12 | Ireland | ie | 48,7 | 5,4 | 14 | 45 | 6,37 |
| 13 | Italy | it | 48,6 | 4,5 | 5,1 | 46,8 | 6,18 |
| 14 | Lithuania | lt | 27,8 | 3 | 7,8 | 25,1 | 5,29 |
| 15 | Luxembourg | lu | 81,9 | 1 | 15,9 | 80,9 | 7,03 |
| 16 | Latvia | lv | 46,2 | 4,8 | 13,4 | 42,6 | 5,01 |
| 17 | Malta | mt | 53,2 | 1,4 | 9,4 | 52 | 5,54 |
| 18 | Netherlands | nl | 41,6 | 7,8 | 11 | 32,3 | 7,14 |
| 19 | Poland | pl | 30 | 4,1 | 9,8 | 26,6 | 4,95 |
| 20 | Portugal | pt | 44,1 | 4 | 9,3 | 42,1 | 5,47 |
| 21 | Romania | ro | 10 | 1,4 | 0,6 | 9,1 | 4,16 |
| 22 | Sweden | se | 71 | 13,3 | 48 | 52,6 | 7,50 |
| 23 | Slovenia | si | 82 | 7,6 | 23,5 | 78,1 | 5,88 |
| 24 | Slovakia | sk | 59,5 | 1 | 20,5 | 57,1 | 4,95 |
| 25 | Average | | 47,12 | 4,09 | 16,39 | 42,03 | 5,85 |

The following figures provide a graphic representation of the relationship between IS and LLL. IS development level (Y-axis) is captured by IDI. This composite indicator, developed in 2009 by the ITU is, according to the author, currently offers the best tool in class (Goliński 2009). LLL issues (X-axis) are captured in the following figures by the characteristics listed in table 1. Each figure shows two characteristics divided according to average values. This allowed the division of the countries into four groups:

- IS development above the average value and the characteristics corresponding to LLL above the average value - the right, upper part of the figure,
- IS below the average and LLL above the average - the right, lower part,
- IS below the average and LLL below the average - the left, lower part,
- IS above the average and LLL below the average - the left, upper part.

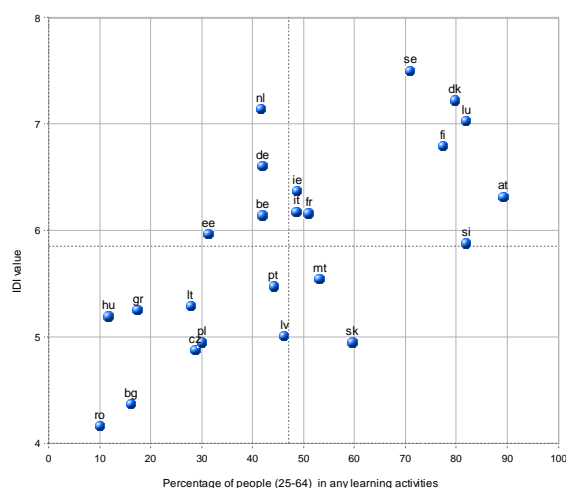


Figure 2. IS and participation in any learning activities.
Data source: ITU 2009 and Eurostat

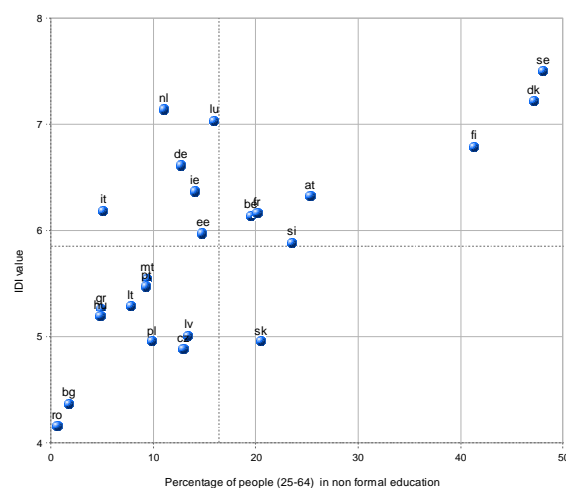


Figure 4. IS and participation in non formal education.
Data source: ITU 2009 and Eurostat

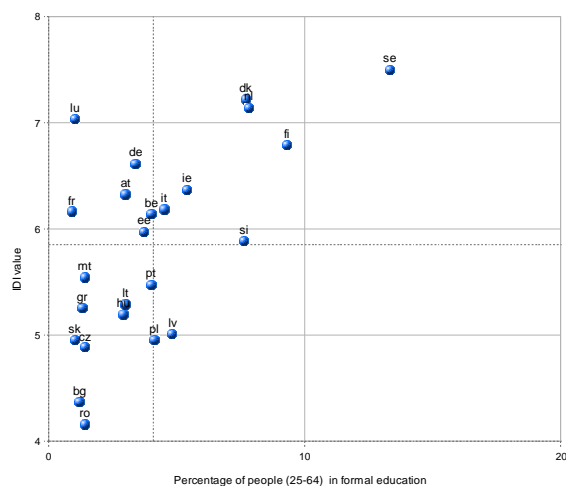


Figure 3. IS and participation in formal education.
Data source: ITU 2009 and Eurostat

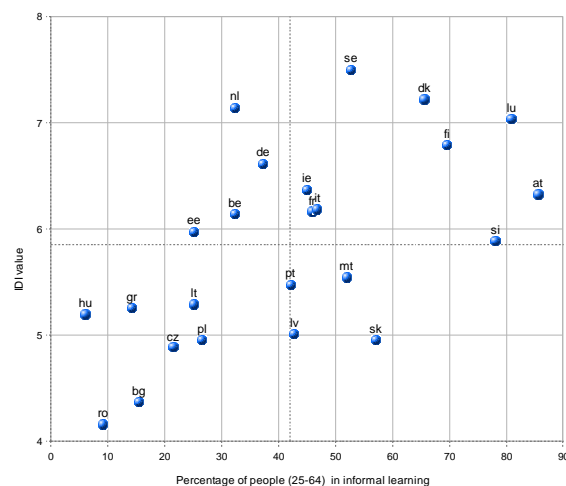


Figure 5. IS and participation in informal learning.
Data source: ITU 2009 and Eurostat

The following conclusions can be made: (see Table 1 and Figures 2-5):

- In the category of participation in any learning activities Austria is the leader and Romania shows the lowest values. Thirteen countries have a value below the average. Poland occupies the 18th place among the 24 countries. From the CEE group only Slovenia and Slovakia have a value above the average. The “loser group” (left, lower part of the figure) consist of remaining CEE countries (with the exception of Estonia, which is above the IDI average), Greece and Portugal.
- In the category of formal education Sweden takes the first place and France the last one. Fifteen countries have a value below the average. Poland occupies the 9th place, slightly above the average. From the CEE group Slovenia, Latvia and Poland have a value above the average. The “loser group” consists of remaining CEE countries (with the exception of Estonia), Greece, Malta, and Portugal.
- In the category of non formal education Sweden is the leader and Romania shows the lowest values. Eight countries have a value below the average. Poland takes 16th position. From the CEE group only Slovenia and Slovakia have a value above the average. The “loser group” consists of remaining CEE countries (with the exception of Estonia), Greece, Malta, Portugal and Italy.

- In the category of informal learning Austria is the winner and Hungary takes the last place. Eleven countries have a value below the average. Poland occupies the 17th place. From the CEE group Slovenia, Slovakia and Latvia have a value above the average. The “loser group” consists of remaining CEE countries (with the exception of Estonia) and Greece.

These figures show a disquieting picture of lifelong learning in CEE countries and Poland. Practically, in all tested characteristics (with the exception of participation in formal education) values for Poland are significantly lower than the average of the countries surveyed. This means that Poles did not use the challenge and opportunity of LLL. In particular, passive here are elderly people. The above described LLL relationship to the information society development implies an opinion that this situation may constitute an important barrier to the modernization of Poland and other CEE countries.

5. CONCLUSION

Many empirical studies of IS support the idea that success is determined by infrastructure and education. Less recognized (albeit essential and interesting) are social and cultural aspects conducive to the formation of information society. It seems to be a reasonable argument that, at a certain level of IS development, such issues can become crucial. The social and cultural context of IS is quite a broad and complex area. The research object may encompass a broad spectrum of problems. One of the most relevant topics is the issue of LLL. Another relevant topic is social capital (see Goliński 2011b). In addition to education in the formal educational structures, continuing education plays a crucial role. An example of the CEE countries has shown that this issue requires improvement and activation.

Considerations presented in the paper have groundwork character. However, referred topics seem to be interesting and worth of further study. Such studies will help determine which characteristics should be analyzed and which indicators should be used in order to better analyze the relationship between IS and LLL.

Low level of LLL in CEE countries is the result of interplay of many cultural, social and historical factors. Their detailed analysis would go far beyond the scope of this paper. Improving the situation in the field of lifelong learning will reduce the gap across Europe and allow new EU members the realization of the vision of the information society.

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DEVELOPMENT OF INFORMATION SOCIETY AND E-GOVERNMENT BY IMPROVING ELECTRONIC RECORDS MANAGEMENT SOLUTION AT ESTONIAN LOCAL AUTHORITIES

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ABSTRACT

The development of the information society and related activities have been the priority of European Union (EU) policies in the recent years. For the period 2007-2013, millions of euros of EU Structural Funds (SF) have been earmarked for carrying out activities and developments related to the transition of the Estonian public sector to the information society. Many projects, both successful and unsuccessful, have been initiated within the SF. This article gives an overview of a project "Citizen view of paperless records management and the development of participatory democracy solutions in local authorities" carried out in about hundred local authorities and aimed at improving their digital records management on the basis of existing Electronic Document Records Management Systems (EDRMSs). Project partners included local authorities, EDRMS developers, and the state in the form of a working group. The project lasted for 1.5 years and resulted in the development of preconditions for digital records management, further development of electronic local authority model and application of e-governance components. The project allowed the Estonian local authorities to improve their digital records management and develop preconditions for service-oriented functionality and participatory democracy.

KEYWORDS

Electronic records management, local governments, EDRMS.

1. INTRODUCTION

A number of studies and analyses on electronic records management in the public sector have been carried out: a survey on records management trends in the South African public sector (Ngoepe, 2008), a case study in a Malaysian government agency (Yaacob & Mapong Sabai, 2011), a study on records management in English local government (Shepherd et al, 2011), a study on public information management in Finnish local governments (Kaurahalme et al, 2011) etc. However, none of the authors have found EDRMS solutions for local authorities that could be implemented throughout a country like in Estonia. Therefore, this paper tries to analyze the factors and criteria that contributed to the success of the Estonian project.

An EDRMS Amphora is used in more than a hundred local authorities. The development of the software product began in spring 2003. By 2008, basic software platform was ready, but local authority specific components still needed to be developed and implemented. Funding for the project was received through the information society priority of the Structural Funds for 2007-2013, in particular via a thematic call for applications entitled "Modernization of records management systems for the improvement of inter-organizational paperless records management".

The project application was signed by more than 70 local authorities, who in a letter of commitment confirmed their consent to use the results of the project after the end of it. A preliminary application was submitted in autumn 2008 and in January 2009 funding for the main application was assigned. By June 2009, necessary formal proceedings were completed. The development activity started in summer 2009 and the project was completed by summer 2010.

The most important objectives of the project were the following:

- increasing the efficiency of local authorities' records management – this has been achieved in about half of Estonian local authorities;
- widening the choice of e-democracy functionalities for local authorities and citizens;
- development of an EDRMS Amphora for Local Authorities for use without license fee – previous license fees were excluded from user policy.

The article describes how the development was carried out and organizational aspects of the project were arranged. The document also gives an overview of the main development activities and describes how specific development activities changed the digital performance of local authorities. The importance of this case study lies in the fact that the success of the EDRMS development project has led to the co-operation of several parties. The project is also noteworthy because preconditions for improving digital records management were developed in more than 100 Estonian local authorities and information society related training courses were carried out in more than 70 local authorities.

This article is structured as follows: first, it provides a short overview of e-governance in Estonia, then the project goals and activities are described. Finally, the results and conclusions of the project are presented.

2. OVERVIEW OF E-GOVERNANCE IN ESTONIA

One of the prerequisites for achieving the objectives set out in the Digital Agenda for Europe (European Commission, 2010a) is interoperability based on standards and open platforms. Interoperability is defined as the capability of different and diverse organizations to communicate with each other in order to achieve mutually useful and agreed objectives, by exchanging information with the help of data exchange based on ICT systems (European Commission, 2010b). Interoperability is no longer considered a pure IT-issue, but a broader phenomenon comprising different aspects of the information society.

E-governance undoubtedly has the potential to reduce administrative burden and increase the efficiency of the public sector. Estonian paperless records management as a part of e-government has been set as an example in Europe on numerous occasions. In 2009, Estonia's transition to paperless records management won the European e-governance best practice project award. In terms of technology, the transition has been facilitated, on the one hand, by the Document Exchange Centre (DEC) created by the State Information System's Authority (RIA) in 2006, and on the other hand, by the broad usage of EDRMSs throughout the public sector. Cross-usage of various data registers and the capability of organizations'/state information systems to communicate with different parties have become the norm.

The general infrastructure in Estonia enables a successful shift to e-services. In this context, the introduction of the national ID-card, mobile-ID and the digital signature need to be emphasized. Certificate-based ID-cards are used by more than 80% of the population. All Estonian cell phone operators issue certificate-based SIM-cards that allow using mobile-ID for authentication and issuing of digital signatures, providing thus interactive web-based services based on unified user identification.

According to the International Organization for Standardization (2001), records management is the field of management responsible for the efficient and systematic control of the creation, receipt, maintenance, use and disposition of records. The norms stipulated by the Estonian legislation have created a situation, where compliance with the law requires the elaboration and introduction of information technology solutions. The ratio of different information technology solutions in the public sector is numerous. According to the law, Estonian public sector institutions are obliged to keep an electronic records registry. This obligation has considerably contributed to the development of digital records management through the introduction of electronic records management systems, thus creating preconditions and facilities for digital records management and for the automation of workflow processes.

Since 2006, the Government of the Estonian Republic has been on a course towards paperless public administration – an objective set out in the Estonian Information Society Strategy (Estonian Ministry of Economic Affairs and Communications, 2009). In order to achieve paperless administration, a system for exchanging electronic records between public sector agencies through the X-Road Document Exchange Centre (DEC) has been established. The X-Road as a data exchange layer of information systems is one of the support systems, obligatory for maintaining state and local government databases. The goal of the DEC is to connect independent EDRMSs for the secure transfer of records. Exchanging electronic records through the DEC is compulsory for all government authorities.

The indicators on e-state development in Estonia and in the European Union show the success of the Estonian central government, but readiness of numerous local authorities to implement e-governance is moderate and depends on the awareness of local authority managers and the size of the budget. The Republic of Estonia is divided into 15 counties, 33 towns and 193 rural municipalities. Each municipality is a unit of self-government with its representative and executive bodies. In the beginning of 2011 “A Survey of Electronic Records Management in the Public Sector Agencies of Estonia” was conducted (Estonian Ministry of Economic Affairs and Communications, 2011). The aim of the study was to establish the current status of electronic records management in the public sector of Estonia. Study results showed that all ministries, administrations and boards are using EDRMSs, but the results for local governments and smaller agencies are lower. Ten different EDRMS products are in use.

However, Estonia is not the only state that faces this kind of problems. In 2006 Toivanen made a pioneering research in Finland on implementing electronic service provisioning in Finnish municipalities. The survey results showed that development in municipalities is restricted by lack of resources, horizontal co-operation and strategic plans. In Finnish context the heterogeneity of the municipalities is an issue to focus, but even the largest cities lack capacity and capability to carry out major reforms (Syväjärvi et al, 2009). The municipalities wish strategic co-operation and collective solutions especially when novel and reformative changes are in question (Syväjärvi & Kaurahalme, 2010).

3. PROJECT GOALS AND ACTIVITIES

The initial goal of the project was to increase the efficiency and administrative capability of local authorities, and to promote fully digital records management. The project also aimed at ensuring interoperability between EDRMSs and state registers and developing preconditions for the implementation of e-democracy in local governments. These activities increase the transparency and traceability of local governments' records management, while excluding the leakage of delicate personal data.

The increase of efficiency and administrative capability was to be achieved, first of all, through improvement of work routines, in order to be able to render more high-quality services with the same number of officials. The transition to fully digital records management allows to accelerate the processing of citizens' and entrepreneurs' applications and facilitates remote work.

In addition to facilitating participatory democracy, it was important to improve local authorities' capability in complying with the law. For example, the Public Information Act stipulates very strict requirements on the publishing and finding of information¹, but the Personal Information Protection Act firmly limits the publishing of delicate personal information. Local authorities waste a lot of time trying to comply with these requirements, while this time could be spent on rendering services to citizens.

The readiness of local authorities to implement e-governance has so far been moderate and dependent on the awareness and readiness of local authorities' managers. In addition, there has not been a state institution(s), which could support the ICT-related activities of local authorities. Local authorities have demonstrated very little co-ordinated joint action in developing the information society. However, more active county governments and local government associations have initiated thematic joint projects (establishment of internet connections, development of joint web portals etc.) on county level. As the development of the information society on central and local level is divided, it is often the citizen who suffers the most. This is why the local governments decided, within this project, to improve the co-ordination of their activities and to increase, thereby, citizen satisfaction. The structure of the project was the following:

- Initial task, analysis and understanding of what kind of development input is needed in local authorities
- Development divided into five stages
- Implementation of development results
- User trainings and consultations
- Evaluation of influence and conformity analysis.

¹Publishing is related to PSI directive, the main goal is openness to citizens, but it is very important to comply with privacy requirements regarding citizens.

3.1 Institutional Structure of the Project

There were two levels in the project: operative and strategic. On the strategic level, a steering committee was established, and on the operative level, a working group was formed. The management of such a project organization had a very high risk factor, since there were many project partners – about 100 organizations. To consider the interests of all partners it was necessary to establish a flexible communication channel, which would provide information and ensure the involvement of all parties.

The course of the project and the achievement of the planned results were monitored by the steering committee. Within the project working group, all active partners (i.e. active EDRMS users and agencies implementing digital records management) were involved in the development issues related to everyday work. This kind of engagement allowed to analyze the development results in co-operation with users and to achieve the goals of the project. Involving users in development process of a particular software product enables to discuss development activities in more detail and with higher practical efficiency. Therefore, in addition to the achievement of goals set out in the initial phase of the project, synergy achieved on the basis of co-operation between local authority units can be brought out as a positive result.

3.2 Development Input and Initial Analysis

To elaborate development inputs, the developer had a strong vision and e-governance experiences which made the co-ordination with local authorities more flexible. The basic platform of EDRMS itself enabled digital document management, but specific digital governance components for local authorities had not been developed in a centralized way. The initial goal was to describe the governance components in such a way that, as a result of centralized development of these components, they could be used in all local authorities. The goal of governance component descriptions was based on the principle that they should manage local authority's workflows from the beginning to an end. Three sets of functionalities were developed: 1) a system for the digitalization of decision-making process and the preservation and retention of legal acts, 2) a system for the publication and sharing of information, and 3) a system for the communication with non-system users (including cross-usage of data between Estonian state registers).

Issues related to the publishing of information were analyzed regarding the principle that citizens must have, pursuant to the Public Information Act, convenient access to a local authority document register. Since the development was based on the already functioning EDRMS platform, the existing publishing functionality (public document registers) was audited first and, as a result of this, public document registers of local authority partners were put in order. Local authorities were given convenient solutions for ensuring compliance with the Public Information Act and improving information flows for the tracking of local authority workflows.

Another important focus area of the project was the preservation and retention of an organization's document repository. Bringing together paper documents and the digital world has been a great challenge in recent years, since information to be retained may exist both on the paper and in the electronic form. Due to this, one of the tasks of the project was to create a digital archive module within the EDRMS. This module offers EDRMS-based functionality to accomplish all archiving procedures that have so far been paper-based. Regarding the needs of users, the initial goal was to create an archiving functionality with two levels – a part of the document system for maintaining documents withdrawn from active usage (the so-called intermediate archive) and a final archive for the retention of documents not to be submitted to the National Archives.

3.3 Project Development Methodology and Implementation of a Newly Introduced Functionality

The total volume of the project was approximately 2000 development hours and the list of the newly introduced functionality was very long. The list was divided into five logical phases:

- **1st PHASE – Preparation of the EDRMS and analysis of development input:** Cancellation of user-based licensing policy in the current EDRMS platform. Establishment of a centralized database of credentials, creation of a project environment as a unified development repository, analysis of development

activities and preparation of development specifications, auditing of environments in order to upgrade the existing platform and make settings for new developments.

- **2nd PHASE – Retention functionality and creation of a digital archive module:** Creation of a database for active and non-active documents, retention schedule and procedures (separation and extinction) at the end of retention deadline, facilities for the conversion of documents into archive-resistant format and submission to the National Archives.

- **3rd PHASE – Development of the official's desktop:** Integration with various office software products, context-dependent help, wizards for the creation of workflow documents and improvements to the workflow management.

- **4th PHASE – Publishing of local authority information and development of participatory democracy:** Publishing of agendas of municipal council and government sessions, connecting published information to the RSS-feed, establishment and authorization in the citizen view based on the ID-card and mobile-ID, development of a functionality for commenting and voting on different documents and draft laws. Interfaces for external environments and cross-usage of data.

- **5th PHASE: Implementation and final commission of the system, training:**– Trainings for all officials on the usage of the newly introduced functionality and increasing awareness of the information society.

In addition to software outcomes there can be identified a number of discernible changes in the working routines and usage of system. During the project there was an extensive growth of digital signature, which is still continuing trend. Also, there was quite big increase of EDRMS users influenced by the free licensing and user training.

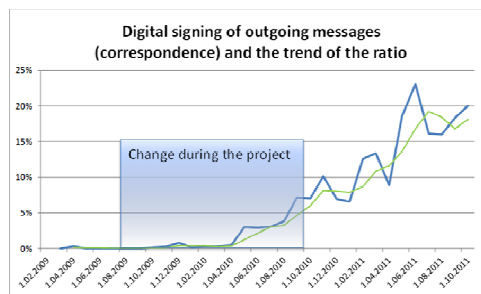


Figure 1. Growth of digitally signed documents

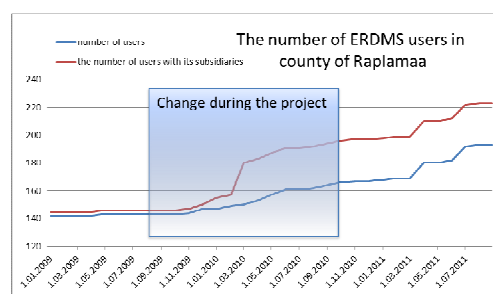


Figure 2. Growth of EDRMS users by the example of one county

3.4 Implementation and User Trainings: Critical Success Factor

In the implementation of IT solutions, training plays a critical role. One of the most important criteria in the planning of the project activities was the training of users. Within the project, two training phases were arranged in 71 local authorities: one phase focused on issues related to participatory democracy and (e-service workflows, the other phase focused on archiving issues. In the training, group work was carried out in computer classes, enabling the officials to learn about improved workflows and new work routines based on a real information system. At the same time, such training gave fast and direct feedback about the usability of the new functionality. This, in turn, provided necessary iterativeness in software development process, so that the realized functionality could be customized.

The goal of the public sector is to upgrade to paperless records management, which, in its turn, presumes a more efficient implementation of electronic records management. Suffering from insufficient funding and lack of labour force, many smaller local authorities find it difficult to be up-to-date with latest development trends of the information society. Discussions with users held in the course of different phases of the project enabled the project team to analyze and prevent various problems and bottlenecks.

4. CONCLUSION

By the end of the project, preconditions were developed for the creation of an efficient and transparent modern local authority that would correspond to the expectations of citizens and entrepreneurs. 1) **In about**

100 local authorities and their subdivisions, EDRMS and adjacent information systems were modernized according to the state information policy priorities, i.e. transition to the paperless records management in the public administration. 2) **Document publishing** was brought into compliance with the requirements of the Public Information Act and different EU directives such as PSI norms and Open Data Initiative. 3) **EDRMS and the main state** information systems were integrated via the X-road in order to enable automated information exchange and reduce surplus data input/the duplication of entering the data. 4) **An e-inclusion** solution was created and participatory democracy was integrated in working routines on the basis of EDRMS; 5) **A digital archiving solution** was created to retain (digital) documents.

The project has established a technical platform for the implementation of e-governance components. However, it should be noted that readiness to implement the created solutions has not always met the expectations. The greatest value of the project lies in the development of preconditions for the elaboration of local authority model and in the description of methodology for improving e-governance. The work of authors in the field continues and activities related to the development of e-governance are ongoing. In the course of various (scientific) projects new solutions and prototypes are constantly created for the implementation of various e-governance components at local authorities.

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AN EMPIRICAL STUDY ON THE ACCEPTANCE OF A SECURITY INFORMATION SYSTEM FOR CITIZENS

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ABSTRACT

SIS4you is an Austrian research project with the aim to empower the general public by providing information and advice how to self-protect against burglary and theft. This shall be realized by means of an Internet-based security portal, which allows a low-threshold access for the citizens and which shall be developed in co-operation with the competent authorities (Federal Ministry of the Interior and the police). Negative experience regarding the acceptance of the public that occurred in a similar project in Great Britain must be avoided. Therefore, in advance of the technical realization, a comprehensive social science program is implemented to address the needs of the general public. So far, three focus groups and a representative survey among 2000 Austrians from the age of 16 upwards were implemented. The interest and potential use of the security portal is about 35% of the population. The results show that for building confidence in the portal, the involved and responsible authorities must be visible and crime statistics on the map should not be too detailed (county level), up-to-date (up to two days old), and not too accumulated over longer time periods (maximum one month). Registration should only be optional in order to avoid disclosure of personal data when using the platform.

KEYWORDS

Crime prevention platform, personal security perception, security-related public education, crime map, public survey

1. INTRODUCTION

The SIS4you project (SIS4you project, 2011) aims at creating an Internet platform for comprehensive burglary prevention by the means of providing information, advice, and education for citizens through professional experts from security authorities. Therefore an early warning system is established which helps to reduce the threat vulnerability of apartments, houses and business premises. The project is implemented as a multi-functional security portal web application. Advanced IT technologies such as e-learning, semantic information processing, and visualization techniques are integrated into a converged platform. The innovation lies in both functionality and the development of a proof-of-concept prototype. The web application is pioneer work in intrusion prevention for the large-scale public, helping to raise awareness. As a consequence, the project is initiator for future initiatives, products and markets.

Social science research is applied to ensure that citizens accept, and finally trust the product, and data protection concerns are considered in the design of the platform. The needs of the citizens were evaluated by the means of three focus groups and a quantitative survey. In the center of interest is the analysis of conditions that ensure confidence in the platform as well as the promotion of the increased security provided by the platform, while avoiding elements that contribute to uncertainty among citizens. Problems as they occurred in similar projects such as the 'crime map' in England (<http://www.police.uk/>) can be avoided. Major criticism of the project was about too detailed crime statistics which might unsettle the population and further stigmatize regions. Similar drawbacks and barriers to user acceptance were already considered in the design phase of the platform. The following key elements are studied from a social sciences perspective in greater detail: (1) preparation and composition of general information on burglary prevention, (2) e-learning opportunities with a focus on instructional videos, (3) willingness for personal registration on the portal, (4) interactive elements such as the reporting of suspicious observations and (5) the presentation of current events and alerts on a map.

The main contribution of this paper deals with the results from real user surveys regarding functional requirements on such Web-based platforms, as well as major concerns and hurdles that could hinder or even prevent broad acceptance in the general public.

2. BACKGROUND AND RELATED WORK

A dedicated tool for enhancing security awareness and training of company employees was developed by (Furnell et al., 2002). In contrast to that, our platform focuses on security aspects relevant to the whole population. Previous works suggested using well-established social network sites (Vence et al., 2009) to initiate social campaigns and inform the general public, for instance in the area of health information distribution. However, there are major privacy threats when it comes to personalized services which require the users to enter profile information (Williams, 2010).

One controversial part of the platform is crime mapping as investigated by (Chainey, Tompson, 2008), (Doran, Burgess, 2011) and (Manning, 2008). In 2009, the British police launched an online crime map (Jones, 2009) which was continuously updated and extended to all streets of England and Wales (Travis, 2011) according to recent crime reports (Flatley et al., 2010). As reported, the public's unexpected high interest caused the platform to crash (Travis, Mulholland, 2011), which clearly reveals the importance and high acceptance of such a platform. Since the public launch of crime maps, research focused on various aspects for improvement, such as the granularity of visualized information (Phillips, Lee, 2011). Also major criticism regarding unsettling people, and questions about the usefulness of such maps have been raised (Sampson, Kinnear, 2010).

3. PLATFORM DESIGN STUDY: METHODS AND SAMPLES

Focus Groups. In order to optimize the usability of the platform and promote it to the public a quantitative survey was conducted and three focus groups were formed. The outcome of the survey was an essential input for the content and design of the SIS4you platform. The findings from these focus groups were incorporated immediately and directly in designing the questionnaire for the quantitative survey to obtain a representative estimation of the portal's use. In the course of a discussion, focus groups allow for finding backgrounds of opinions and basic attitudes. Thus, complex motives in the context of subjective security perception can be captured appropriately. Here, several people are interviewed simultaneously, which allows interactions among themselves. Optimally, it is used in combination with a representative sample survey. Prior to a quantitative survey in February 2011, three two-hour focus groups have been conducted. In order to meet the diverse regional needs and different requirements of house owners and apartment renters, the groups were recruited accounting for different criteria: (1) the 'commuter belt' around Vienna includes mainly house owners, (2) the inner-city area of Vienna contains apartment owners, districts with higher socio-economic potential, and smaller residential neighborhoods, and (3) the urban area of Vienna with apartment owners, districts with lower socio-economic potential, and larger residential neighborhoods. Participants in the focus groups were mixed in matters of gender, age, and education. The screening took place in two steps. First, using a telephone screening, twice as many people that meet all the conditions have been selected for the participation in the focus group. This form of recruitment has the advantage that, immediately before the start of the focus groups, a second screening step can be carried out and eventually an optimal focus group can be formed of 8 to 10 people.

Quantitative Survey. In the available empirical studies, an Austria-wide survey has been carried out. The basic population is the Austrian population over the age of 16 years. The survey was conducted in the period from 1st March 2011 to 30th April 2011, and each interview lasted 30 minutes on average. Computer-assisted personal interviews (CAPI) were conducted by respondents in their own homes, selected by the Viennese Institute for Social Research IFES. The selection of households was done by a multi-stratified random sample. Furthermore, the interviewees in the households were also selected by the Swedish key procedure, which is also a random selection method in social sciences. The interviewer and the interview are controlled by international standards, such as checkups, training processes, plausibility checks, and response pattern analysis. By sampling broadly, the structure of the interviewee group is representative for the Austrian

population, minor deviations were weighted. The sample includes 52% women, 21% have as highest degree a compulsory education, 36% an apprenticeship, 20% a trade school (BMS, middle school), 15% a diploma (final examination) and 9% had a university degree. The age distribution in years: 22% up to 29 years, 16% 30 to 39 years, 20% 40 to 49 years, 15% 50 to 59 years, 13% 60 to 69 years and 14% were 70 years or older. 56% of the respondents are working. 36% of the respondents live in a detached house, 9% in a serial or two-family house and 55% in flats.

4. RESULTS AND DISCUSSION

Perceived Security. The Austrian population generally feels safe: 38 percent very confident and another 42 percent feel rather secure. Only 4 percent can be classified as unsettled. In their own homes six out of ten respondents feel very safe. 36 percent estimated the personal risk, to become a victim of a criminal act as above average. Similar results have also been observed in two other studies, carried out by IFES with a sample size of $n = 1955$ and $n = 1500$ respectively (Raml, Schuster, 2011a/b). In another study conducted by IFES and funded by the KIRAS program (Raml, Schuster, 2011a), five personality types were discovered: persons with a strong sense of security (21%), with a higher perception of safety (32%), with extensive relegation fears (21%), with a high fear of crime (17%) and strong global uncertainty (8%). Especially the last two groups (about a quarter of Austria's population) represent the primary target group of the SIS4you security platform. The following security measures have already been taken by the respondents: 34% have installed motion detectors, 31% have acquired security doors, windows, or locks, 9% protect themselves with an alarm system.

Security Information Provisioning. Only a fifth of the respondents have informed themselves about security at road shows or by reading information on the Internet. The state of knowledge on security topics such as intrusion protection, costs, funding opportunities, and product information is evaluated as rather low. Only one fifth to maximum one third of the respondents thinks that they are well informed. The need for well prepared and understandable information is therefore high, and the platform has potential to dramatically alleviate individual prevention efforts and to strengthen, subsequently, the subjective sense of security.

The portal should primarily be an information platform, where users can easily find an overview of the most important issues and objectives about security and in particular on securing their homes. This should be communicated to the public even in this form, all other functions, such as a crime map or the possibility of sending messages to authorities, should be modular extensions. The platform should be kept simple and rather controversial features should be introduced only gradually, so that people can gather experiences with this 'stripped-down' platform first.

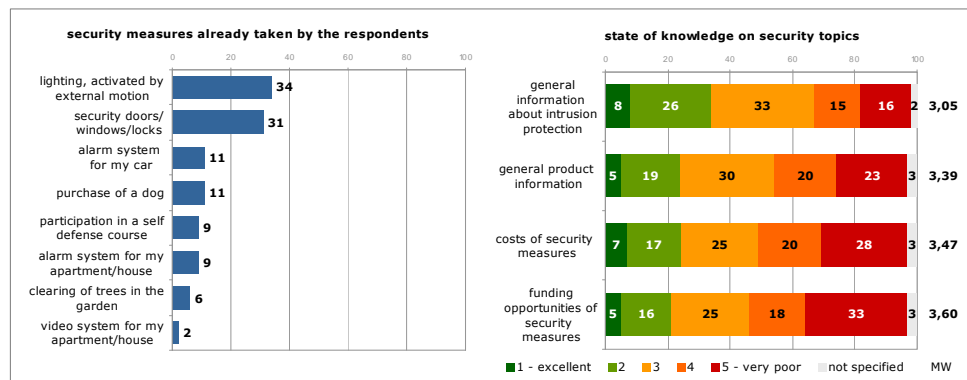


Figure 1. Security Information Provisioning

Potential Impact. The interest in the platform is at 35% and therefore rated as high (compared to the target group of 25 % of the population as mentioned above). There is great interest in information about rules of conduct in case of emergency (58%) and in general information about burglary prevention (52%). The platform should primarily provide information about the occurrence and prevention of burglaries (70%), but beyond that there are additional needs for information that must not be neglected: confidence tricks (53%), car theft (51%) and internet fraud (41%). The data analysis clearly discovers that information on safety

measures and solutions should be at the center of the platform - including e-Learning lessons and animations of modern homes with which one can perform a vulnerability assessment of his/her own home. A third of the interviewees would use a 3D view of a house or an apartment with an attached security analysis. The main reason why a significant fraction of the population would not use this service, is that no one likes to enter detailed information about his/her house. Therefore, an example apartment and an example house, equipped with a balcony, terrace, cellar, garden, ground floor windows, etc. should be provided. The users can then decide which areas in the home they want to look at.

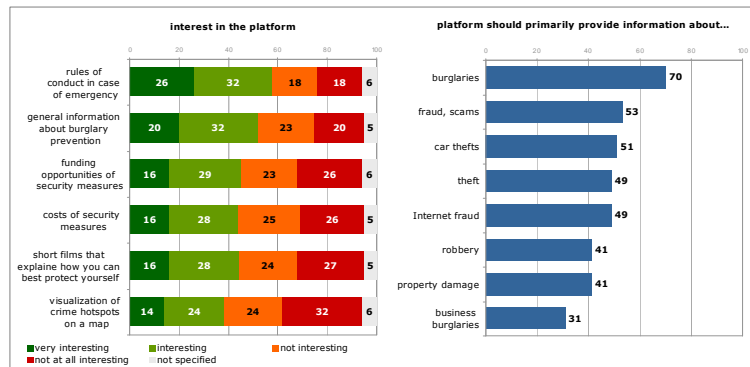


Figure 2. Potential Impact of the Platform and Provided Information

User Acceptance. Measures to increase trust in the platform are essential to achieve a wide acceptance by the population. This includes in particular the visibility of the logos of the Federal Ministry of the Interior and the Austrian police, which enjoys high reputation among the population. Furthermore, personal data of citizens should not need to be entered mandatory for basic platform usage. These measures reduce the fear of misuse, and ensure – from the perspective of potential users – the privacy of personal data. We clearly discovered that in the population concerns about misuse are quite widespread. 51 percent of the respondents expressed concerns about the possible misuse by criminals and 45 percent expressed doubts about the assurance of anonymity, if registration would be necessary. People also fear that an opportunity to report suspicious observations could easily lead to defamation of others. The most controversial feature would be the crime map. One part is excited about the opportunity to be warned of and learn about endangered residential areas. However, the other part fears panic and fear-mongering. In that case, people tend to feel more insecure rather than sensing additional security. Large concerns are also mentioned in terms of possible economic consequences. A crime map, for example, could result in a loss of value of real property. For instance, the fact that in a particular area only a less affluent clientele settles might have negative consequences for the established shops. A strong reduction of major doubts should be possible, if the following points at the crime map are guaranteed: (1) Usage policies: With the launch of the platform, it is important to communicate the user, how data is going to be used and how to deal with information. (2) Up-to-date data: Information presented on the crime map should be as current as possible – a daily update would be needed. (3) Latency of the data: Data accumulation over a longer period of time (more than one month) should be avoided in any case. A concern is that this could have a negative impact on property prices. (4) Granularity: In terms of granularity of data, respondents think that the results should be at least ‘one level above’ the street (e.g., residential area and district level).

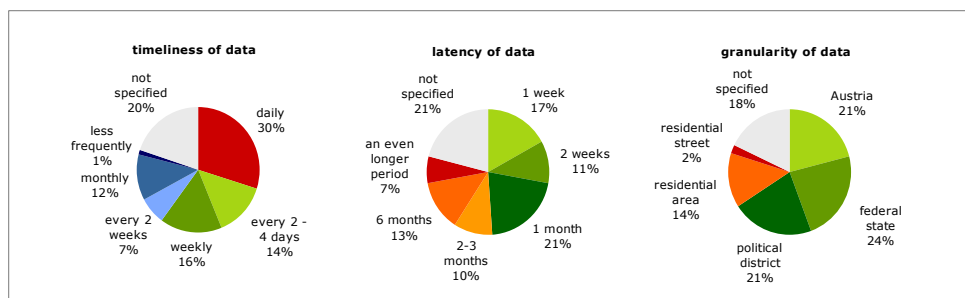


Figure 3. User Acceptance

5. CONCLUSION

In this paper, we discussed results of an empirical study dealing with perceived security in Austria's population, and clearly identified the need for further public education regarding a wide range of security-related aspects. The conducted empirical study is a first important step towards building a widely accepted Internet platform for the provisioning of security-related information, advice and education. It is of paramount importance to consider public concerns and doubts from the beginning, and to undertake any possible countermeasures in order to alleviate major objections and properly address related challenges. Future work includes the public rollout of the platform, accompanying user surveys and periodic evaluation of the user acceptance of single features.

ACKNOWLEDGEMENT

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SUSTAINABILITY OF CITIES, INNOVATION AND COMPETITIVENESS – ASSOCIATING CONCEPTS

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ABSTRACT

Competitiveness is the basis of economic progress of a country. Innovation is one of the foundations of competitiveness. Competitiveness Studies aim to evaluate Competitiveness through a set of indicators, which evolved from year to year, aggregating indicators related to Sustainability of Cities. This article is intended to explore the concepts of Competitiveness, Innovation and Sustainability. It will describe the methodology of two important studies on Competitiveness, showing results in Brazil. The growing importance of city sustainability indicators for these studies will be described, highlighting the role of Information and Communication Technology.

KEYWORDS

Innovation, National Innovation Systems, Sustainable Cities, Competitiveness Studies

1. INTRODUCTION

The competitiveness of a country is a macroeconomic and relative notion based on Innovation concepts. Macroeconomic because it is based on the great structuring dimensions: Economic, Social and Environmental dimensions; and relative, because it evaluates a country in relation to the others.

For Competitiveness, the role and importance of technological Innovations for the economic development of nations was established in the 1930's by the Austrian economist, J. Schumpeter (1883-1950). Subsequently, other researchers, such as Boutillier et alii (1999), highlighted the importance of technological innovations for the improvement of production methods; diversification of products; increase in consumption and credit; and for the economy growth. Technological Innovation became part of the political agenda of developed and emerging countries.

To spur competitiveness of a country based on Technological Innovation is a complex process due to its systemic nature. It requires interaction among interdependent actors, defining the concept of National Innovation Systems (NIS). Soete et al (2010), refer to the German economist, Friedrich List (1789-1846), as the precursor of this concept, as by the 1840's decade, he already discussed the systemic character of the interaction among Science, Technology and Competences. Soet et al (2010) highlight many ideas of protection to new companies and a broad range of policies to accelerate or enable industrialization and progress – most of them related to learning new Technologies and their application, delineating the concepts that are the pillars of current National Innovation Systems (NIS). The basis of the NIS is the importance of the systemic interaction among numerous components of the inventions: research, technological change, learning and Innovation. The NIS must be focused on Industry, as companies are the engine of productivity growth, ongoing technological improvements, and, therefore, Innovation. The NIS need to involve the Federal State, which holds a central role in supporting, organizing, improving and evaluating institutions and organizations, as well as guaranteeing the existence of a favorable economical and social environment.

Under this amplified concept of NIS, at the end of the 20th century, emerging countries, such as China (MOST, 2009 and Liu, 2011), India (Franco et al, 2011) and Brazil (Morgado and Casanova, 2010; Morgado, 2011) drafted the policies that delineated their NIS. Brazilian policies privileged high technology sectors, that is, those related to Information and Communication Technologies, in line with Wyckoff and Pilat (2010), who consider this approach to be one which achieves best results for a country, given its multiplying effects in the productive chain. This strategy was formalized in the OECD Innovation Strategy Manifest (OECD, 2010), launched in May, 2010. In its Industrial, Technological and Foreign Trade Policy,

of 2004 (Morgado and Casanova, 2010), Brazil also emphasized the importance of Local Productive Arrangements, which draws regions and cities to the core of the Competitiveness issue.

The current concept of Innovation, adopted by INSEAD (2011) in its Global Innovation Index, based on the Oslo Manuals (OECD, 1992, 1997 and 2005), formalizes the institutional and local inter-relationship. This broadened concept is going to be the basis of Studies on Competitiveness, which, in turn, will be influenced by the concepts of Sustainable Cities, as demonstrated hereinafter.

2. SUSTAINABILITY OF CITIES

In 2008, in Davos, in the World Economic Forum conference (World Economic Forum, 2008), the SlimCity initiative was launched, approaching the sustainable development of Cities, aiming at reducing carbon emissions and increasing local efficiency in large terms.

The SlimCity initiative (World Economic Forum, 2009) seeks to orient Municipal Management towards three major areas: Social, Economic and Environmental, being based on the pillars of Intelligent Energy, Sustainable Buildings, Urban Mobility and Housing for all. The cities are responsible for 70% of carbon emissions and because they are the “engine of economic prosperity” (World Economic Forum, 2008). In 2007, the sum of the GDP of the ten major cities in the world was higher than the accumulated GDP of 162 countries. Following the SlimCity initiative, many cities implemented programs of interaction with citizens, in an attempt to evaluate Quality of Services, Interaction with City Administration, and Priorities of its residents regarding the use of municipal resources. Furthermore, the urban growth rate is nearly 3.5% per annum, as per Gourat et al (2011), and it requires Information and Communication Technologies to enable Municipal Governance and collection from citizens.

The SlimCity and, later, the Sustainable Competitiveness Project (World Economic Forum, 2011a), became influential in important Competitiveness Studies, such as the Global Innovation Index (INSEAD, 2011) and the Global Competitiveness Report 2010-2011 (World Economic Forum, 2011b). The latter included, in its 2011 version, various indicators directly associated to Sustainability, such as the Budget Balance, Strict Environment Regulation, Application of Environmental Legislation, Ecological Protection, Intensity of Energy Use, Use of water in agriculture, Forest Cover and Air and Water Pollution.

3. STUDIES ON COMPETITIVENESS

Considering that a country’s competitiveness is the result of a macroeconomic aggregate, which, strictly speaking, could only be evaluated “ex-post” by complex economic research, studies, such as the Global Competitiveness Report (World Economic Forum, 2011b) or The Global Innovation Index (INSEAD, 2011), arise. These studies assess Competitiveness through Indicators, which are grouped and pondered according to a methodology, resulting in an Index for each country, which are presented in rankings. The studies are, thus, an image of Competitiveness, used as a periodical assessment instrument, which, today, are adopted by Public and Private Administrators to guide investments and actions.

Indicators of the two studies cited above are of two basic natures:

- Indicators based on quantitative data, from international sources, such as the World Bank, International Monetary Fund (IMF), Organization of Economic Cooperation and Development (OECD), World Trade Organization (WTO), World Health Organization (WHO), etc.
- Indicators derived from research applied in each country by a network of partners, which make up the majority of the indicators. In the case of the Global Competitiveness Report (World Economic Forum, 2011b), we have two basic types: the ones based on “grades” (from 0 to 100), as in the case of the “Job Rigidity” Indicator; and the ones based on the Lickert Scale, as the “Brain Drain” Indicator (which varies from a “no, the best brains leave the country”, to a “yes, there are opportunities for talents in their own country”).

Therefore, we can state that most indicators of these studies are supported by “perceptions” of the research respondents, reflecting a favorable or unfavorable “mental state”. Perceptions can reflect changes more rapidly than quantitative data, and they may be influenced by political actions. So, City Sustainability

indicators, for being local and associated to the citizens' views, can reflect results in a more direct and immediate manner.

3.1 The Global Competitiveness Report of the World Economic Forum

The Global Competitiveness Report 2010-2011 (World Economic Forum, 2011b) categorizes its indicators in three Groups of Sub-Indexes: the Requirements Sub-Index, the Efficiency Enhancers Sub-Index and the Innovation and Sophistication Factor Sub-Index:

- Requirements Sub-Index, composed of 3 Pillars: (1) Institutions, (2) Infrastructure and (3) Macroeconomic Environment. Its result is achieved by the average of the Pillars and these ones, by the average of their indicators.
- Efficiency Enhancers Sub-Index, composed of 7 Pillars: (4) Basic Health and Primary Education, (5) Higher Education and Training, (6) Goods Market Efficiency, (7) Labor Market Efficiency, (8) Financial Market Sophistication, (9) Technological Readiness, and (10) Market Size. Just like the previous sub-index, its result is calculated by the average of the Pillars and these, by the average of its indicators
- Innovation and Sophistication Factor Sub-Index, composed by 2 Pillars: (11) Business Sophistication and (12) Innovation. It is calculated in the same manner as the preceding pillars.

The final result of the Global Competitiveness Index calculation, considers the weighted average of the Pillars, based on the "Development Stage" of each country, which is defined by their GDP, as shown in Figure 1. Brazil is positioned at the "Transition from stage 2 to 3" level, along with other 18 countries, among which, Chile, Mexico and Russia. India was ranked at "Stage 1", while China at "Stage 2".

Table 1: Subindex weights and income thresholds for stages of development

| | STAGES OF DEVELOPMENT | | | | |
|---|---------------------------|---------------------------------------|-------------------------------|---------------------------------------|-------------------------------|
| | Stage 1: Factor-driven | Transition from stage 1 to stage 2 | Stage 2: Efficiency-driven | Transition from stage 2 to stage 3 | Stage 3: Innovation-driven |
| GDP per capita (US\$) thresholds* | <2,000 | 2,000–2,999 | 3,000–8,999 | 9,000–17,000 | >17,000 |
| Weight for basic requirements subindex | 60% | 40–60% | 40% | 20–40% | 20% |
| Weight for efficiency enhancers subindex | 35% | 35–50% | 50% | 50% | 50% |
| Weight for innovation and sophistication factors subindex | 5% | 5–10% | 10% | 10–30% | 30% |

* For economies with a high dependency on mineral resources, GDP per capita is not the sole criterion for the determination of the stage of development. See text for details.

Figure 1. Development Stages of the Global Competitiveness Report

In the Global Competitiveness Report 2010-2011 (World Economic Forum, 2011b), Brazil was classified at the 53rd position in the general ranking, among 142 countries, having moved up 5 positions compared to the previous year.

The following indicators deserve positive highlights: Market Size (10th position), Business Environment Sophistication (31st position), Financial Market Efficiency (40th position), Technology Adoption (57th position); and Innovation (44th position).

A negative performance is observed regarding the following indicators: General Infrastructure (104th position), Macroeconomic Balance (115th position), General Quality of its Educational System (115th position), Labor Market Rigidity (121st position) and Progress based on Competition (131st position).

The Global Competitiveness Report 2010-2011 offers a graph view of Brazil's positioning regarding its Pillars:

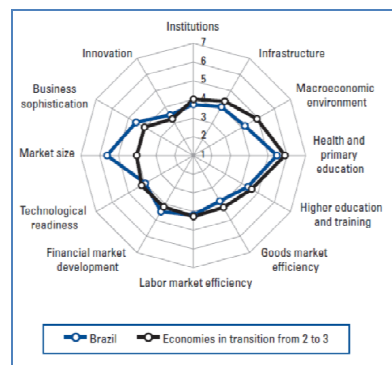


Figure 2. Positioning of Brazil in the Group of Countries that present their Economy in Transition.

3.2 The Global Innovation Index of INSEAD

The Global Innovation Index (INSEAD, 2011) is based on two Sub-Indexes, the Innovation Input Sub-Index and the Innovation Output Sub-Index, each of them composed of Pillars, five for Input and two for Output:

- Innovation Input Sub-Index, composed by the following Pillars: (1) Institutions, (2) Human Capital and Research, (3) Infrastructure, (4) Market Sophistication and (5) Business Sophistication. Its result is calculated by the simple average of indicators that compose each of these five pillars.
- Innovation Output (or Results) Sub-Index, composed of the following Pillars: (6) Scientific Production and (7) Creative Production. Its result is achieved by the simple average of indicators that compose each of these five pillars.

The Innovation Efficiency Index Ratio is then calculated, measuring how efficiently the Inputs are used, calculated by dividing the Innovation Output Sub-Index by the Innovation Input Sub-Index. And, finally, the General Index of the Global Innovation Index is calculated by the simple average of its two Sub-Indexes.

In the Global Innovation Index 2011, (INSEAD, 2011), Brazil occupied the 47th position, among 125 countries, improving 21 positions in relation to the previous year. It obtained a remarkable position in the Output Sub-Index, being the 32th in this ranking and being the 18th among Median-High Income countries. This positive performance in Results allowed Brazil to overcome its poor performance in the Input Sub-Index (68th position). The country reached the 47th position in the general ranking of the Global Innovation Index 2011. The main rankings of Brazil, regarding Results, were the Applications to register Utility Models (24th position), Trademark Registrations Filed (23rd position), Labor Productivity (26th position), Export of Computers and Services, including Communication (15th position), Export of Creative Goods (2nd position), Use of ICT in business and organizational models (23rd position) and Use of ICT in Business Models (24th position).

Even among Inputs, where Brazil's overall performance is undoubtedly poor, as it occupies the 68th position, we highlight the indicators according to which the country was positioned among the 30 first countries: Gross Investment in R&D (30th position, with 1.1% of GDP), Share of Renewables in Energy Use (24th position), Ecological Footprint and Biocapacity (7th position), Abundance of Information on Credit (25th position), Market Capitalization (23rd position), Total Value of Shares Traded in the Stock Exchange (27th position), Companies Offering Formal Training (13th position), Development Stage of Local Arrangements (30th position), Import of High-Technology Minus Re-Importation (15th position), and Imports of Computers and Services, including Communication (16th position).

Contributed negatively to the poor performance in Inputs, indicators regarding the following pillars: Institutions (87th position); Human Capital and Research (76th position), pillar to which the Education Sub-Pillars belong and; the Market Sophistication pillar (80th position), to which Credit and Taxes pillars belong.

4. FINAL COMMENTS

Studies on Competitiveness, which have been offering useful information on countries competitiveness, demonstrated, in their recent evolutions, the increasing importance of indicators associated to Sustainability.

These sustainability-related indicators became a key factor in Competitiveness indicators. Although having a national scope, they reflect local actions oriented to the improvement of Urban Sustainability.

We can see, for instance, in initiatives such as the Projeto Cidades Sustentáveis (Sustainable Cities Project) (<http://www.cidadessustentaveis.org.br>), the collection of local indicators of Responsible Consumption, Homeless Population, Public Transport and Urban Planning. These initiatives, totally supported by Information Technologies, stimulate the awareness of Sustainability in the Cities, influence policies and promote an enhancement in citizens' perception. And, as we could see, the perception improvement can exert a direct impact on Competitiveness Studies. Sustainability of Cities, thus, becomes a very important matter to be taken into account in the studies of Country Competitiveness.

Information and Communication Technologies (ICT) play an important role in this context. It goes beyond being the focus of Innovation policies based on high tech. According to Gourat et alli (2011), ICT are a key instrument for the improvement of City Governance, being capable of contributing to the increase in efficiency and effectiveness of systems, through e-Gov, and to data collection among citizens, through portals.

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EXPOSURE OF YOUNG PEOPLE TO VIDEO CONTENT: A QUALITATIVE INVESTIGATION

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ABSTRACT

The paper introduces a qualitative investigation to explore and analyse user experience of young people with video content in different forms, in the framework of KidLab Media Research, an innovative environment for field studies with younger generations. Key findings of a focus group in a lower secondary school classroom are introduced and commented. Finally, perspectives for future research are presented.

KEYWORDS

Audiences, cultures, focus group, new media, protection of minors, user experience

1. INTRODUCTION

Developments in delivery technologies of multimedia content are leading to radical changes in the modalities of fruition by users. The phenomenon refers to the evolution from one-way analogue to interactive digital television, to a convergent multimedia environment in the home, up to an intelligent space where the TV set acts not only as a screen but as a central gateway for communication and interaction of people and objects based on ambient intelligence. It also refers to the distribution of multimedia content over the Internet and through mobile communication networks, and to the emerging role of users (especially the younger generations) as content producers.

In the framework of scenario analysis in the field of media convergence, the original methodology KidLab Media Research was developed, initially focusing on the characterization of the use of video content on multiple platforms by the younger members of the population, through experimental investigations (for recent projects dealing with children and new technologies see the following reports: Sonia Livingstone et al., 2011; Rideout et al. 2006). KidLab Media Research, which is related to the disciplinary approach of Scenario Engineering (Nicolò and Sapio, 1996, 1998 and 1999), created in Fondazione Ugo Bordoni, involves the use of functional blocks integrated into a multidisciplinary research environment that fosters the study of the behaviour of younger generations related to new media content accessible through digital television and the network. The KidLab School Pilot project is a first step towards this direction. Its main objectives are the exploration of dynamics of adoption and use, attitudes and cultural patterns, user profiles, purchase intentions and consumption, scenarios of convergence, psychological and social risks.

KidLab School Pilot involves a comprehensive institute (primary and lower secondary school) in Roma (Italy) through the interaction with teachers and pupils. A set of specific tools were developed for the field research, taking into consideration the peculiar characteristics of younger audiences and of the school setting. The integration of qualitative and quantitative methods will provide greater consistence to results (Giaoutzi and Sapio, 2012).

In the following sections we will present the key findings of the first focus group (collective interview in the classroom) organised in the framework of KidLab School Pilot.

2. METHODOLOGY

In the first phase of the field study the research team adopted a qualitative methodological approach in order to explore the phenomenon, while building hypotheses to understand the point of view of the young users, their behaviours, their emotions, their representations and their needs. Focus groups are a standard practice in social sciences, allowing interviewers to study people in a more natural setting than a one-to-one interview. They can be used for gaining access to various cultural and social groups and raising issues for exploration (Marshall and Rossman, 1999). Dealing with pre-adolescent students, special care was taken in order to keep invasiveness to a minimum, to obtain unbiased answers and not to disrupt the delicate equilibria of the class.

The focus group was held in the library of the comprehensive institute "Giorgio Perlasca" in Roma (Italy) and involved the pupils of the I C (lower secondary school) in the morning of April 20, 2011. Nineteen students participated (9 males and 10 females, mean age 12 years) sitting in a circle, three teachers, an interviewer, a recorder, an auxiliary interviewer and the school psychologist. The duration of the group interview was about two hours. The discussion guide was structured in order to investigate modalities of video consumption by the students.

3. KEY FINDINGS

3.1 Television

At the beginning, the interview deals with the pupils' impressions of television. Each child is asked to select a word best describing television according to his/her feelings. Answers are diversified: they cover different aspects of the television concept from technology aspects (i.e. *electronic device*, *signal*, etc.) to fruition aspects (i.e. *couch*, *pizza*, etc.), even if the most popular answers are about their favourite TV channels or programmes. More in depth, it emerges that they seem to be mainly attracted by programmes such as reality shows or serials, but also traditional children programmes such as cartoons, music and sport seem to meet their interest. Remarkably enough, all answers lack reference to any specific persons or superstars, any film titles or any sport idols. Besides, keywords collection on a blackboard suggested by children leads to a rough picture of children preferences due to mutual influences and imitation behaviours.

3.1.1 What

Among the interviewed students a consistent group is very attracted by thriller movies. The main reason seems to be their characteristic to accentuate the suspension of disbelief, especially thanks to their capability to involve watchers, not reachable with other types of programmes. Specifically, thriller movies possess a high power of capturing the attention: they are able to generate suspense up to the sensation to interact with the scenes. Children explained that they have the impression to influence the story described in the film, and to participate actively in the story. Indeed interest, inquisitiveness, fear seem to be the features that stimulate the pleasure of watching television. In other words, young people prefer to watch thriller movies because they are able both to completely involve them during the vision and to show the greatest unpredictability.

"They scare the hell out of you..."

"It's cool when you watch something that can frighten and involve you..."

"They force you to watch the entire film, up to the very end, if you want to know about the conclusion..."

"They can give you a sense of interaction with the scenes, as within a 3D effect, and you believe you are in the movie, and sometimes you shout 'Do not open that door!'..."

After these preliminary considerations, the interviewer asks if they find some movies to be too gory. The kids' reactions are very different: some nod affirmatively, others deny.

"I put a pillow on my head..."

"I use a blanket..."

"Hands over my eyes..."

"I keep watching..."

"When I watch a thriller, then I cannot sleep at night..."

"I put my hands over my eyes and shut my ears, because even if you don't watch, you can imagine what is happening if you listen..."

The interviewer asks if they usually watch thriller movies alone or with someone else. Somebody replies *"alone"*, and others *"with my parents, friends, brothers"*.

The next question is about parents' prohibitions to watch some programmes. Also in this case the class is split into two opposite responses: permission and prohibition to watch programmes with gory or erotic contents, even if someone of the latter group admits overcoming the prohibition by watching in the bedroom.

Reality shows are another hot topic.

"I watch reality shows because I can see what people do during the day. And I like them because sometimes I dream of participating when I am older..."

Someone adds different motivations:

"I like talent shows, because I like to dance..."

"Because I like to watch what other persons do..."

But children seem to appreciate documentaries as well. Motivations are different:

"Because sometimes they show not only animals, but even what happens to people: something odd happens and you are flabbergasted, but then there is a happy ending..."

"I like to gather information about animals..."

"I learn how animals are, and what they do during the day..."

"I want to know which animals you can eat (both cooked and raw), or which plants can cure..."

"Because I can see rankings of the most dangerous animals..."

Some pupils say they have pets, and this explains their interest towards nature documentaries. But it also emerges that they are strongly attracted by horrifying or unusual events (i.e. extreme survival techniques involving eating disgusting things), by freak animals (or people), by everything dissimilar to normal standards due to some physical problems (i.e. people without limbs).

The next examined contents are cartoons. At the beginning kids find it difficult to explain why they are attracted by these types of programmes, and they provide laconic answers such as *"because cartoons are funny!"*, afterwards answers become more articulated:

"Because they are artificial..."

"Even if they are fake, they contain real situations..."

"I watch cartoons while I have pizza, when I have nothing else to do or when my mother forbids me to use the Playstation, or finally when there is no other interesting programme to watch..."

"There are horror cartoons..."

"They make me laugh..."

"I am forced to watch cartoons because my youngest brother likes them! If I try to switch channel, he starts screaming..."

3.1.2 When and with whom

The focus group participants watch television both alone and with other persons (i.e. parents, friends, etc.). They usually watch in the afternoon and the evening.

"I watch TV in the morning during breakfast, and in the afternoon for a few minutes, and after dinner in the evening..."

"During my normal activities in the whole afternoon, and then I do my homework or use my computer..."

"In the afternoon for one hour, if I do not go to the gym, and then in the evening after dinner..."

"I watch TV when I have nothing else to do during the afternoon..."

"In the morning before breakfast..."

"While I have dinner and for one hour after dinner with my parents and my brother..."

"From Monday to Friday in the evening, and during the weekend only if there is a match with the Roma football team..."

It is interesting to note that some pupils watch television after doing their homework, others follow the opposite sequence.

3.2 Computer and Internet

All the pupils unanimously say they like computer and the Internet more than television.

3.2.1 Activities with the Computer

The participants are asked to tell what they do with their computers. Here are the collected answers, which include names of software programs, types of activities, social networks, games and websites (the gathered items are not listed in a specific order, but as they were written on the blackboard).

"Facebook, MSN, photos, YouTube, Emule, Picnik, Megavideo, streaming, Skype, Google, Google Maps, Stardoll, Gioco.it, online games, Flash games, miniclip, Abo, Spider, translations, Cityville, Lottomatica, Real Player, Pet Society, Snai, Farmville, drawing, Excel, chess, movie and music downloading, videos, Fantacalcio, Roma football team videos, listening to songs, writing on WordPad, forums, writing on WinWord, sharing (with content creation), videochatting with friends, parodies, Wikipedia, homeworks and school researches"

All the pupils but three play role games on the Internet by creating characters. However, they only use free games. Moreover, if games, which are initially free, become premium during their use, they are abandoned by the children without hesitation. Nevertheless, a boy tells that he used a small amount of money to make virtual purchases in order to provide his avatar with many things. Two similar cases are reported too. Someone uses Skype to communicate with relatives, independently from the fact that they are in a near area or abroad. The pupils say that they prefer to do school researches with the computer, even though several of them still handwrite such researches. Anyway, these more in-depth studies are accomplished only when they are assigned as homework by teachers. Eleven participants use electronic mail.

3.2.2 Facebook

Eighteen pupils use Facebook. Twelve of them have Facebook constantly active. Fourteen use other social networks as well. Many children say that they have hundreds of friends on Facebook. In particular, one of them says that he has more than one thousand friends. The participants are asked to tell if they prefer to have face-to-face or Facebook mediated conversations among friends. Nine pupils answer that they prefer to use Facebook, so that they can avoid telling some things personally. One remark by a girl is significant:

"There are things I'm not able to tell in person..."

It seems that the use of Facebook facilitates confidence, quarrels, requests to be forgiven and revelations of liking and love. According to the pupils' remarks, it would seem that in this way shame can be overcome more easily. But a boy says that it is better to get engaged personally rather than to do it via Facebook. And someone also observes that the Internet doesn't always tell the truth. Not every participant using Facebook is usually in it with his (or her) real name and surname. Some of the pupils use pseudonyms. Seven participants tell that they had to ask permission to their parents in order to use Facebook. Eleven pupils have their parents as friends on Facebook. As for the problem of intrusion of parents in the children's use of Facebook, a girl says that she has limited the possibility of condision, thus preventing her parents from having access to some types of information. Three pupils speak with their parents also through Facebook. In particular, a girl tells that she speaks with her mother via Facebook from one room to another in their home.

3.2.3 When, where, with whom

Most of the pupils use the computer in the afternoon. Someone admits using it while doing homework. Most of the participants say that their computers are usually in their bedrooms. All the pupils use their computers with their parents only to learn new things and to solve technical problems, whereas the children seldom help their parents to face the difficulties which arise in the use of the computer.

4. CONCLUSIONS

The relationship between very young people and new media is clearly in a fluid development. The media have fuzzy boundaries that retain little of their original profiles and of that aura of respect they had for previous generations. Hierarchical media like television appear to be poorly adapted to the new patterns of consumption, and children relate to them in inverse proportion to the constraints that they impose on their schedules: if you can take what you want at the time you want, then there is a chance of meeting, or else for them the web is full of contents to see, to listen and to download at will, including TV programs. Youngsters have realised that the web is now a superset of all other media: why would they need more? It also allows

them to break free from their families more quickly. The residue of family cohesion still revolves around the hierarchical media: watching movies on television together, playing a videogame with mom or dad, choosing a new TV set or a satellite platform. From this level onwards, with the multiplication of individual contents and locations, the family is dispersed and adults seem ever more distant.

For the participants in the focus group the equation is computer = communication. They use the personal computer primarily to chat. And the relationship PC/connection remains valid also for other activities performed with the computer: watch movies, download music, do research for school, search for games, information... New media have changed the modalities of interaction with friends: mobile phone and Facebook are seen as indispensable prosthesis to social relations. The peer group, the fundamental point of reference for generations of teenagers, has been replaced by the social network of Facebook friends. The more contacts they have, the more they are worth. Previously, the orientation of values was guided by opinion makers and opinion leaders in television, now message boards and "like pages" orient tastes, choices and interests. The community decides priorities and quality, the community decides what is relevant and what is not.

The KidLab School Pilot field research will form the basis for the design of the broader and more diversified KidLab School campaign, which will also include modes of online interaction, besides the possibility of collecting in the school the full range of information mentioned in the introduction. Moreover, the KidLab School may contemplate the possibility to follow over time the changing use of technologies by one or more classrooms (longitudinal analysis) and may provide the extension of the study to the case of upper secondary school. More generally, a greater number of classes and students will be observed, thus ensuring greater representation of the results and at the same time facilitating benchmarking analysis.

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CHILDREN'S SAFER USE OF MOBILE PHONES AND THEIR DEPENDENCE ON MOBILE PHONES -AN INTERNATIONAL COMPARATIVE STUDY IN JAPAN, INDIA, EGYPT AND PARAGUAY-

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ABSTRACT

Mobile phones have become widespread among not only adults but children and teenagers in the world. This article describes and investigates how children aged 8 to 18 in four countries: Japan, India, Egypt and Paraguay depend on mobile phones in their daily life and correlation between the dependency and their actually use of mobile phones as social media.

KEYWORDS

Mobile phone, children, SNS, texting, Japan.

1. INTRODUCTION

This themed section on mobile phone and social networking Service (SNS) use among children explore the correlations between children's mobile phone use and their tendency to dependency on mobile phones. This article investigates children's use and dependency on mobile phones in four countries; Japan, India, Egypt and Paraguay. We tried to reveal significant similarities and differences in mobile phone use in cross-cultural settings.

Data of 3528 pairs of children (8 to 18 years old) and parents were gathered from four countries. The countries were selected to have geographical, cultural and economical diversities among them. In each country, participating mobile phone operators funded the survey.

Mobile phones and the internet are compelling and far reaching communication and entertainment tools for adults and children alike, but they can potentially be misused so as any other tool. For instance, internet functions enable users to access variety of information and people anywhere on the earth in principal. Via mobile phones, the access is often unsupervised by others since mobile phones are used as personal media generally. This is the case even for adult users, so for young users.

Our study has shown that parents have a high level of concern over their children's use of mobile phones, regardless of children's age, with 70% to 80% concerned about most issues, particularly overuse, costs and privacy. Children also have concerns. What suggestions can we make for the concern? Currently, major approaches taken are parental controls and digital literacy education for children. They are effective at a certain level. We could offer more effective guidelines for the parents once we gain a deep understanding of children's actual mobile phone use. With appropriate concerns and effective measures, children could have more positive experience offered by mobile and online communication.

2. RESEARCH QUESTIONS

2.1 Children's use of Mobile Phones

How do children use mobile phones? We asked questions on broad usage of mobile phones to both children and their parents. The categories of questions:

2.1.1 Types of Mobile Phones

The type of the handset (e.g., smartphone or not), whether the handset new or used, cost of the handset, monthly charge of the mobile phone.

2.1.2 Basic use of Mobile Phones

When they started to use mobile phones of their own, frequency of voice call, text messaging or internet access in daily life, variety of contents they access via their mobile phones.

2.1.3 Use of Mobile Phones as a Social Media

Which SNS they access, the number of contacts they have in their address book in their mobile handsets or on SNS, and degree of their personal contacts' accessibility to the public.

2.2 Children's Dependence on Mobile Phones

Mobile phones have equipped many functions and services which are intended to enable people's life convenient and fun. The functions and services are available for many children and sometimes they use those functions/services every day as ordinal tools. Questions were asked for majoring how they depend on mobile phones in their lives.

2.3 Correlation between Children's Actual use of Mobile Phones and their Dependence on Mobile Phones

Frequent use of mobile phones among children has been observed in many countries which parents have concern about. Also, children sometimes remark their sense of worry about their own tendency to dependency on mobile phones. We tried to figure out if there is correlation between children's actual use of mobile phones and their dependency on mobile phones.

3. METHOD

3.1 General Research Design

Data were collected from 8-18 year-old children and their parent between June and July 2011 in Japan (1000 pairs, web based survey), India (1014 pairs, personal in-home), Egypt (1014 pairs, personal in-home and drop-off) and Paraguay (500 pairs, personal in-home). Children were recruited to complete a paper or online questionnaire. The questionnaire was constructed in English, then translated into Japanese, Hindu, Arabic, and Spanish.

The surveys were outsourced and conducted by researchers and research firms in each of the countries studied. Two questionnaires were created, one for parents to answer and one for children to answer.

3.2 Sampling Methodology

Japan: Internet survey was conducted to children with their corresponding quotas based on the data population information of the 2009. Response rate is 58.6%. India: Face to face interviews were conducted

across 10 urban centers in Metros and Mini Metros. Stratified random sampling was used. 10 to 18 year old children of SEC A, B and C were obtained. Egypt: Face to face interviews were conducted to 1350 pairs of children and guardians living in 4 geographic locations; Cairo, Alexandria, Assuit and Arish. Another 35 pairs were given to workers in a mobile phone operator. Response rate is 73.2%. Paraguay: Face to face interviews were conducted to 500 children between 10 and 18 years of age and their parents, living in Asuncion and the Metropolitan Area (Great Asuncion). Quotas based on the data population information of the 2002 National Census. The samples were chosen randomly.

4. RESULTS

4.1 Children's use of Mobile Phones

In the four targeted countries, nearly 70% of all children surveyed use a mobile phone. One in five children uses a previously-owned mobile phone. Children show higher smart phone use than their parents. The use of new phones such as smart phones is already noticeable among children, up to 14% in Egypt. There is no definitive correlation between age or income level and ownership and usage.

40% of children access the internet from mobile phones and the rate of usage increases as children get older. Frequency of use is extremely high in Japan, with over a third of children accessing it more than six times a day. In Japan and Paraguay, 70% use the mobile internet for more than 30 minutes a day. Overall, 7% of children use their mobile as the main device to access the internet. However, a high proportion of children with smartphones use them as their primary access to the internet, with 56% in Japan, 42% in India and 41% in Paraguay.

Children who use the mobile internet have high SNS use at 73% and this is even higher with smartphone users at 85%. Children use SNS on mobile phones more than parents, with only 43% of parents who use mobile internet. Utilization ratio rises slightly as children get older.

4.2 Children's Dependence on Mobile Phones

Once children have their own mobile phones, they recognize them as a common media for themselves. Children use their mobile phones for several purposes: communication related purpose, entertainment related purpose, information related purpose and practical related purpose. Some children use almost all of the major functions such as camera, music/movie players, m-money, TV or GPS and those functions/services could be already part of their lives.

74% of children surveyed said "Not having a mobile phone is inconvenient." 45% agree to "Feel lonely when they have no call," whereas 49% agree to "Feel lonely when they have no messaging." 59% even feel insecure without mobile phones. 54% feel bothered when they cannot use their mobile phones and 41% have failed to spend less time on their mobile phones. These figures indicate how children depend on mobile phone in their every day life. No correlation is found with age of children or county.

4.3 Correlation between Children's Actual use of Mobile Phones and their Dependence on Mobile Phones

Children's tendency to dependent on mobile phones has positive correlation with: number of messaging received/sent which is shown in Table1 below. It was majored by the children's positive answer to "Felt bothered when I cannot use mobile phone" and "I have caught myself using the phone/surfing the internet/reading messages when bored." It means the more frequent text messaging receiver the child is, the more the child tends to feel bothered when he/she cannot use mobile phone and catch himself/herself using the phone/surfing the internet/reading messages when he/she is bored. Also, positive correlation with the number of contacts children have in SNS they use and children's tendency to dependent on mobile phones. It was majored by the children's positive answer to "Not having a mobile phone is inconvenient." It indicates that more contacts children have on SNS, more convenient children feel for using mobile phones.

Some correlations between children's actual use of mobile phones and their dependence on mobile phones were recognized, however, we could pay attention to those which have no correlation among those variables shown in Table1.

No correlation was found with: age or sex of children, the expenditure on education or monthly cost of the mobile phone children use.

Table 1. Correlation between Children's mobile phone use and their dependency on mobile phones

| | | SNS use | | | Twitter use | | | Number of contacts on SNS | | |
|----|---|------------------------------|---------|------|--------------------------|---------|------|---|---------|-----|
| | | N | | | N | | | N | | |
| 1 | Not having a mobile phone is inconvenient | 0.040 | (0.218) | 968 | 0.05 | (0.419) | 259 | 0.195** | (0.000) | 700 |
| 2 | Feel lonely when I don't receive any voice calls | -0.004 | (0.897) | 968 | -0.056 | (0.369) | 259 | -0.024 | (0.525) | 700 |
| 3 | Feel lonely when I don't receive any messagings | -0.004 | (0.903) | 968 | -0.031 | (0.623) | 259 | -0.005 | (0.897) | 700 |
| 4 | Communication by mobile phone is sometimes troublesome | -0.002 | (0.959) | 968 | 0.019 | (0.758) | 259 | -0.009 | (0.802) | 700 |
| 5 | Feel insecure without mobile phone | -0.004 | (0.908) | 968 | 0.177** | (0.004) | 259 | -0.003 | (0.936) | 700 |
| 6 | I have gone without eating or sleeping because of mobile phone | -0.001 | (0.965) | 968 | 0.084 | (0.175) | 259 | 0.000 | (0.992) | 700 |
| 7 | Felt bothered when I cannot use mobile phone | -0.003 | (0.925) | 968 | 0.007 | (0.907) | 259 | -0.023 | (0.551) | 700 |
| 8 | I have caught myself using the phone/surfing the internet/reading messages when bored | 0.001 | (0.971) | 968 | 0.087 | (0.164) | 259 | -0.006 | (0.872) | 700 |
| 9 | I have less time with family/friends or doing schoolwork because of mobile phones | -0.002 | (0.952) | 968 | -0.039 | (0.529) | 259 | -0.002 | (0.965) | 700 |
| 10 | Failed to spend less time on mobile phones | -0.003 | (0.934) | 968 | 0.021 | (0.732) | 259 | -0.015 | (0.682) | 700 |
| | | Number of messaging received | | | Number of messaging sent | | | Frequency of accessing SNS (Japanese data only) | | |
| | | N | | | N | | | N | | |
| 1 | Not having a mobile phone is inconvenient | -0.021 | (0.370) | 1782 | 0.009 | (0.698) | 1782 | 0.209(*) | (0.027) | 111 |
| 2 | Feel lonely when I don't receive any voice calls | 0.027 | (0.252) | 1782 | 0.029 | (0.219) | 1782 | -0.047 | (0.627) | 111 |
| 3 | Feel lonely when I don't receive any messagings | 0.006 | (0.799) | 1782 | 0.035 | (0.134) | 1782 | -0.112 | (0.24) | 111 |
| 4 | Communication by mobile phone is sometimes troublesome | -0.018 | (0.452) | 1782 | 0.018 | (0.441) | 1782 | -0.247** | (0.009) | 111 |
| 5 | Feel insecure without mobile phone | -0.018 | (0.443) | 1782 | 0.018 | (0.444) | 1782 | 0.120 | (0.211) | 111 |
| 6 | I have gone without eating or sleeping because of mobile phone | -0.018 | (0.452) | 1782 | 0.019 | (0.433) | 1782 | 0.180 | (0.059) | 111 |
| 7 | Felt bothered when I cannot use mobile phone | 0.049* | (0.041) | 1782 | 0.076** | (0.001) | 1782 | 0.064 | (0.503) | 111 |
| 8 | I have caught myself using the phone/surfing the internet/reading messages when bored | 0.062** | (0.009) | 1782 | 0.065** | (0.006) | 1782 | 0.126 | (0.187) | 111 |
| 9 | I have less time with family/friends or doing schoolwork because of mobile phones | 0.008 | (0.745) | 1782 | 0.039 | (0.099) | 1782 | 0.084 | (0.379) | 111 |
| 10 | Failed to spend less time on mobile phones | -0.022 | (0.364) | 1782 | 0.010 | (0.686) | 1782 | 0.216* | (0.022) | 111 |

Levels of significance: ** 1% (2-tailed), * 5% (2-tailed)

(): Statistical Error

5. CONCLUSION

In the four targeted countries; Japan, India, Egypt and Paraguay, most children showed active use of mobile phone. Children call, text, access internet and connect with friends all the time. Children use more mobile phone functions than their parents. New significant trend in new type of handset- smartphones- have started to be recognized. It is assumed that more children will use mobile phones thoroughly and recognize them as main devices for accessing internet when smartphones become more popular among them.

No definitive correlation between age or income level and ownership/usage means mobile phones are already kind of commodity which is not a luxury gadget any more. Our study shows that children adapt new devices to their lives quickly. For instance, children casually use new services such as SNS on mobile phones more than parents. Once they get used to use them, it become hard to live without the devices which are convenient and fun. Mobile phones are already personal devices next to their skin.

While messaging on mobile phones remains hugely popular among children, SNS is now becoming immensely popular worldwide and could be a key communications tool in the lives of children. It was revealed that more contacts children have on SNS, more convenient children feel for using mobile phones. It is natural for those who have more friends/acquaintances on SNS to recognize mobile phones convenient as it enables them to access SNS everywhere they go since the mobile phones are “mobiles.” It leads to children’s tendency of dependency on mobile phone in their life spontaneously. What it could suggest? What measure we can take so that children can embrace the positive experience offered safer use of mobile phones?

First step is that we recognize the mobile phones are already part of children’s life. Especially children are at the stage of stimulating social development of them, it is vital for them to building up the organic social network and a mobile phone is currently extensively used as a main communication device.

Second step is to know children’s actual use and the potential negative experience which children could face when they use mobile phones. It enables parents to have appropriate concern and leads to appropriate measure parents could take against children’s use of mobile phones.

Third step is that we create an environment in which children naturally acquire adequate literacy for surviving information society. What’s important here is that parents also try to update their knowledge related to mobile phones or information society since technology makes rapid progress in this area. Cultivating learning attitude of parents together with their children would be required.

In the study, we examined and revealed the correlation between children’s actual use of mobile phones and their dependence on mobile phones at a certain level. We could try to grasp more accurate mobile phone use by children, potential negative experience according to the actual use and the effective measures for the negative experience for children’s positive experience offered by mobile and online communication.

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SOCIAL MEDIA IN SME - DEVELOPMENT OF A PERFORMANCE MEASUREMENT METRIC

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ABSTRACT

Social Media is one of the most important trends within the internet at the beginning of the 21st century. More and more people are online and spend a lot of time using Social Media – especially Social Networks like Facebook, LinkedIn and Xing. In addition to this, more and more enterprises use these networks for their marketing and to communicate with their customers. Currently large enterprises are more active concerning Social Media than small and medium-sized enterprises (SME) and often invest large amounts to use this marketing channel. The question is if and how SME can use such networks for their external communication as well. At first glance, the investment for the construction of a Social Media presence is not very high: usually creating such an internet page is for free. In contrast to this, the support needs a lot of money, time, human resources and knowledge, which is a big challenge for SME. Because of their lack of resources, it is very important for SME to use Social Media efficiently and effectively to prevent an unnecessary input of resources. This can be achieved by a special performance measurement metric. A first concept for such a metric concerning Social Media in SME is presented in this short paper.

KEYWORDS

Social Media, SME, performance measurement metric, Social Networks

1. INTRODUCTION

Currently Facebook is the most successful social network in Germany: Almost 50% of the German internet users have an account (cf. BITKOM, 2011). Currently, more than 750 million people are actively using this social network worldwide, in Germany there are 20.5 million active members (cf. Facebook, 2011). According to alexa.com, Facebook is the second most frequently visited website worldwide (cf. alexa.com, 2011). Other Social Networks like LinkedIn will achieve a similar success in the next years. Based on these facts the paper is focused on Facebook but drawing conclusions for other networks is also possible.

Like most Social Networks, Facebook allows the creation of profiles, looking at the profiles of other users as well as the networking with other members (cf. Boyd/Ellison, 2008). An interesting feature is the possibility to create a page as an enterprise – for free. At this page it is possible to provide both static information such as a link to the homepage, opening hours, contact details etc. as well as dynamic and multimedia-based content. Because of the large number of members and the multifunctional possibilities to present an enterprise and communicate with customers, a lot of German enterprises use Facebook, which is accepted by the private users. Thus, the following explanations within this short paper – including the development of the metric – are focused on Facebook.

Analyzing the homepages of large enterprises and SME, it is noticeable that much more large enterprises show the “Visit us on Facebook” button than SME do. The question is if and how SME can use the social network for the presentation of their business and the communication with their customers as well. One big difference between large enterprises and SME is that the latter often suffer from a lack of resources which makes it difficult to create regular content with a high quality and communicate on a periodical, active way with their customers (= fans on Facebook). To be competitive, SME need a chance to use Social Media as the large enterprises do.

Since the beginning of the Social Media “hype” there is the question if and in which way the success of such measures can be evaluated. For the responsible persons within the enterprises it is important to know if

the investment in such activities is worthwhile for the enterprise (cf. Hoffmann/Fodor, 2010, p. 41). Therefore the Institute for Management Cybernetics works on a performance measurement metric which makes it possible to evaluate the efficiency and effectiveness of an SME's Facebook page.

The remainder of this paper is organized as follows. First the short paper discusses some case studies of SME and their presence on Facebook. Based on these examples the third chapter shows a first concept of a performance measurement metric for the evaluation of Social Media usage in SME. At the end of the paper a conclusion and outlook is given.

2. METHODOLOGY OF THE CASE STUDIES

Social Media is a dynamic medium, which is evolving very quickly. In contrast to this, the research activities in this field are limited. To analyze the benefits of using Facebook to communicate with the customers as well as the possible problems, real examples have to be examined. That's why the authors chose the *scientific monitoring* as a research method (cf. Bortz/Döring, 2006, p. 262). Due to the possibility to access, save and automatically process the data, the used method is of the form *automatic monitoring* (cf. Bortz/Döring, 2006, p. 268 f.).

Afterwards the pages are analyzed quantitatively – by using a self-developed script – as well as qualitative. The monitoring is supported by a monitoring plan with characteristics based on a literature review and findings which were developed while choosing the Facebook pages:

- Presentation of the SME.
- Optical appearance and reception of the users.
- Static information.
- Duty of imprint¹.
- Existing tabs.
- Statistical data.
- Utilization by the operating SME.
- Interaction by the fans.
- Promotions.

3. CASE STUDIES: SME USING FACEBOOK

Within this part of the short paper the results of an analysis of several Facebook pages run by SME are shown. The goal of this analysis was to identify efficient practices as well as mistakes and their avoidance.

Because of the large number of SME in Germany it was necessary to concentrate the studies on certain industries. This decision was based on the *Klassifikation der Wirtschaftszweige 2008* (cf. Statistisches Bundesamt, 2008) as well as the following items, which suggest that using Facebook would make sense for the respective enterprise:

- The enterprises of the industry produce primarily for the end-consumer. Because Facebook serves as a possibility for private persons to build networks, industries with B2B enterprises are rather unsuitable.
- The target group of the enterprise consists primarily of young people, or at least not only of elder people. The majority of the Facebook users in Germany is between 14 and 29 years old (cf. BITKOM, 2011, p. 4).
- The customers make their buying decisions rather spontaneous and short-term. Additionally, it is very easy to change the provider and buy the product of a competitor. Furthermore, the customers need the respective goods very often – for example groceries.

Concerning the described items, the enterprises within the categories² *garment manufacturer, retail industry, hotel and restaurant industry* as well as *other personal services* (e.g. hairdresser, cosmetician etc.) are examples for being well-suited to use Facebook for their communication with customers.

¹ According to the German law, it is mandatory for web service operators to include an imprint in their page, containing information such as the name, the address, contact data etc. (§ 5 of German Telemediengesetz).

Because the studies address enterprises in Germany, the SME have to be located in Germany. Another condition for the choice of the case studies is a certain amount of activity concerning the Facebook page. Furthermore SME that make all their business online are not considered.

The following characteristics that are based on recommendations in the literature are used to analyze and evaluate the case studies:

- Introduction of the enterprise
- Visual appearance and reception of the users
- Static information
- Duty of acknowledgement³
- Number, type and appropriateness of tabs (subpages)
- Interaction of fans
- Promotions and other special features

Based on these characteristic the Institute for Management Cybernetics chose two fruit juice producers, two hairdressers and two jewelers. These six SME use Facebook very differently, both concerning the extensiveness and the content of the communication. The quantitative results are shown in table 1:

Table 1. Statistical data concerning the Facebook pages of the case study SME

| SME | Using Facebook since | Number of fans | Average number of postings of the SME per week | Average number of comments/ likes per posting of the SME | Average number of fan postings per week |
|------------------------|----------------------|----------------|--|--|---|
| Fruit juice producer 1 | 05/2010 | 1646 | 3,8 | 7,1 / 8,8 | 2,4 |
| Fruit juice producer 2 | 10/2010 | 536 | 0,9 | 0,8 / 4,2 | 0,5 |
| Hairdresser 1 | 01/2011 | 1443 | 2,4 | 2 / 3,2 | 2,2 |
| Hairdresser 2 | 01/2010 | 160 | 0,1 | 0,3 / 1,1 | 0,2 |
| Jeweler 1 | 07/2010 | 4555 | 14 | 3,2 / 12,5 | 8,8 |
| Jeweler 2 | 06/2011 | 74 | 0,3 | 0 / 2 | 0,1 |

The statistical data shows a correlation between the postings of the SME per week and the number of fans: The bigger the number of weekly postings is, the more sympathizers are acquired. However, to generate well-founded conclusions about the correlations of these characteristics a bigger number of SME and their Facebook pages need to be analyzed. Furthermore, more characteristics like the SME's degree of popularity or the use of other media should be integrated.

Within the analysis of the six mentioned SME, four main problems were identified, the first one being lack of activity. For a successful Facebook presence, the regular creation of high quality content and the continuous communication to the customers (= fans on Facebook) are very important. Related to this, it is moreover necessary to involve the fans. An example is to consult them concerning new products. The customers can also comment the postings of each other and by doing this, creating discussions and content. The third main problem is the compliance with legal regulations, e.g. the duty of imprint. The consequences of a noncompliance could be expensive warnings (cf. Knackstedt et al., 2006, p. 27). The last main problem that could be identified is the lacking integration of promotions and other special features. Interactions are a good possibility to acquire fans but the SME has to think about all risks before implementing them.

These main problems can serve as a first basis for SME that want to implement a Facebook page or are communicating with their customers via this social network yet.

² You can find these categories within the *Klassifikation der Wirtschaftszweige 2008* (cf. Statistisches Bundesamt, 2008).

³ § 5 of the *Telemediengesetz*

4. FIRST CONCEPT OF A PERFORMANCE MEASUREMENT METRIC

Based on the analysis of the mentioned case studies as well as existing discussions about the measurement of Social Media within the literature a first concept of a performance measurement metric concerning Social Media is presented.

Usually it is possible to define the costs of Social Media activities very easily. These include for example the expenses for the construction of a Facebook page by a Social Media agency or the costs of the daily expenditure of time concerning the support of this page. In contrast to this, the financial benefit is very hard to monetize.

The metric which is developed by the Institute for Management Cybernetics is targeted at SME. Therefore it should be usable by this target group without any specific problems – for example it shouldn't need an expensive analyzing tool – and it should indeed make it possible to show the success of the Social Media activities. Hence the criteria for the metric have to be directly apparent or easily obtainable for the enterprise which runs a Facebook page. Based on the three “Pillars of Social Media Measurement” *reach*, *discussions* and *outcomes* as defined by Murdough (cf. Murdough, 2009, p. 95 f.), a first step was to define such criteria. Table 2 shows them. The criteria belonging to the pillar *reach* indicate how big the audience of the page is. In the pillar *discussions* there are criteria describing how active the operators and the fans of the page are. The criteria of the pillar *outcomes* are measured outside of Facebook and specify the effects of the Social Media activities on the business.

Table 2. Criteria concerning the performance measurement

| Reach | Discussions | Outcomes |
|---|---|--|
| <ul style="list-style-type: none"> • Number of fans • Ratio of active fans • Average number of impressions per enterprise posting • Connectedness of the fans | <ul style="list-style-type: none"> • Average number of fan postings per week • Average number of fan comments to the enterprise's postings per week • Impression-to-interaction ratio • Evaluation of the sentiment | <ul style="list-style-type: none"> • Ratio of homepage which were referred from the Facebook page • If available: ratio of online shoppers referred from Facebook • Google ranking of the Facebook page |

The next step is to analyze how to measure these criteria as well as how strong or weak they should be weighted within the metric. This has to be done in dependence on the business objectives of the enterprise. For example, an SME which favors a broader reach could weigh the number of its fans' friends very strong.

5. CONCLUSION AND OUTLOOK

To evaluate their performance within Social Media, SME need a dedicated metric which satisfies their specific characteristics and demands. Usual metrics concerning the evaluation of investment decisions – like the *Return on Investment* (ROI) – do not fit with the needs concerning Social Media. Therefore, the Institute for Management Cybernetics analyzed six Facebook pages within a case study. Based on this, a performance measurement metric will be developed.

To generate well-founded conclusions about the correlations of the characteristics which were used within the analysis, a bigger number of SME and their Facebook pages has to be surveyed. Additionally, more characteristics like the SME's degree of popularity or the use of other media should be considered.

The three *Pillars of Social Media measurement* by Murdough serve as a basis for the metric. A first step was to define criteria which fit into one of the three pillars. A next step should be to check these criteria with some SME by creating a questionnaire and making a survey. In addition to this, the criteria have to be weighted in dependence on the enterprise's business objectives.

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CORRELATION OF LINK COUNTS BETWEEN COMPANY HOMEPAGES AND OFFICIAL ECONOMIC STATISTICS

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ABSTRACT

In the course of a project to create a decision support system in the area of disaster management, interrelations between businesses are needed at the level of single companies countrywide - which cannot be supplied by official statistics. Since companies often add links to partners' or customers' homepages on their websites, the possibility of using these links to represent company relations was investigated. In order to determine if this approach is feasible the results of a web-crawl was compared with the official input/output static published by the Austrian statistics agency "Statistik Austria".

KEYWORDS

Web-Structure Analysis, Input-Output Statistics, E-Society, E-Business, Company Relations, Webometrics

1. INTRODUCTION

For a decision support system in the area of disaster management, one of the goals is to determine the possible impact of an isolated disaster in a small region on the country's economy. To determine which companies lie directly in an affected region, data from the official Austrian yellow pages were geocoded and filtered. However, the impact on the economy is far larger since suppliers and customers of these companies are also affected. To determine these companies, currently only statistical data in the form of input-output statistics is available for showing how dependent a certain branch is on other branches, e.g. that carpenters depend on the products of a sawmills. But by using this data one cannot directly determine exactly which single companies depend on which other companies, e.g. which sawmill supplies a certain carpenter.

One form of direct interrelation between companies are hyperlinks from one company's homepage to another. Today, an internet presence is essential for most businesses. According to the official Austrian statistic agency, 80.2% of all Austrian companies had their own company website in 2009 (Statistik Austria, 2010a). One of the key-algorithms used by search engines to rank pages is their apparent importance according to links from and to the site (Brin and Page, 1998). For this reason, companies aiming at getting highly ranked by search engines include links to partners or customers in exchange for links from their site back to them. This method is one of the key concepts in search engine optimization (Frydenberg and Miko, 2011). It can therefore be expected that many real-world business relations between companies can be found by extracting the links between the companies' homepages.

To verify this hypothesis, a web-crawl was conducted, extracting the links between company homepages. The resulting links were aggregated to the level of branches and compared with the official input/output statistic published by the Austrian statistics agency "Statistik Austria" (2010b).

2. RELATED WORK

Thelwall (2001) investigated if backlinks to university websites reflect the institute's research authority and field. In contrast to Smith (1999) he came to the conclusion that there is an association between research ratings and the university's web presence. These opposing conclusions could be accounted for by the increasing impact of the Internet on scientific work in these years. A very recent work of Thelwall (2011),

comparing link counts with URL citations, again showed a high correlation, especially in the area of academia and business.

The analysis of weblinks has also been successfully applied to other domains such as combating search engine spamming (Becchetti et al, 2008) or Information Retrieval (Henzinger et al, 2000) and of course for search-engine ranking (Brin and Page 1998). Recent surveys on Web Mining techniques and applications were published by Zhang (2008) and Bhatia (2011). Thelwall (2010) even names this field as one of the largest open research fields in information science.

3. EXPERIMENT

The experiments were carried out in March and April of 2011 in Austria and only for Austrian companies. Evaluation and comparison were done with official publications of the Austrian statistic agency, available in print and online as referenced. For this paper, the names of branches were translated to English.

3.1 Data Sources

In order to seed the web-crawler, the official Austrian Yellow Pages (Herold Marketing CD Business 2009) was used. From this database, the company name, homepage and branch of all Austrian companies were taken. In total, the CD contains 326,010 company entries, 178,800 of these records also contained the URL of the company's homepage. Internet providers often grant free web-space in their domain for their customers resulting in homepages like "www.aon.at/companyone", "www.aon.at/companytwo". Since they all share the same domain, they cannot be properly associated with a single company, i.e. it cannot be distinguished which company a link to this domain is referring to. For that reason another approx. 20,000 records had to be discarded. Since the database also contains an entry for every settlement of a company, e.g. every store of a trade chain, the final list of websites contained 120,205 unique domains.

To evaluate if links between the companies' websites really represent its business relationships, the results are compared to the official input-output statistic published by the Austrian statistics agency "Statistik Austria". The publication used (Statistik Austria, 2010b) contains a matrix stating the value of goods needed from different categories to create a certain value of produce of a category. There are 57 product categories listed, and the publication includes a table defining which branch code ("ÖNACE Klasse 2003") is included in which category. In the company database described above, a branch code is used that can also be converted to this code, and each company is assigned to as many as 5 branches distributed by percentage.

In order to use the statistical data for the comparison, the values (given in Euros) for each product category were converted to percentages, resulting in a 57x57 matrix stating the dependencies of the different product categories; e.g. the branch "C29 machine production" depends on "C28 metal production" by 14%, on "C51 wholesale companies" by 21%, on "C74 company related services" by 11%, etc.

3.2 Web-Crawl and Link Extraction

The web-crawl was carried out in March of 2011 by a small tool developed by the authors specifically for this purpose. The tool was developed in Microsoft Visual Studio .NET 2010 and used Microsoft SQL Server Express as database. The actual work was divided into four different sub-tasks, executed in separate threads on a common desktop computer.

The sub-tasks and workflow are shown in Figure 1: The pre-seeded download database contains the list of URLs to download, which is done by the first thread of the web-crawler. The crawler only downloads the plain html page including possible frames, but without images or other media. The results are added to a separate page database. The second task extracts all links from these pages, by parsing the html code and extracting all relative and absolute URLs referenced in anchor tags or javascript "navigate to" calls. For relative references, the source-URL is included to create a valid absolute URL. The results are then stored in another separate link database. The third sub-task then filters and categorizes these links: links to non-html pages are removed, e.g. mailto, ftp, etc. The remaining links are then categorized as page-internal (source page and destination page are equal, e.g. hash (#) links), site-internal (source and destination domain are equal) or site-external. The fourth and final sub-task then evaluates these links: page-internal links are

discarded. Site-internal links are added to the download database if the source page was a seed-page (only the first page of any site and all the pages it links to are crawled, but no deeper). If a site-external link references another known domain and the link does not yet exist in the result database, it is added.

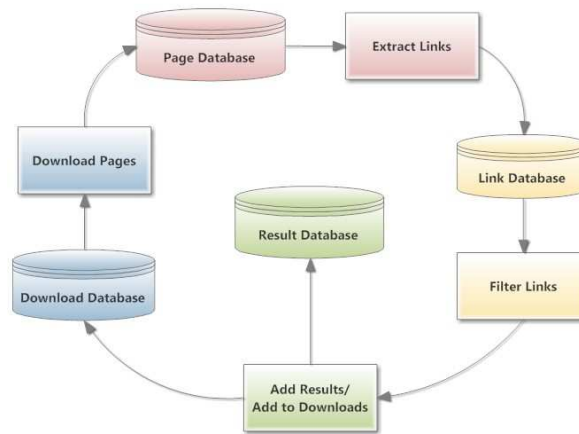


Figure 1. Web-Crawler Sub-Tasks and Workflow

In this way, all 120,205 sites were crawled: 92% of the sites could be reached; the first page and all pages on the same site it links to were downloaded resulting in 1.3 million pages (29GB of html files). 75 million links were extracted from these pages and approx. 1.5 million site relations between company domains could be extracted.

3.3 Results

To verify if the extracted relations between the companies' internet domains can be used to represent their business relationships, the extracted data is compared to the official input-output statistics described in Chapter 3.1. For this purpose, the links from company to company are converted to links between branches using the codes supplied in the company database and are then aggregated to obtain the total number of links from one branch to another. This matrix of link-counts is converted to a percentage column by column that can now be compared to the dependency percentage derived from the input-output statistics as described in Chapter 3.1.

The actual numerical comparison was done by calculating the correlation coefficient for each product group, comparing the two sets of percentages, i.e. determining the column-wise correlation of the two matrices. The results are presented in Table 1 and show that the correlation is highly dependent on the product group. Table 2 displays a comparison of the correlation coefficient to the percentage of companies who have their own website and the percentage of companies who sold products over the Internet in 2009 (Statistik Austria, 2010a).

4. CONCLUSION AND FURTHER WORK

The results clearly show, that the hypothesis of a direct relation between the statistical input-output factors and the links between companies' websites is only valid for certain branches, mainly in the financial sector, the producing industry and parts of the service industry, but not companies in the fields of sports and entertainment, public infrastructure or the extractive industry. Surprisingly, the correlation is not significantly higher in branches where more companies have their own website, so even if more companies go online in the future, this situation is unlikely to change. With reference to the E-Commerce percentage (the value is not the percentage of goods sold over the Internet, but the percentage of companies who sold at least some products over the Internet) there is again no higher correlation.

When examining the branches with especially high and especially low correlation it seems feasible to take the typical type of business relationship into account: while business relationships in the producing industry

(raw material suppliers and resellers) typically last for several years, relationships in the construction business are normally on a single contract basis. Given the diversity of relationships in the construction business, it could well be that the links on their homepages represent meaningful long-time business relationships, but the distribution does not match the statistical dependencies because there are no links on their homepages to companies where only short-time or single-contract relationships exist. Additionally, consumer-oriented businesses like the sports or entertainment industry, which also shows a low correlation, obviously will not have links to their private customers' homepages and therefore the links from and to their sites can only represent suppliers or sponsors.

We believe that the data we gathered shows that, at least for certain branches, it is feasible to use the links between company homepages to represent business relationships. Since this data can be obtained and updated fairly easily and cheaply compared to actually asking companies to reveal their business relationships in an inquiry – which they may or may not do – it was certainly the only alternative for our project. It also shows that the real-world network of business relationships is also present on the Internet in the form of company homepages and the interrelations there. As further work, a similar study for other countries and especially larger economies such as the European Union or the United States would be of interest and could show how the Internet and the real economy are intertwined there.

Table 1(a). Correlation of input/output statistic and web-links by branch

| Branch | Correlation (%) |
|--|-----------------|
| Forestry | 90,0 |
| Air transport services | 86,5 |
| Telecommunications, radio and television equipment | 78,4 |
| Financial intermediation services | 78,4 |
| Rubber and plastic products | 73,6 |
| Post and telecommunication services | 68,7 |
| Furniture, jewelry, instruments, sports equipment, toys and other products | 64,3 |
| Auxiliary transport services and travel agency services | 64,0 |
| Wood, wood products and cork (excluding furniture) | 57,1 |
| Medical-, control-, and optical instruments, watches and clocks | 53,4 |
| Energy services and energy supply | 52,7 |
| Glass, ceramics, mineral products | 50,2 |
| Renting of machinery and equipment | 49,6 |
| Land transport and transport services via pipelines | 49,5 |
| Office machines, data processing equipment and facilities | 49,1 |
| Retail trade services | 49,0 |
| Chemical products | 47,2 |
| Educational and teaching services | 46,0 |
| Clothing | 45,2 |
| Services related to credit institutions and insurance companies | 44,8 |
| Water transport services | 40,0 |
| Motor vehicles and motor vehicle parts | 39,1 |
| Ores | 37,5 |
| Leather and leather goods | 36,6 |
| Publishing and printing products, recorded audio and visual media | 36,4 |
| Food products, beverages | 36,2 |
| Real estate and housing | 33,5 |
| Metals and products thereof | 33,4 |
| Electrical machinery and apparatus | 32,7 |
| Insurances (excluding social security) | 31,6 |
| Sewage, waste disposal and other waste management services | 27,4 |
| Public administration, defense and social security | 23,9 |
| Agriculture and hunting | 23,4 |
| Uranium and thorium ores | 21,4 |
| Research and development services | 20,8 |
| Machinery | 19,9 |
| Water services and water supply | 19,3 |
| Services of data processing and databases | 19,0 |
| Fish and fishery products | 18,8 |
| Tobacco products | 15,0 |
| Coke, refined petroleum products and nuclear materials | 14,7 |

Table 1(b). Correlation of input/output statistic and web-links by branch

| Branch | Correlation (%) |
|---|-----------------|
| Metal products | 9,6 |
| Textiles | 6,8 |
| Commercial brokerage and wholesale trade services | 5,6 |
| Recovery services | 3,3 |
| Services of health, veterinary and social services | 3,3 |
| Hotel and restaurant services | 2,7 |
| Petroleum and natural gas, services incidental to oil and gas extraction | 2,0 |
| Services of membership organizations and other associations | 1,85 |
| Coal and peat | 1,0 |
| Paper, paperboard and articles thereof | 0,4 |
| Culture, sports and entertainment services | 0,0 |
| Other Services | 0,0 |
| Other vehicles | -5,8 |
| Trade services, maintenance and repair of motor vehicles, automotive fuel | -7,2 |
| Business services | -13,0 |
| Construction work | -13,9 |

Table 2. Comparison of correlation with other Internet-related statistical figures (Statistik Austria 2010a)

| Sector | With website (%) | E-Commerce sales (%) | Correlation (%) |
|--|------------------|----------------------|-----------------|
| Credit and Insurance companies | 97,9 | n.a. | 56,9 |
| Transport and communications | 75,1 | 11,0 | 45,2 |
| Manufacturing | 82,6 | 14,5 | 36,7 |
| Energy and water supply | 92,2 | 5,0 | 20,5 |
| Real Estate, renting and business services | 86,6 | 5,5 | 6,87 |
| Accommodation and catering | 83,4 | 9,5 | 2,7 |
| Sale, maintenance and repair of vehicles and second hand goods | 85,8 | 17,3 | 0,8 |
| Culture, sports and entertainment, other services | 76,9 | 12,3 | 0,0 |
| Construction | 73,6 | 0,5 | -13,9 |

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A NEW GENERATION OF HOSPITAL INFORMATION SYSTEMS – QUESTIONS AND DIRECTIONS

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ABSTRACT

The aim of this paper is to present some ideas about current research in hospital information systems' design and some new unanswered problems. The presented research is based on joint work with Medical University Sofia, on requirements from other hospitals and discussions with industrial providers of such systems. We target investigations, design, organisation and improvement of hospital information systems as well as enhanced personal health records structure, tracking of life long medications, treatments, changes in the body and general health status. Additional research is oriented to preventive diagnostic and investigations on relevance of life quality and healthcare based on the eHealth/mHealth technologies.

KEYWORDS

Hospital information system, Telemedicine, mHealth, Medical data analysis, Data Mining.

1. INTRODUCTION

The aim of this paper is to present some ideas about new directions for design of Hospital Information Systems (HIS) based on results obtained in the context of the joint research project DAPSEpro for investigation, design, organisation of a hospital information system. Extending our work in the years and cooperating with other providers and research groups we found some new possibilities for HIS improvement and reorganisation.

The primary research started with investigation of current status of installed and operating hospital information systems on the territory of the Medical University Sofia. Elimination of the usual paper-based information exchange to IT-based one is one of the primary topics.

Medical University Sofia is a huge distributed hospital complex. It has tens of different clinics, laboratories and buildings.

Results of this investigation and some of implemented solutions are presented in (Evgeniev et al. 2010, Ivanov et al. 2009). It was focused on the following main problems

- Hospital systems collect a diverse variety of patient information represented in many digitized or hard-written types. This information is distributed, heterogeneous and of various data types. Creation and support of patient's analyses library is a problem solved under presented project. -

- Data validity, security and protection - Data validity is very important to make decision-making process stable and safe. This includes time validity and safety and security of delivery. Data access and privacy are very important and have to provide end-to-end security and validation in the system.

- Tracking patients when they are out of the hospital – technical, medical and economical aspects

- IT problems of archiving and digitalisation of images and documents from material carriers.

- Improvement of analyses of medical images.

At the design and implementation time we found some unforeseen problems and they became new targets for research and development. Some of this new targets and their interrelations stimulated writing of this paper.

2. SYSTEM STRUCTURE

The implemented under DAPSEpro Intelligent Medical Information System's (IMIS) structure and subsystems are shown on figure1. It offers the following features:

- Unified environment for data exchange between installed apparatus and systems in the hospital;
- Access to the information resources via heterogeneous communication environment (mesh).
- Tracking the full process of hospitalization of every single patient.
- Data collection and storage for every medication and procedures.
- Offers Remote Medical WWW Services for out-of-hospital health tracking and care.
- Management of all procedures and medications.
- Administrative tracking of all patients.
- Remote messaging of medical personnel about health status of selected patients based on remote vital data acquisition and control.

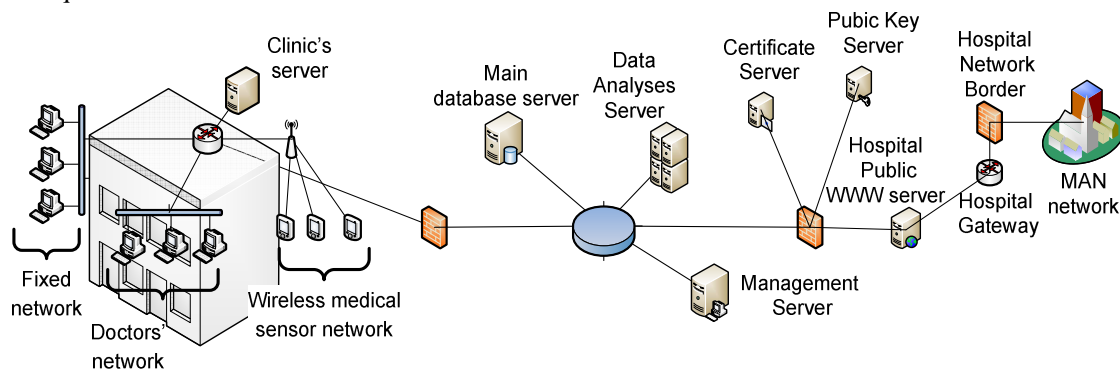


Figure 1. General structure of IMIS.

The initial DAPSEpro covers today two clinics – clinics of nephrology and pulmonary diseases. All activities were strongly oriented to meet requirements of Electronic Health Record standards and Bulgarian requirements for health records.

According to figure 1, the Fixed clinical network provides connectivity for all machines and apparatus in the hospital from one side and servers and personnel terminals from the other side.

The Wireless medical sensor network provides access for the medical personnel to data servers and connects sensors and apparatus having wireless possibilities to transfer small amount of data. This makes both people and machines mobile on the clinic's territory.

The Management Server controls all administrative processes and controls access to database server which hosts all records about manipulations, personnel and patients' archives, etc.

2.1 Successive Parts

Starting with pure technical project supporting administrative and medical activities we found that the usual approach to implement some appropriate solution and after that to study medical personnel how to use it is not enough good. So sensitive area as medicine does not accept pressing of that type. To get better technical paper for preliminary design the design group did wide exploration of needs and requirements of the personnel.

Requirements were grouped in several groups. Starting work was oriented to the general administration, patients' health records, clinical orders and result delivery, wireless access to database, fast connection to all available image machines.

These parts were designed and implemented. They offer planned basic functionality and have embedded possibility for extensions.

One unpredicted element of the system was way we connected the Microbiology laboratory to the HIS. The Microbiology laboratory has smooth process for cultures analyses and results report based on paper control and tracking. Antimicrobial resistance check is based on the WHONET v.5.5. It do not offer

programmable interface for computerised access. It has human interface only. This forced design of a local system with two-level structure. On the first level are connected all analyses machines having outputs to computer. All analyses results that need human interactions (like microscope analyses) are recorded manually using unified fill-in-the-blanks forms.

The upper level includes WHONET server, local database server and administrative terminals. Network server is positioned over this level and connects laboratory micro-network to the hospital network.

Very successful was especially designed scanner and image processing subsystem for digitalisation and processing of X-ray and ultrasound images. It provided possibility to digitize small and big pictures using one and the same adjustable device in extremely high resolution (better than film grains). It offered possibility to reconstruct and use old and low-quality pictures. Part of the newly implemented analyses is based on dynamic filtering. Detailed explanation of this solution is presented in (Georgieva D. et al., 2011).

Telemedicine application of smart mobile phones as communication and data processing device for wearable and mobile sensors connection point is another successive work. It is described and presented in (Evgeniev I. et al., 2011 and Gueorguiev V. et al., 2011).

2.2 Questionable Parts

Here we will present some elements of the work which became questionable or simply opened new targets.

2.2.1 Unified Machine and Apparatus Connection

One of the basic tasks for the DAPSEpro was to investigate all available medical machines and to design some hardware abstraction layer (HAL). It should offer functionality making connection of a new machine relatively simple and make possible design and implementation of generalised control and data acquisition interface to the upper system's levels.

Today this part is not finished and do not promise to be finished easily. The problem is that machines from different vendors offer different hardware and software interfaces. Implementation of a HAL in most cases needs simply to position additional intermediating controller to implement hardware and software transformations and logical isolation. This is complicated and expensive task.

2.2.2 Security and Safety

Requirements about data security and safety increased all the time in the implementation process.

HIS requires general security as every operator operating personal data. Here were found the following number of problems:

- Uncontrollable number of access points to the systems. All terminals, mobile access devices and similar are generating hard to solve problem for unauthorized access prevention.
- In the hospital people are in hurry all the time and sophisticated security system requiring slow or repetitive log-in / log-out will be disabled fast.
- Static security is not enough. This type of system needs dynamic security but it is more complex and hard to implement.

Data safety is the next problem. Today IT offers many different solutions. The problem is that data have to be delivered fast and without modifications.

- Data are very sensitive. They include medication orders, results from analyses, diagnoses and so on.
- Data have huge amounts – images and permanent sensors.

2.2.3 Image Analyses

Current approaches for analyses of images from different sources become more important. The new generations of image machines are producing directly digital images. They are mostly in DICOM. This format is a standard for this area but it is a source of new type of problems:

- Generated images are huge and need much disk space.
- Analyses and manipulation of all metrics, comparison and other need deep non-medical knowledge what is not well understood by doctors.

Much more problematic are sources producing output on material carrier (paper, film or other). Even today digitalization of images from paper or films is problematic. There are a number of problems. If the

image is simple graphic every flat-bed scanner is enough good. Digitalisation of film images is much more sophisticated. Simple scanning is impossible. The film image has much more details than directly digitised picture. One qualitative scanning can extract all these details from the picture and to present them to the doctors.

- In some previous research we proposed some new approaches to solve the problem with digitalisation of images from X-Ray and ultrasound machines which were proved in practice. The new step in this work is implementation of dynamic filtering and HDR transformations. Results are very promising but need more work with medical doctors to make results clear and free of artificial artefacts.

- The other challenge is the human-machine interface making analyses, interpretation and control of work close to the understanding of medics.

One new question found by our group was the problem of 3D reconstruction based on one or very few pictures. This approach is different from that one used in computer tomography (CT). The idea is to recover not 360° image but part of it. This saves a lot of radiation load of patients. Some results are still available but again work in dynamic filtering and shadows selection/ zoning/ distraction is in progress.

Absolutely new request to us in the time of work was preparation for realistic body model that can be manipulated and modified to be representative for the origin at every stage of his life. This area is new for our group but we started collaborative work with teams from other European universities. The state-of-the-art here is availability of 3D skeletal models and models of some of organs. How all of this will be combined in one representative model and how it will be modified to present changes in someone's body is still open question.

Image collection for long time archives is hard problem as was mentioned above. A small hospital produces only images in size of 5 to 10 TBytes per year. To keep this amount of data "forever" becomes a problem with many dimensions.

3. OPEN PROBLEMS

3.1 Medical Questions

We mentioned above that IT technologies can provide to the medical society wide stream of new possibilities.

Personal health record covering all aspects of someone's health history is still questionable. Problems are coming from two sources – how and where we can keep records and who needs life long data tracking.

One of the challenges today is remote consultancy. It needs in many cases transfer of imaging and numerical information, held on paper documents and similar. It has to be presented in every HIS.

A special point is drug tracking in the context complex analyses of how they influence patients, combinations, age, gender and other cross-relations.

Mentioned above problems of creation of better body and organ 3D models for every-day diagnosis and health tracking and personal health profile sustain.

3.2 Technical Questions

It is obvious that today HIS are distributed. The problem here is that they are classical mesh systems. They are hierarchical systems of systems. A lot of currently available subsystems have to be integrated in new systems. Constantly part of them has some specifics that need special patches or convertors to enable inclusion.

More problematic is the fact that wireless connection from different mobile devices becomes widely used.

We see two general things needing theoretical and practical solutions.

- 1) First is that current distributed HIS architectures generate problems for the medical personnel if it has to acquire data from different sources connected to different servers or subsystems. In many cases this needs to know the exact system structure, to have access rights to its different elements and so. Hospitals are geographically distributed and their divisions have to be connected properly and to look like single object.

The addressed solution here is similar to the “cloud”. This is the so-called virtual mono machine. The idea is old but can be implemented today because of technological revolution and performance bust. On abstract level the system is represented like a single computer implementing all system’s functionality. This is the way the user sees telephone network. All layering, abstractions and networking are hidden inside. Part of this idea is designed and implemented in DAPSEpro system.

This approach has one important drawback. It needs very formal approach on the boundary between the abstract mono-machine and real distributed systems.

The advantages of this approach comparable to “cloud” are much a) better security and b) flexibility for future extensions.

2) The second general problem for solving is the mentioned above mobile access to HIS and medical services. It covers two very different objects – any kind of people’s access device (smart phones, tablets and so) and mobile medical equipment (wearable sensors, equipment in ambulances, autonomous devices with wireless connectivity). All this is part of today’s mHealth technologies.

Here we have to meet security and safety requirements. They are subject to be increased all the time.

The direction of information exchange is the next thing to be solved. Primarily the main direction was from the sensors and apparatus to the HIS. Today the exchange is fully bi-directional. To the mobile user area transferred data of any kind – numerical, images and so. Moreover – there is a special kind of education for students and for patients oriented to modern mobile devices and networking technologies.

All of this emphasizes the understandings of new modalities and identification of opportunities for implementing interoperable devices and systems, and integration available HIS.

3.3 Business Questions

A lot business questions have to be answered when HIS is designed and implemented. They point to the following different aspects:

- The price for data center – in exploitation time this becomes really expensive.
- Security support – depending on security level planned to reach the price is becoming significant.
- Every-day expenses for hospital activities, patients care, medications, etc. have to be tracked.
- Connections with health insurance companies.
- Interdisciplinary work in the area of general health and mHealth as the way to decrease unnecessary stay in hospitals, preliminary diagnosing, out-of-hospital support.

4. CONCLUSION

Here in this paper is presented an implementation of first version of Intelligent Hospital Information System. Together with this presentation are discussed many open problems and new directions for future research. They are discovered in three separate sections. Some new solutions are proposed here, too.

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APPLICATIONS AND USES OF DENTAL ONTOLOGIES

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ABSTRACT

The development of a number of large-scale semantically-rich ontologies for biomedicine attests to the interest of life science researchers and clinicians in Semantic Web technologies. To date, however, the dental profession has lagged behind other areas of biomedicine in developing a commonly accepted, standardized ontology to support the representation of dental knowledge and information. This paper attempts to identify some of the potential uses of dental ontologies as part of an effort to motivate the development of ontologies for the dental domain. The identified uses of dental ontologies include support for advanced data analysis and knowledge discovery capabilities, the implementation of novel education and training technologies, the development of information exchange and interoperability solutions, the better integration of scientific and clinical evidence into clinical decision-making, and the development of better clinical decision support systems. Some of the social issues raised by these uses include the ethics of using patient data without consent, the role played by ontologies in enforcing compliance with regulatory criteria and legislative constraints, and the extent to which the advent of the Semantic Web introduces new training requirements for dental students. Some of the technological issues relate to the need to extract information from a variety of resources (for example, natural language texts), the need to automatically annotate information resources with ontology elements, and the need to establish mappings between a variety of existing dental terminologies.

KEYWORDS

Ontology, dental informatics, semantic web, dentistry, web science, e-health

1. INTRODUCTION

The advent of the Semantic Web (Berners-Lee, Hendler et al. 2001) has provided the means by which (at least some forms of) human knowledge can be made available on the World Wide Web (WWW). Typically, the knowledge associated with some target domain of discourse (e.g. dentistry) is represented in the form of an ontology using a special purpose knowledge representation language, such as the Web Ontology Language (OWL), and it is then made available for use by publishing the ontology on the WWW.

Within biomedicine, a large number of ontology development efforts have been established to support practitioners and researchers working in a variety of areas. Perhaps the most notable of these efforts is the Gene Ontology project¹ (Ashburner, Ball et al. 2000), which aims to standardize the representation of gene and gene product attributes across multiple species and data sources. However, many other biomedical ontologies² are available, and these support a rich range of actual (and potential) bioinformatics applications.

In spite of the general support for ontologies within the biomedical community, there are relatively few ontologies available for use by the dental community at the present time. What ontology engineering efforts have been undertaken have largely been directed to the provision of small, special-purpose and application specific ontologies (e.g. Bogdan 2011); large-scale dental ontologies with broad coverage of the dental domain are currently absent. This is somewhat surprising given the generally positive reception of dental ontologies in the scientific and medical literature (Sittig, Kirshner et al. 2003; Smith, Goldberg et al. 2010; Schleyer, Mattsson et al. 2011). Sittig et al (2003) thus argue that the development of a dental ontology constitutes a key challenge for dental informatics. They argue that “Such an ontology forms the basis of the

¹See <http://www.geneontology.org/>

²See, for example, the ontologies available at the OBO Foundry website (<http://obofoundry.org/>).

field of dental informatics” and that “Without such a standardized controlled terminology, all other clinical data and knowledge bases will not be of much use.”

The current paper forms part of an effort to develop an ontology for the dental domain that is being undertaken by the University of Southampton in collaboration with dental practitioners. The main aim of the paper is to identify some of the uses and applications of dental ontologies. This is intended to motivate ontology development efforts by highlighting the potential benefits of ontologies to the clinical and scientific dental communities. A second aim of the paper is to identify some of the sociotechnical issues associated with the uses of dental ontologies. Here, the main objective is to arrive at a better understanding of the research challenges facing those who work in the nascent fields of both Web Science (Shadbolt and Berners-Lee 2008) and dental informatics (Schleyer and Spallek 2001).

2. USES AND APPLICATIONS OF DENTAL ONTOLOGIES

2.1 Data Analysis and Knowledge Discovery

One of the main uses of ontologies is to support the publication, dissemination and exploitation of large datasets. Ontologies can therefore serve as a semantic backbone for linked data initiatives that seek to make data available on the Web in a form that is amenable to machine-based processing (Bizer, Heath et al. 2009; Heath and Bizer 2011). As an example of this kind of initiative, the UK Government is currently seeking to make large bodies of public sector information available via its data.gov.uk website³. The range of datasets currently targeted by this effort include UK geography, transportation and crime; however, future efforts may also include information from the health domain.

One of the benefits of making data available in a structured, easily accessible and understandable format is that it opens up a rich range of analytic opportunities. Some of the applications that have been developed using UK public sector information (see <http://data.gov.uk/apps>) attest to the diversity of ways in which linked data might be analyzed, manipulated and exploited. Of particular interest in this respect is the opportunities that such data provides for the discovery of new knowledge. Thus, when multiple bodies of data are made available, and the elements from different datasets can be easily aligned and integrated, it becomes possible to analyze data in a way that reveals new relationships, contingencies and causal relationships. In some cases, this can lead to new insights and scientific discoveries in a particular domain. For example, through the analysis of the International Classification of Diseases (ICD) codes entered in Electronic Health Records (EHR) in the US, researchers were able to identify an association between myocardial infarction and the COX-2 inhibitors rofecoxib and celecoxib (Brownstein, Sordo et al. 2007). These kind of data-driven discoveries highlight the value of efforts which seek to make data available using the techniques and technologies of the Semantic Web. When data is published on the Web as linked data, it becomes available in a form that supports the sort of filtering, retrieval and manipulation capabilities required for knowledge discovery. In addition to this, when data is made available alongside other datasets in the context of the Semantic Web, it becomes much easier to integrate data from disparate datasets. For example, one could attempt to integrate patient dental records and conventional medical records, or one could aim to analyze dental treatment outcomes with respect to a variety of socio-economic and geo-political variables. These kinds of analyses not only support decision-making at the national level (for example, highlighting the shortcomings of current social policy or indicating required changes to the way oral healthcare is delivered), they also support a range of scientific research activities intended to advance our understanding of dental conditions and the relative success of different treatment interventions.

In all likelihood, one of the main points of interest of Web-based data publication efforts in the dental domain is likely to be patient dental records. Such records typically provide valuable information about the kinds of conditions reported by patients, the diagnoses made by dentists, the advice given to patients, and the various treatments administered. They also, at least sometimes, provide important information about predisposing health factors, such as tobacco use and use of xerogenic medications. Clearly, the availability of such data at a national and international level would be a tremendous boon to those concerned with epidemiological and health-related research, especially if such data could be successfully combined and

³See <http://data.gov.uk/>

integrated with other kinds of information (for example, information about the psychosocial, environmental, familial, socio-economic, genetic and physiological characteristics of patients).

The main issues for ontology-mediated publication of patient information in the dental domain at the present time relate to concerns over patient confidentiality, the ethics of using patient data without consent, and the problem of making existing data available in the format required by the Semantic Web. In respect of patient confidentiality, for example, people are understandably cautious about the possibility of personal information becoming available for wider, even if steps are taken to anonymize patient data. It is here that one of the core strengths of linked data – its ability to easily link to other disparate datasets – becomes a potential point of concern. This is because the more linkages we establish between a particular data element (e.g. a particular dental condition) and other data elements (e.g. prevailing medical conditions), the easier it becomes to infer additional information. This is both a boon and a burden. It is a boon inasmuch as it enables us to reveal important relationships and associations that drive the process of scientific discovery and understanding, but is a burden inasmuch as it sometimes reveals information that we would otherwise want to be kept hidden. In the current case, there is a concern that the more we link patient-related data elements, the greater the chance that we might inadvertently reveal the identity of a particular patient. The solution is, of course, to somehow restrict data linkages in a way that protects patient confidentiality. However, it is not clear how (or whether) this could be done *a priori* for any particular dataset, and there is also a risk that by restricting the kind of networks into which data elements can be embedded we sacrifice some of the epistemic insights that such data promises to make available.

2.2 Education and Training

Ontologies form important resources in terms of the epistemic infrastructure of a domain, and it would thus be surprising if they did not have some sort of role to play in terms of education and training. In fact, the way in which ontologies have been used to support education and training is often indirect. Seldom are ontologies used by themselves as resources in the way that, for example, conventional textbooks would be used. Instead, ontologies tend to be used as a resource that supports the operation of e-learning systems. Within dentistry, for example, ontologies have been used to support the semantic annotation of virtual 3D models that are subsequently used in teaching students about dental anatomy (Dias, Brega et al. 2011). Ontologies have also been used in augmented reality applications that assist students in learning about the preparation of teeth for all-ceramic restorations (Bogdan 2011).

In addition to the use of dental ontologies to support the training and education of the next generation of dental researchers and clinicians, there is also an issue here concerning the extent to which the advent of the Semantic Web requires changes to the kinds of things that dental students get taught. If Semantic Web technologies are going to be an important element of future dental information technology, then there may be a requirement to teach students about such technologies as part of their dental training. As Mendonça (2004) comments: “From an educational perspective, educators have expressed concerns that health care professionals are not well prepared to meet society’s expectations with regard to evidence-based practice and the use of information technology in the delivery of health care” (pg. 595).

2.3 Compliance with Legislative Constraints and Regulatory Criteria

In some countries, the provision of dental services is regulated by national agencies and compliance with the regulatory framework is often a condition for the financial remuneration of such services. In the UK, for example, dentists working within the National Health Service (NHS) are subject to regulatory constraints governing the conditions under which financial remuneration may be made for specific dental services (National Health Service 2005). One use of ontologies here is to support dental practitioners in understanding and complying with such regulations. One could imagine, for example, the conditions of the regulatory instrument being captured in an ontology and a reasoner being used to check proposed treatments for unintended violations of the regulatory constraints.

Of course, from the perspective of the regulatory body, there is often a need to detect abuses of the regulatory system. In the case of the UK, for instance, there have been a number of cases where NHS dentists have been convicted of falsifying patient records in an effort to secure public funds. In addition, the manner in which dental services are funded within the NHS could make patients vulnerable to unnecessary reparative

work by unscrupulous dentists. The use of ontologies to record patient information arguably makes it easier for regulatory authorities to detect incidences of non-compliance and malpractice. Once patient records become linked to specific individuals through other datasets at a national level, then the misrepresentation of patient information becomes harder to implement. Similarly, dentists who opt to undertake unnecessary treatments risk becoming statistical outliers when their treatment records subjected to comparative analyses along demographic and geographic criteria. All this argues in favor of greater transparency when it comes to the kinds of treatments that dentists administer.

2.4 Evidence-Based Dentistry

Evidence-Based Dentistry (EBD) is a specific form of Evidence-Based Medicine (EBM) (Sackett, Rosenberg et al. 1996) that emphasizes the integration of scientific and clinical evidence with the expertise of individual dental practitioners in order to improve patient care. However, while the goals of EBD are clear enough, the actual means by which scientific and clinical findings can be successfully integrated into routine clinical practice remains problematic. Clearly, like other forms of EBM, EBD requires streamlined access to the latest empirical data regarding specific medical conditions as well as prevailing views on what constitutes best practice in specific situations. As such, one application of ontologies in support of EBD could be to improve access to relevant information resources in particular clinical decision-making contexts. This can be accomplished by using elements from the ontology to ‘semantically annotate’ specific resources (e.g. research articles) on the Web. This process of semantic annotation makes the semantic referents of the annotated resources accessible to applications whose task it is to make practitioners aware of those resources. In practice, of course, this process confronts a number of challenges concerning both the annotation of resources and the mechanisms by which practitioners are made aware of the resources. In the first case, there is the question of whether the semantic annotation process is to be done automatically. If so, there is a requirement for robust resource classification systems that often rely on sophisticated machine learning techniques. In the second case, it is important to fully understand the human factors issues associated with information processing and decision-making in the dental domain (see Schleyer, Mattsson et al. 2011).

2.5 Information Exchange and Integration

One use of ontologies is to support information exchange and integration between user communities that countenance distinct data models and vocabularies. This particular use of ontologies has been a significant focus of research attention within the Semantic Web community for some time, and a rich literature has emerged regarding candidate techniques, technologies and representational formalisms (Kalfoglou and Schorlemmer 2003). There are, in fact, a number of ways in which ontologies might be used to support information exchange and integration in the dental domain. One use is to support the linkage of dental information with other kinds of information. For example, recent work has sought to develop ontologies in support of both salivaomics research (Ai, Smith et al. 2010) and the classification of orofacial pains (Nixdorf, Drangsholt et al. 2011). Both of these domains seem at least potentially relevant to dentistry in either a clinical or research context, and it is therefore important that appropriate linkages between the various ontologies are established.

A second use for ontologies in information exchange and integration contexts is to serve as a ‘semantic bridge’ between a variety of potentially competing taxonomies, terminologies and controlled vocabularies that have recently emerged in the dental domain. A particular problem is presented by the multiplicity of diagnostic coding systems that have been developed to describe dental diagnoses. One such system is SNODENT, which is maintained by the American Dental Association (ADA) (Goldberg, Ceusters et al. 2005). Another is the ‘EZ’ coding system described by Kalenderian et al (2011). The emergence of different coding systems constitutes a potential source of conflict and competition between different agencies, whereas genuine progress in advancing the state-of-the-art of oral healthcare arguably demands cooperation and collaboration at both the national and international levels. Ontologies may be seen as one means of reducing the inherent tension here. They enable existing coding systems to be used, while simultaneously providing the basis for meaning-preserving modes of information transfer. This does not mean that there are no significant sociotechnical challenges confronting the realization of these interoperability solutions. In addition to the requirement for effective collaboration technologies, most semantic integration efforts require

some degree of flexibility by one or more agencies in order to establish an effective mapping. This is particularly likely to be the case when it comes to dental diagnostic coding systems, since some coding systems have shown deficiencies in both content and coverage (Goldberg, Ceusters et al. 2005) and may therefore require modification.

2.6 Clinical Decision Support

Clinical decision support systems (CDSSs) are computer programs that are used to support clinical decision making, often by exploiting bodies of domain-specific knowledge. CDSSs have been the focus of considerable research and development attention within the dental community over the past several decades (White 1996; Mendonça 2004), and a number of applications have been developed to support decision-making in specific areas. For example, in a comprehensive review of the literature, White (1996) identified over thirty decision support systems in the dental domain. He grouped these systems into seven areas, including dental emergencies and trauma, orofacial pain, oral medicine, oral radiology, orthodontics, pulpal diagnosis, and restorative dentistry. Other systems that have emerged since White's review include systems to support decisions related to oral surgery (Brickley and Shepherd 1996), caries management (Benn 2002) and treatment planning (Finkeissen, Böhret et al. 2002) (see Mendonça 2004, for a review).

In spite of their potential benefits to dental clinicians, CDSSs are not commonly used in dental practice. One reason for this may be that such systems often have very limited scope in terms of the kinds of decisions they support – they are often designed to support one particular kind of decision (e.g. treatments for lower third molar problems). CDSSs also impose an overhead in terms of the cost associated with knowledge maintenance – it often requires a lot of time and effort to keep the knowledge base of a CDSS up-to-date. Both of these problems may be seen as having their origins in the 'knowledge acquisition bottleneck' associated with many knowledge engineering efforts. The problem is that CDSSs rely on expert knowledge, and such knowledge is both difficult and expensive to acquire. Dental ontologies may provide a partial solution to this problem. Firstly, by making knowledge available in the context of the WWW, ontologies enable CDSSs to automatically update their knowledge bases with respect to the latest knowledge that is available. Furthermore, by acting as a consensual representation of knowledge in the dental domain, ontologies can effectively harness the efforts of researchers, clinicians and knowledge engineers on a global scale. Finally, the use of ontologies as a representational device for the publication of dental datasets (see Section 2.1), provides a means by which the requisite knowledge for CDSSs may be made available as a side-effect of the daily process of recording human clinical decision and dental treatment outcomes. Of course, not all the reasons for the poor uptake of CDSSs relate to the technical difficulties of acquiring and maintaining knowledge. Work in knowledge engineering has often failed to pay adequate attention to the way in which humans process information and make decisions in real world situations. As Schleyer et al (2011) comment, "Without a good understanding of how clinicians review, analyse, and process clinical information, the design of effective computer-based tools to support these activities is severely handicapped." The highlights the importance of adopting human-centered design approaches in the development of future CDSSs.

3. CONCLUSION

In spite of an ever-increasing number of biomedical ontologies, dentistry still lacks a high-quality ontology with good coverage of the dental domain. One reason for this may be that the potential uses and applications of dental ontologies have not been adequately described. This paper represents an attempt to address this issue. It describes a number of ways in which dental ontologies might be used and the kind of benefits they might provide to patients, the dental profession and society at large. If we are to press maximal social benefit from dental ontologies, however, we need to have a clear idea not only of the kinds of uses to which ontologies may be put but also the kind of sociotechnical issues that are raised by these uses. Most of the applications described in this paper are associated with significant social and technical issues, and these highlight important areas for future research and development. Importantly, many of the issues associated with the exploitation of dental ontologies are unlikely to be resolved by researchers working within a single discipline. Instead, the resolution of many of the issues described herein requires the concerted effort of

experts from multiple fields, including social scientists, computer scientists, psychologists and legal experts. This requirement for multidisciplinary collaboration suggests that the topic of dental ontologies is a excellent candidate for research attention in the nascent discipline of Web Science (Shadbolt and Berners-Lee 2008). Web Science is a discipline which focuses its attention on the sociotechnical aspects of the Web, and it also seeks to orient technology development in ways that benefit society. Such scientific and social goals are perfectly compatible with the future development and exploitation of ontologies in the dental domain.

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TOWARDS AN INFORMATION SOCIETY: WHAT CAN BE DONE TO FACE THE CHALLENGES?

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ABSTRACT

The rapid percolation of Information and Communication Technologies into the daily lives, post 1990, has suddenly transformed the lifestyles of people across the continents, and its impact is more pronounced in countries like India whose economic development, incidentally was also put on fast track during the same time, thanks to the liberalization, privatization and globalization initiated and adopted as a policy by the government. India finds itself in a queer situation where the educated upper elite residing in urban areas are adopting and galloping to the changing currents, while a great majority of country's populace, still remaining firmly anchored to agrarian economic resources, seems isolated and lost, in the cacophony of emerging technologies. A realization is fast dawning on the policy makers in India, that urgent measures be taken to augment information literacy among the marginalized groups and bridge this digital divide in the shortest possible time. The only way to effectively bring this social integration and bring every individual on equal platform is through increased active role played by the governments, large business firms, philanthropic agencies and academic institutions who by making available the necessary wherewithal in terms of easy to handle gadgets and translation software help bridge the digital divide. The academic institutions have a tremendous responsibility to shoulder in this regard and this paper is intended to discuss the opportunities and challenges present on the path, in front of academic institutions, particularly working in the higher education sphere.

KEYWORDS

Digital divide, information apartheid, e-Society, electronic gadgets, role of institutions of higher education

1. INTRODUCTION

This really is an irony! While the computer mediated information storage and exchange over global networks is shrinking the world into a global village, the same technology is pushing the globe into the catastrophic division of 'information haves' and 'information haves-not'. While some parts of the globe are advancing with tremendous pace - playing, dancing and rejoicing with technologies and innovations, a large section of the world in developing and underdeveloped countries is still battling with literacy missions and primary education campaigns. The advent of ICT, on one hand, is resulting in virtual communities, opening doors of its citizenship to everyone; on the other hand it is resulting in the growth of a few regions of the globe into digital hotspots and hubs of activity, leaving the rest of the world as passive participants and onlookers, in the real world. This is particularly evident in countries like India, where the society and its economy is two generations behind - with agriculture as its base, whereas the other countries have marched ahead from agriculture to industrial to information economies. Even within India, there is a striking disparity. The Indian metros like Mumbai, New Delhi, Bengaluru, Hyderabad and Pune are major contributors to world's software development, on par with their global counterparts, contrasted by semi-urban and rural regions of the country which still battle with the issue of providing quality education to its rural populace. Though the government is ever increasing the budget outlay to educational sector in every five year plan, there are several constraints that hinder the swift progress leaving a large chasm.

However, this very communication and information revolution which caused the digital divide, promises to be the panacea for all these lacunae and shortcomings, provided we devise methods to bring it into the daily lives of every individual. The mobile telephone technology together with satellite television transmission, which penetrated even the very low income groups, seems to hold a tacit solution to the

problem of bringing everyone on to the same platform. It is seen everywhere that even a person with bare minimum literacy is able to operate the mobile phone and address some of his problems. Similarly the satellite televisions have considerably succeeded in entering the daily routine of people, elevating the general awareness levels of the common man even though their operation demands some degree of human handling of technology. Taking cue from the success of these two new technologies that efficiently penetrated the common masses it is time, instead of spending millions of currencies on conventional methods of education, effort be made to bring this powerful and intuitive computer aided information technology into the daily lives of the common masses to quickly raise them on the ladder of information literacy. The attempt here is to suggest some such possible activities with a focus on semi-urban and rural villages in India.

2. THE ENIGMA

Here is an enigma. While computers and internet have entered the market over two decades ago they are only popular with well educated and upper echelons of the society whereas the mobile telephone technology within just a few years of its introduction, registered thumping success even with the barely literate masses. While even the illiterate and the poor are comfortable handling mobile phones, how is that the computers are still hardly put to use by the lower strata of the population? The answer to this lies in the important truth that, as long as a person does not *live with* a new gadget, its mastery is not possible. While mobile phones come at affordable prices and are easy to carry, computers are not; they are not part of the life routine of common man. Secondly, the technology that is offered by the tool should be capable of addressing the immediate requirements of user and the appreciation of utility of that tool or gadget in solving life's important problems should dawn on the user. Take the case of mobile telephones and television sets. Even though the menu displayed by these gadgets, more often than not is in English, a language foreign to the rural users of India, they immediately acclimatize themselves, as they live with these gadgets. What's more, they realize the utility of these widgets in solving their problems concerning communication and entertainment. This, sadly however, is not the case with computers and information gateways. They are not in the immediate environment of the common masses and so they never have an opportunity to use, let alone master these gadgets. This leaves a deep chasm which is the root cause for this vast and fast expanding digital divide. As long as a person gets chance only to occasionally come in contact with some new technology which requires good understanding of a language that is foreign to him, he only looks at it with fearful eyes, never daring to bring it into his personal life.

2.1 The Academic Scenario

Thus, while illiterate and semi literate masses are grappling with the challenge of being part of information revolution taking place in their surrounding environment, the plight of student community hailing from rural and semi-urban localities is no good either. This is true not only in respect of students of primary and secondary education but is starkly evident even in case of students of higher education. The World Wide Web and other electronic resources in the form of CDs and DVDs contain such a huge mass of information that, if properly tapped, could completely transform the academic scenario and bring the underdeveloped and the developing world on par with the developed parts of the globe. But sadly there are many road blocks on the way, which even though are not really insurmountable, still pose challenge only because of lack of serious efforts to clear them off.

2.2 The Challenges at the Educational Institutional Level

The transition to e-learning resources is a big challenge to the academic institutions located in semi-urban and rural areas of India, for multiple reasons. Firstly, a sizable number of students, except those who are pursuing a course in computer applications are not comfortable with handling computer systems. To address this problem, a compulsory paper on computer applications is introduced in the first year undergraduate programs of all faculties. Yet, this does not fully resolve the problem as the students were never exposed to computers before and there seems inherent inertia in their minds in adapting to the new technologies. The tendency is more to *clear* the computer paper in the examination rather than appreciate its potential as a tool

for resource location. Secondly, language plays a havoc as most of the learning resources are available in English and not in the language they are proficient in – their mother tongue. Even the technology and tools that enable them access the learning resources are heavily dependent on English, the privilege of translation that their European counterparts enjoy, being not available to them. This severely discourages the learners from adapting to the technological environment. The third great challenge is the availability of infrastructure, which of late, is substantially mitigated thanks to the liberal allocation of funds by the government. However, it is still a concern to the institutions run by private societies. Last but not least is the non-availability of competent faculty who can efficiently impart the skills of new technologies in the native language of the learners. Added to all this is lack of information literacy drives that dexterously blend the modern ICT tools with the conventional curriculum.

2.3 The Linguistic Barrier

One of the most fundamental barriers that stops the learners of higher education from favoring the e-resources to conventional books is the language barrier. A great deal of world class literature in every field of knowledge is produced and made available in English, a language the rural populace in India are not comfortable with. India is a land of multiple languages. Though the national language of the country is Hindi, more than 60% the country's population has many other vernacular languages as its mother tongue. A great number of youth in the rural and semi-urban areas still pursue their education - even at higher education levels - in their mother tongues. Owing to this their comprehension levels of English language are as rudimentary as their computer handling skills. This compels them to bank on books published by local publishers in the language of land, which in turn are way below the international standard in terms of quality and concurrence. This results in a vicious circle where the knowledge acquired is obsolete and so does not reflect the modern developments, as translation into vernacular language with ease, dexterity and efficiency reflecting the purport of the original text without losing the grace, is only seldom seen. This makes the rural youth a second rate citizens in knowledge acquisition, alienating them further. The facility of translation enjoyed by their European counterparts and even other Asians such as Chinese and Japanese is also not available to them. While most websites offer the option of viewing their content in multiple international languages and so sometimes offer them in the official national language of India, Hindi, they would not offer their content in other major Indian languages such as Tamil, Telugu, Marathi or Bengali. Since the learners want the accessing technologies as well as the learning material in their native languages, this leaves them out of bounds.

Another disheartening fact is that the societies in developing countries are mostly the end users, not the producers of new knowledge. And even the marginal contribution by the new knowledge producers from the developing world is always invariably in English as they want their inventions and discoveries to be heard by larger international audience. Thus any modern addition to the existing body of knowledge is always in international languages and so the users of other languages are deprived from the latest contributions.

There have been some efforts by the premier technology universities of India like Indian Institute of Technology, Kanpur, CDAC, Pune and Bangalore who produced translation software such as Anglabharati, Matra and Mantra. But the biggest drawback is that all these translation software are available at a premium and not as free. The success of Microsoft Corporation with many of its products such as their operating systems and word editors is chiefly due to the fact that they allowed complacently, turning a blind eye, the pirated versions of their software to be used by the computer users without paying a penny, as they wanted wide usage of their products and thus generate demand which can be monetized later. They were content with the profit they were making from the business organizations in developed countries and other parts of the globe and not tightening the screw on the home users. This led to the success of personal computers at least with the educated and creamy layers of the society, as they were introduced to new vistas without having to pay anything for the interfacing software. Precisely, this is the strategy to be adopted in case of translation software as well in developing countries. Instead of spending millions of Rupees on developing only infrastructure, what is urgently needed is the development and free distribution of automatic parsers and translation software *en mass*. This will enable the users from rural and semi-urban regions to familiarize themselves with what is available for them out there in the electronic environment. Another major hurdle is keying in the search words in vernacular languages which, however, is considerably reduced by the introduction of Unicode writing system, but is still slightly technical and not fully intuitive. While the

permutations and combinations of just 26 letters produce all the words and expressions in English, the phonetic languages of India have 56 letters with their *hrasvas* and *dirghas* and *dwtiwaksharas* thus making the keying-in a far more complex task.

2.4 The Money Factor

With the information turning into a commodity, that can earn money with every transaction, the realization soon dawned on the business enterprises that transfer of information from one person to the other or one place to the other can be a very lucrative business proposition. Thus the e-books and e-journals that are available online are highly priced (upwards of 100\$). Though the library consortia are supportive in the access of these materials at substantially discounted prices, since such subsidized access is not available for the home users their popularity is not growing as much as it should. There have been some positive open access initiatives in this direction by Open Society Institute and others who strongly advocated open access to scholarly literature and research documents but none of the major e-content developers such as amazon.com, Cambridge University Press, Oxford Press are in a mood to pay attention to it. They consider these summits and declarations as goody-goody conventions with no practical impact. The copyright laws, which guarantee complete rights to the creators for at least 50-70 years in most countries stand as impregnable wall to free access to scientific knowledge. There is an urgent need to amend these copyright laws in every country by unanimously agreeing to bring the copyright protection to 10 years. The Google books project just like the million books project started on a promising note. The initiative as described by Wikipedia “has been hailed for its potential to offer unprecedented access to what may become the largest online corpus of human knowledge and promoting the democratization of knowledge, but it has also been criticized for potential copyright violations.” It also ran into legal wrangles soon and at present it offers the electronic copies of its scanned books only to the people in United States, Australia, Canada, and the United Kingdom, again resulting in what the authors of this article prefer to call, the information apartheid.

2.5 The Information Apartheid

There is an amount of nonchalance and apathy by the developed world of Europe, towards the problem of access to information by the rural population of developing countries. While they manage with the ways and means to provide translations to the web and other digital contents in all European languages, they overlook the regional and vernacular languages of Asian and African countries, only considering the national languages of the developing countries and ignoring the rest of the languages which a substantial number of people use as their chief medium of communication. For example, though Hindi is the principal official language of India, individual mother tongues in India number several hundred; the 1961 census recognized 1,652 languages. According to Census of India of 2001, 30 languages are spoken by more than a million native speakers, 122 by more than 10,000 (Source: Wikipedia). Though this may not be an intentional exclusion of some groups and communities, the lack of initiatives to include all these people in the e-society fold is tantamount to information apartheid. Unless the information-haves realize the need to shoulder the responsibility to help their less privileged brothers, the division of the society continues. This is again like the ethical responsibility of financially rich to help the poor in the society through taxes and donations.

2.6 Light at the End of the Tunnel

However, the frightening reality of only some advantaged groups in some pockets and regions of the globe benefiting from the fruits of these all powerful technologies, leaving the rest in oblivion and dividing the world, not by the social and economic criteria of the previous eras, but into two groups – information-rich and information-poor with an insurmountable fathom of incapacitating technology, seems to come to an end soon. The Ministry of Human Resource Development of Government of India has launched a massive project of providing pocket tablet named Aakash (earlier named Sakshat) at an unbelievably low price of under \$30, to everyone pursuing higher education. This is a much needed positive step in the direction of bridging the digital divide. In fact, a similar grandiose project was initiated under the title OLPC (One Laptop Per Child) by Nicholas Negroponte in 2006 which of course failed to make an impact that it promised in developing countries. Once this tablet enters the daily lives of learners, just as the mobile phone

successfully did, it is certain that access to technology based resources would tremendously increase, resulting in greater participation of everybody in the e-society.

3. WHAT OUGHT TO BE DONE?

Just as, whether or not we like, we all pay taxes for social developmental activities and for providing basic education and subsidies to the poor, the information generators and high end users of information have to pay for the e-content on behalf of the less privileged and make available to them the e-resources in their own languages. In the same vein, the producers of electronic editions of encyclopedia are to be compelled to produce editions in regional languages and sell them at discounted prices. After the sale of specific number of copies of any e-content, the material should be necessarily earmarked for regional language translations and the cost of such translation and distribution should be levied on these profit making companies with an equal share from government and UNESCO funding. Similarly, the manufacturers of computer hardware shall be asked to produce e-tablets at discounted prices and distribute them in underdeveloped and developing countries. The software giants, like Microsoft, Adobe and others have to be compelled to produce regional versions of their products. At present, in India, any business establishment with a profit of over five *crore* Rupees (50 million Rupees) per annum have to shell down a specific amount of money as its Corporate Social Responsibility and spend it on social development work. About 20% of such money pooled under CSR should be utilized for all activities that bridge the digital divide. Every research and development establishment and laboratory in the world must be compelled to submit their findings at least in the form of decent abstracts to Wikipedia for open access by general public.

Every year, the state governments in India play a populist card and waive off the bank loans given to the farmers resulting in substantial burden to government's exchequer each year. Instead, if the governments allocate funds in developing and distributing simple and easy to operate gadgets with at most two or three navigational buttons that act as computer tablets as well as mobile phones and which provide the information the rural masses need – such as price of agricultural products in neighboring markets, crop management information etc., - the quality of life of general public would considerably improve.

Similarly, electronic display boards similar to the ones used for advertisement display in cities and urban areas are to be erected at prominent places in every village which in turn are to be connected with Community Information Centers for continuous display of information in the local languages. This way, the masses are saved from the fear of entering into an information center to seek the information required. This brings the masses closer to the information they badly need for their development. For managing the information on these electronic display boards, the services of faculty departments of the neighboring colleges may also be tapped. But these very academic institutions suffer from serious inherent challenges as they themselves are battling hard to adapt to electronic environment for their student community leave alone serving the societal needs.

3.1 The Role of Academic Institutions

Apart from the role to be adopted by the governments and large business firms, as outlined and hinted above, the academic institutions have an equally important role to play in this enormous task. The academic institutions particularly working in the field of higher education act as information gatekeepers and information intermediaries for the young generations. Since a good deal of information generated in the recent times is made available in e-formats through CDs, DVDs and internet, the time is ripe for the academic institutions to quickly make the transition to e-content based teaching and learning. Most of the academic libraries in countries like India still are conventional libraries with more than 90% of their budget spent on procuring books in physical format. Even the classroom teaching is heavily dependent on use of textbooks, and the reading rooms in the colleges are nothing but large halls housing benches and bookshelves. There are no digital learning centers in the college campuses and even if they are any, they are used only for lazy internet surfing and seldom for serious and active reading.

3.2 What should the Academic Institutions do?

At present, there is no separate wing in the universities and higher education institutions that acts as a fulltime interface between them and the society. The Ministry of Higher Education, University Grants Commission and other policy making bodies must ensure that all universities and institutions of higher education have a separate and exclusive department to address the societal needs and disseminate the research findings to the masses through electronic display boards.

Each institution of higher learning shall necessarily establish an e-content development center where material for the syllabus of each course program is to be developed in the language of the region. For this the faculty members are to be coaxed to contribute at least ¼ of their working hours in the e-resource development. The students and faculty members are to be encouraged to use e-documents rather than the physical books as they provide multiple facilities to bookmark, highlight, copy, edit, redraft and distribute any number of copies, and also relieve the libraries of space constraints. The college website must be used for all communication with the students and faculty members. For interdepartmental missives, software like Microsoft SharePoint or Lotus Notes are to be employed rather than printed circulars. The college library must have an independent website which should act as a portal providing vital information links to web resources. It should act as a one stop resource locator for all the web resources the students seek with important web links. Each college should necessarily establish digital learning center which is a modern version of conventional reading rooms. Online administration of internal assessment tests should be considered and students should be allowed to answer even the descriptive questions using computers. The final answers thus keyed in a word processing software may finally be converted into *pdf* format and submitted to the teacher for final evaluation. This will rule out the possibility of malpractice and later entries. The project work given to the students must necessarily require the student to locate the resources using web search. The major players in the realm of higher education such as Indian Institute of Technology should shoulder the responsibility of developing e-content in regional languages keeping in view the current syllabus of various universities.

4. CONCLUSION

There have been many struggles throughout the history of the world to wipe off the disparities of class, race, gender etc. In all these struggles the disadvantaged communities could register reasonable success and bring in some degree of equality in the society. However, the division of society into information-rich and information-poor is much more a menacing threat, as in this case, the disadvantaged would not have the ability to locate, evaluate, and use effectively the resources to wage war against the all powerful information controllers, and demand their right to be well informed. This will only end up as a war they could never win as the future society is fully controlled by the power of information and the ability to convert this information into knowledge. If a section of the world decides to methodically carryout systematic measures to exclude certain individuals and groups from the information resources that are the backbone of future knowledge societies, such suppressed class could never raise their heads and fight for their legitimate rights. Before such a fascist force emerges and takes control of world, every democracy-conscious individual must make sincere efforts to integrate all human beings with the virtual thread of information and ensure everybody's citizenship in the e-society.

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SOCIAL NETWORKING AND LIBRARIES

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ABSTRACT

Observing the changes in the information landscape and new emerging online services, one type of service has really taken the online users by storm – social networking. Adopting the simple Web 2.0 principles such as harnessing the powers of the users and free signup, social networks have built a very large user base and became very interesting to different companies as a marketing tool. Today, the most popular social network globally is Facebook. With more than 500 million users worldwide, and more than half of them using Facebook on a daily basis, the marketing potential of the Facebook platform becomes obvious. As Facebook became more and more popular, different non-profit information institutions, such as libraries, began exploring ways in which they can reach potential users. The authors present the results of the research on Croatian libraries presence on Facebook, the most popular social network worldwide and in Croatia. The research was based on the analysis of the number and type of Croatian libraries present on Facebook, types of their representation (group/profile/page), number of subscribers and maintenance frequency.

KEYWORDS

Social networks, library, Facebook

1. INTRODUCTION

Since its beginnings in 2004, Facebook (<http://www.facebook.com>) managed to become not only the most popular social networking service worldwide, but also a starting point of many online trends. According to different sources, Facebook user base in July 2011 was between 500 and 750 million users worldwide (Hepburn, 2011; Facebook, 2011). Increased use of this platform can also be seen in Croatia. Data from July 2011 (Internet World Stats, 2011; Socialbakers, 2011) show that from 2.5 million Internet users in Croatia, over 60% of them (1.4 million) own a Facebook account. Local research confirmed that social networks dominate the field of online services in Croatia, with Facebook being the dominant one (Banek Zorica and Ivanjko, 2011). The Facebook phenomenon and its influence can be seen not only in private sphere of an individual, but also in different sectors, such as businesses, institutions or other organizations whose presence is emerging almost on a daily basis. Many of them are starting to use Facebook for reaching a large number of potential customers in a partially free and easy to use environment or reaching out in the customer space.

In the area of non-profit institutions, libraries were among the first ones that started to explore the possibilities of social networks. First researches on social networks and libraries have shown that, although a significant number of libraries have started to create its presence in social networks, virtual presence in such environment was still considered experimental. The majority was still considering the notion of social networking as too unstable and „unprofessional“ for traditional library services (Charnigo and Barnett-Ellis, 2007). Furthermore, Facebook was mainly perceived as fun (not suitable for business purposes), private (users do not want professional services inside their private social network), too commercial or even dangerous (known problems with data privacy) (Bejune and Ronan, 2008). On the other hand, Secker (2008) offers a different attitude towards Facebook, stating many benefits that libraries can get from creating their presence on Facebook.

In the area of user oriented research, latest research conducted by OCLC (2011) shows a steep decline in the use of library web sites, stating that almost all researches today start with Internet search engines (84%) and none of the participants started their research on the library web site. Social networking plays a vital role in the online lives of people, with 66% of Americans using social networking services. Local research on

Croatian student population has confirmed those results and found that Croatian students see a role for the library inside their social network, and would like to use some of the library services in that environment, such as searching the catalogue or receiving useful and relevant notifications from the library (Banek Zorica and Ivanjko, 2010). It can be stated, with fair certainty that, libraries can receive benefit from shifting their focus from library web sites to social networks in reaching their users. Social networks could help libraries in creating their presence in the online information landscape and transferring their “offline” brand into online environment, which they have not been able to achieve through their web sites.

One of the first researches, focused on the content or the analysis of the data libraries post in social networks, gathered various data on libraries and their Facebook space (such as fan numbers, wall postings, number of photographs, etc.) concluding that libraries have used Facebook mostly as a marketing tool, while communication aspects were not utilized as much as it would be expected (Jacobson, 2011). Another research was based on the analysis of the data which selected sample of libraries posted during a period of eight days. Results have shown that library posts were posted only by librarians who were the profile administrators and the majority of posts were a push notes i.e. library activities, photographs and user notifications. The user activity was almost non-existent (Calvi, et al., 2010).

2. RESEARCH

In order to investigate the use of Facebook as a business platform for Croatian libraries local research was undertaken. Since there were no similar researches in Croatia dealing with the presence of libraries on Facebook, the main contribution of the research is to gather data on Croatian libraries present on the Facebook platform and the number of users they have managed to attract. By gathering data on current trends, useful data can be provided to libraries considering Facebook as an option, as well as those already present on Facebook, in identifying possible pitfalls or useful practices.

2.1 Methodology and Sample

The data was collected during July 2011 using several methods: a) examination of the Facebook page “Croatian Libraries on Facebook”, b) entering the keyword “library” in Facebook search, and c) browsing all the gained results as well as browsing the libraries’ “friend lists” and activities in order to discover new libraries. The collected data consisted of 94 libraries which have created 106 various Facebook representations (profile/group/page). After browsing their wall activity, 7 Facebook representations were excluded from the sample due to their complete inactivity. The overall sample included 94 libraries with a total of 99 representations. Further analysis on the sample of 94 libraries was conducted on July 21, 2011. This analysis included: library type, type of Facebook presence (profile/group/ page), number of subscribers (number of friends (profile)/members (group)/likes (page)), is the profile/group private or public and number of days from the library’s last wall post.

2.2 Results and Discussion

First, the sample was analyzed based on library types. Table 1 show that, out of a total number of 94 libraries that have a Facebook representation, over half of them are public libraries (55%), and there are a significant number of elementary school libraries (23%).

Table 1. Total number of Croatian libraries with Facebook presence.

| Library Type | # of libraries | % |
|----------------------|----------------|-------------|
| Elementary school | 22 | 23% |
| High school | 5 | 5% |
| Faculty libraries | 8 | 9% |
| University libraries | 5 | 5% |
| Scientific libraries | 1 | 1% |
| Special libraries | 2 | 2% |
| Public libraries | 51 | 55% |
| TOTAL | 94 | 100% |

To gain a better insight into the size of the sample in relation to the total number of libraries, the data about the presence of Croatian libraries on Facebook were compared with recent Croatian Bureau of Statistics data concerning the number of total libraries in Croatia. It was found that only university libraries are in majority present on Facebook, where only one university library does not have some kind of Facebook representation. Results also show a significant presence of public libraries (20% out of total number of public libraries in Croatia), while the percentage of other libraries on Facebook was practically negligible. A smaller number of faculty, scientific and special libraries were found, which can implicate that they have not yet found sufficient reasons to use Facebook platform in providing their services. In this segment, the importance of the social component is obvious, since libraries who see themselves as more “social” (public libraries) have recognized the importance of social networks, unlike the ones considered more “professional” (faculty, scientific and special libraries).

The next analysis examined the type of Facebook representation, i.e. did the library create a profile, page or a group. Results showed that the majority of libraries decided to create a profile (52%), followed by creating a page (36%), and the smallest number opened a group (12%). This clearly shows the lack of basic understanding of Facebook and its Terms of Service, as well as the obvious absence of rethinking the Facebook strategy. In fact, Facebook TOS clearly state that Facebook profiles are intended exclusively for private users, and their violation entails legal liability, as well as suspending the user account and losing the entire data made available by the user. Results show that more than half of the libraries are risking their user account to be suspended and all the data permanently lost. Apart from creating a certain type of Facebook representation, libraries can also limit the access to its contents by making it public or private. The majority of libraries made their contents public (84%), but there were 16 libraries (16%) which decided to keep their content private and inaccessible to users. Out of these 16 libraries, 8 of them accepted our friend request or request to join the group so they were included in the overall sample.

The number of Facebook subscribers is another major exemplar of the impact of library Facebook presence. Depending on the type of Facebook presence, research collected the data on number of “friends” (profile), number of “likes” (page) or number of members (group). Figure 1 shows the distribution of libraries depending on the number of Facebook subscribers to their content.

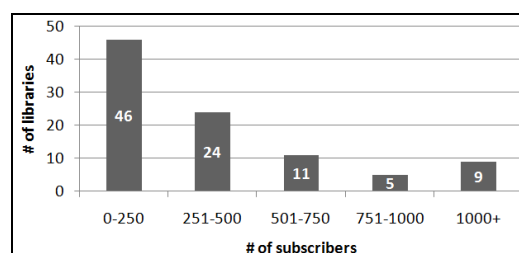


Figure 1. Number of Facebook subscribers by classes

The data presented in Figure 1 show that most libraries (73%) have up to 500 subscribers. In order to see whether libraries from larger cities have more subscribers, the number of subscribers from 25 libraries with the largest number of subscribers was compared to the population number of cities they are from. Results

showed that 18 out of 25 libraries with the largest number of subscribers are from cities with population under 50 000, so the original assumption was not confirmed.

In addition to the number of subscribers, research collected data about the maintenance frequency. As stated before, the data was collected on July 21, 2011 so the number of days since last library wall activity, was recorded. Results have shown that more than 50% of Facebook presences had at least one post in 15 days, and about one third of them have a low maintenance frequency or are totally inactive.

3. CONCLUSION

This research explored current situation with the use of Facebook as a potential business platform for Croatian libraries. Research gathered data on 94 libraries with a total of 99 Facebook representations (profile/group/page). The results have shown that over 50% of libraries that have a Facebook representation are public libraries, i.e. every fifth public library in Croatia has a Facebook presence. Also, 5 out of 6 university libraries in Croatia have a Facebook representation. Overall number of faculty libraries, scientific or school libraries that have created a Facebook presence is very small (2-6%). As for the types of Facebook representations (group/profile/page) libraries have decided to create it was discovered that more than 50% of libraries have created a profile, a Facebook representation exclusively suited for private users. This shows that more than half of the libraries is directly breaking Facebook TOS and risk their user account to be suspended and all the data lost. This data can implicate a lack of strategy in determining a presence plan inside Facebook. Possible lack of strategy (and probably staff) has another implication - low wall activity: around one third of library presences haven't been updated in 30 days. As for the subscriber number that libraries managed to attract, that number is below 500 for almost two thirds of the libraries (73%). Surprising result was noticed when libraries with a largest number of subscribers were compared to the population of the place they are originally situated. The results have shown that 18 out of 25 libraries with the largest number of subscribers are from cities with population under 50 000, thus proving that libraries from smaller places have generally been more successful in attracting larger number of online subscribers. This can implicate the importance of local "offline" community in building a bigger online user base.

Research shows that although the overall number of Croatian libraries that have a Facebook presence is fairly large (especially public libraries), only small portion of them have a regularly updated presences combined with a larger user base and most of them are just trying to be „where the users are“ without a clear strategy. Future research should investigate the structure and content of information that libraries post in their chosen social network, as well as investigate possible strategies and business models in creating a successful social network presence.

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TOWARDS A FRAMEWORK FOR MANAGING INFORMATION SECURITY IN ZANZIBAR'S PUBLIC ORGANISATIONS: A DEVELOPING COUNTRY'S VIEW

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ABSTRACT

Information Systems (IS) have become important tools in developing countries for data management, visualisation hence an essential tool to aid decision makers at all levels within organisations of all types, both private and public sector. This paper seeks to redefine the term developing country from an information security perspective. The empirical investigation involved a survey wherein questionnaires and face to face interviews were used, field observations, documents review and a review of literature, in the specific context of one exemplar developing nation: Zanzibar. The findings show that national culture, skills in information security, information assurance technologies implementation, adoption of standards and best practice, as well as legal and regulatory framework all de facto redefine our notions of developing and developed nations in the context of IS management and E-Governance. The definitions and findings used herein are intended to be generalised so as to offer guidance in planning IS using suitable frameworks tailored to meet the specific organisational and cultural needs that are typically found in developing countries.

KEYWORDS

Developing countries; information security; culture; governance

1. INTRODUCTION

1.1 Information Security Background

IS innovation has been adopted throughout the world. But the adoption is different between countries and organisations. According to Earl (2002; cited in Kimwele et al., 2010) usage of IS defines the security level of IS in an organisation. Providing security to information asset faces same challenges as providing security to other assets. Public organisations in developing countries face many challenges such as national politics, financial constraints, and shortage of skilled personnel.

Information security deals with confidentiality, integrity and availability of information. Confidentiality means the information is disclosed to authorised users only. Integrity means the information is not modified by unauthorised users. Availability refers to the information being available to authorised users whenever required. These three items make the pillar of information security. A good information security management would provide a way of prevention or minimisation of harm to organisational assets.

Table1 shows the gross domestic product (GDP) per capita and internet usage for Zanzibar, Kenya, Saudi Arabia and France. France has a higher level of ICT usage compared to Zanzibar, Kenya and Saudi Arabia. Zanzibar and Kenya have a low usage of internet and low GDP. The effectiveness of information security program needs investment (amongst other issues). It is therefore very important to implement an effective information security program within public organisations because of the importance of the assets they hold.

Table1. GDP and ICT usage (Source: POFEDP (2011), OCGS (2011), WB (2011), TCRA (2010), IWS (2011))

| Country | Population | GDP per capita (US\$) | % Internet users | % ICT in goods export |
|--------------|-------------|-----------------------|------------------|-----------------------|
| Zanzibar | 1,211,000 | 557 | 11 | 0.4 |
| Kenya | 40, 512,682 | 790 | 9.7 | 1.3 |
| Saudi Arabia | 27,448,086 | 16,190 | 43.6 | 0.3 |
| France | 64,876,618 | 42,390 | 69.5 | 5.4 |

1.2 Zanzibar Background

Zanzibar is a part of the United Republic of Tanzania and ruled by its own Government, led by its president who is elected by the people of Zanzibar through democratic processes. Vast majority of Zanzibaris are Muslims. The national culture of Zanzibar is a mixture of Islamic and African cultures. Although a large population of the Zanzibar people are Muslims the government of Zanzibar is ruled by secular laws. Ethnic groups in Zanzibar are Africans, Indians, Arabs and Europeans. The majority of small business transactions are conducted without written contracts. This is because in Islamic belief breaking trust carries huge burden in the hereafter. Also, favouritism exists in the Zanzibar society based on blood relation, marriage, region of birth, area of residency and political affiliation. According to Holstede's national culture index scores, Zanzibar as part of East Africa has moderate power distance, low individualism, moderate masculinity, moderate uncertainty avoidance and low long-time orientation (Asai and Hakizabera, 2010).

The public sector forms 3.4% of the Zanzibar population (OCGS, 2011). The Zanzibar public sector provides services such as education, health, transportation, power, finance, communications, agriculture, legislation and social services. Zanzibar government has adopted various IS include but are not limited to the integrated financial system, payroll systems, human resources systems, the driving licensing system, the road licensing system, tax systems, the car registration system, the registration of death and birth system, the citizen registration system, voter registration and various websites that offer information about various issues and forms for online and offline filling. This adoption is part of long term development strategy called Zanzibar Development Vision 2020 to be achieved by year 2020.

1.3 Rationale and Contribution for the Study

We undertake this study because there is concern about security of information stored in the public sector in Zanzibar. Also – following the discussion in the previous section – there is concern that the solutions provided by information security management frameworks that work for other organisations in other countries may not necessarily be appropriate for Zanzibar's public sector. In this paper we present a discussion on features that make a country to be considered in a category of developing countries in information security perspective.

2. ISSUES OF IS IN DEVELOPING COUNTRIES

Many developing countries have imported IS innovation from developed countries. Few developing countries innovate their own IS technology. This lack of innovation forces developing countries to adopt ideas that are not appropriate to their local context (Bhatnagar, 2000; Albirini, 2006). Rare efforts are made to adapt the imported technology to local culture. According to Foray (2009) developing countries have a small economic sector and weak absorptive capacity in terms of ability to produce locally oriented innovation. Thus, at present, most developing countries are severely disadvantaged within a global economy which is increasingly more technology and information intensive.

Developing countries do not have enough skilled people required to efficiently use the technologies acquired and innovate them to meet local needs. It is well known that resources of computers, telecommunications, and relevant technical skills are very limited in large regions of the world, notably Africa, central Asia, and some regions of Latin America. According to Foray (2009) technology transfer involves transfer of knowledge, transfer of the capacity to absorb, implement and develop the technology. In addition, adoption of technology requires acquisition of information concerning the technology, training in

how to use and maintain the technology, and adaptation of technology to local conditions. Many developing countries lack financial resources to develop their own human and managerial capacity. Due to financial constraints in developing countries adoption of new technologies is difficult to achieve effectively.

Many developing countries lack the legal framework that support IS security or have weak law enforcement on IS offences (Ndou, 2004). Eight years ago 26 of 30 Organisation for Economic Co-operation and Development (OECD) countries passed legislation recognising digital signatures (Basu, 2004). In Sharia Law, digital evidence is not admissible in Sharia Court (Al-Murjan and Xynos; 2008). Many developing countries lack cyber laws (Karokola and Yngström; 2009). Many developing countries cannot enforce anti-corruption laws due to lower wages of civil servants. Also, intellectual property laws are not enforced.

Because of financial constraints in many developing countries, their ICT infrastructures are weak and lag behind those of developed countries (Avgerou, 2008; Basu, 2004). Furthermore, there is often a big gap between rural and urban areas in developing countries in terms of access to ICT infrastructures. Many developing countries do not have sufficient infrastructure to support IS security. Power shortage is experienced by many developing countries. Even with the landing of fibre optic cable in many developing countries the price of broadband is still high for the majority of the population. It has been found that national culture influences the adoption of innovation (van Everdingen and Waarts; 2003). Some national cultures would allow the sharing of password with a co-worker, a friend or a relative (Björck and Jiang; 2006).

3. METHODOLOGY

In this study a mixed methods approach was used. Data collection was done through questionnaires, a face to face interview, document review, literature review, site observation and informal discussion. The respondents were selected from ten public organisations of the Island of Zanzibar. Literature review was used to make comparison analysis with other data collected from other researches on information security in the developing and developed countries. The research was conducted between February 2011 and March 2011. A total of 100 questionnaires were distributed with 20 questionnaires to management staff, 30 questionnaires to IT staff, and 50 questionnaires to general staff. 16 management staff, 23 IT staff, and 37 general staff returned the questionnaires. In this investigation we shall compare information security posture of Zanzibar public organisations with those of Saudi Arabia, France, United Kingdom and global. We have used the following sources of data in our investigation: CLUSIF (2008), Abu-Musa (2007), Abu-Musa (2010), POFEDP (2011), OCGS (2011), WB (2011), Ernst & Young (2010), CSI (2011), PWC (2008), TCRA (2010) and Internet World Stat (2011).

4. RESULTS AND ANALYSIS

Table 2 shows existing legislation for protecting IS in United Kingdom, Zanzibar and Saudi Arabia. Zanzibar and Saudi Arabia have less legislation in comparison with UK. The results show that 80% of studied environment reported virus and 20% reported theft of equipment as their breaches of security. While 20% French local authority reported virus, 38% reported theft of equipment, 6% reported disclosure of information, 44% loss of essential services and 31% reported usage errors as breaches of security.

We observe that the breaches have not been quantified in Zanzibar. The results show that 11% of respondents in Zanzibar received periodic training and awareness in information security while 18% of French companies provide training and awareness. French companies use several methods in raising awareness such as training new employees (36%), use publications (42%), and leaflets (15%). Zanzibar organisations have no qualified information security personnel while 46% of organisations globally have personnel with professional qualifications in information security.

Table 2. Legislation

| Country | Legislation |
|----------------|---|
| Zanzibar | Zanzibar Penal Decree Act of 2004, Zanzibar Industrial Property Act of 2008 |
| Saudi Arabia | Telecommunications Act, Anti-Cyber Crime law |
| United Kingdom | Computer Misuse Act 1990, Crime and Security Act 2001, Freedom of Information Act 2000, Data Protection Act 1998, Regulation of Investigatory Power Act 2000, Privacy and Electronic Communication Regulations (EC Directive) 2003, Copyright, Design & Patents Act 1988, Human Rights Act 1998 |

Only 10% of organisations in Zanzibar have been certified with ISO27001 in 2011. In the UK, 51% of organisations that are aware of BS7799 have fully or partially implemented it in 2008. BS7799 is equivalent to ISO27001. The results show that 9% of organisations in Zanzibar test their business continuity plans regularly compared to 36% of Saudi organisations and 56% of French local authorities. Results show that in the study environment, information assurance technologies used are anti-virus software, firewall, virtual private network, and encryption. While French local authorities have adopted extra technologies such as certificate-based authentication, single sign-on, intrusion detection and USB keys.

5. CONCLUSION

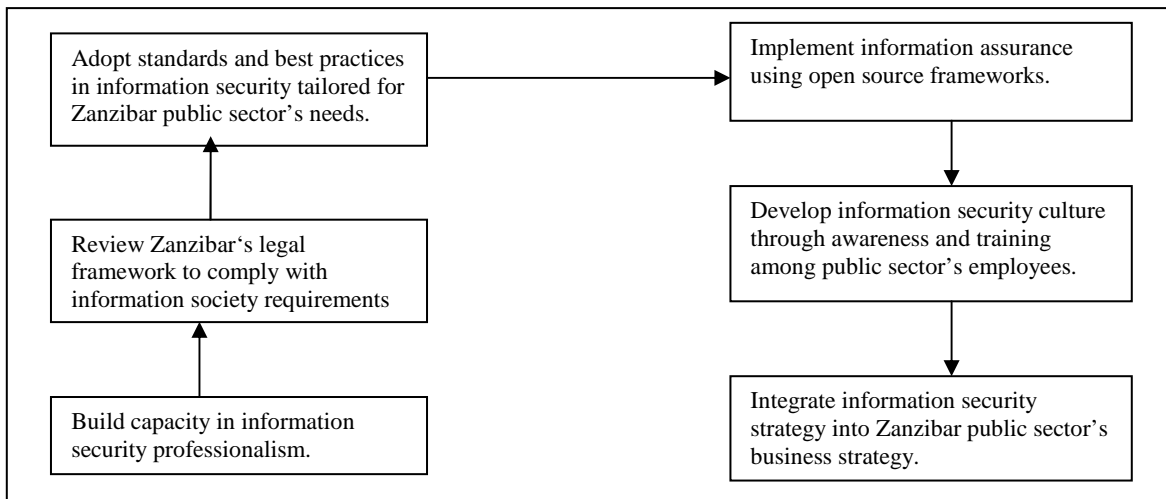


Figure 1. Proposed information security framework

In order to implement an effective IS security for organisations in developing countries, it is important that we understand the features that make a country to be in the developing country category in terms of information security. Indeed there are many definitions provided by many researchers in terms of economic view or geography. However no definition describes a developing country in terms of information security. In our investigation we compare the findings gathered by primary research in Zanzibar with other countries.

We noted that organisations in Zanzibar are lagging behind those in the UK in adoption of security standards. Main security breaches in Zanzibar are viruses and theft of equipment. Zanzibar has no qualified information security personnel. Organisations in Zanzibar do not have business continuity plans. Employees in Zanzibar lack periodic training and awareness in information security. Assurance technologies adopted in Zanzibar are few compare to those adopted by French local authorities. Zanzibar's legal framework has few legislation to protect IS compare to UK's legal framework.

In conclusion we find from our study that in developing countries national cultures are not information security friendly and affect technology diffusion. Also, there is shortage of skill in the technological sector which affects information security implementation. In addition, assurance technologies used in developing countries are not mature to cover against all threats and main security breaches are virus attacks and theft of equipment. Furthermore, legal and regulatory environment have few legislation to protect against crime on IS. We observed that adoption of information security standards and best practices is low and lag behind

those of the developed world. These challenges will make the basis for our features of a developing country in terms of information security. Figure 1 represents our proposed information security framework for the Zanzibar public sector. Indeed further research is needed to investigate how such a framework would be applicable to other developing countries and how existing IS security strategies from developed countries must be modified to suit the needs of Zanzibar.

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WELCOME TO AIRSTRIP ONE: SOMEONE IS (SURELY) TAKING CARE OF YOUR PRIVACY!

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ABSTRACT

If “privacy” has been currently challenged by the pervasiveness, the convergence and the new potentialities of information technology (IT) such as on-line social network and ambient intelligence space, an ethical conception of privacy is still possible and should influence the future developments and implementations of IT.

In this paper, models and EU provisions of privacy are discussed. It is shown that an alignment of the legal and technological conversations is desirable. We argue that we need to seek for the current meanings of the ethics that surround both the development and the appropriation by society of these technologies.

KEYWORDS

Privacy, data protection legislation, ethics, privacy by design, territory, IT

1. INTRODUCTION

The pervasiveness, the convergence and the new potentialities of information technology (IT) such as on-line social network are materialising Orwell’s Big Brother, personalisation of abuses of power with regards to fundamental rights such as privacy in his 1984 novel¹. In this paper, we argue that if “privacy” has been currently challenged by these co-existing technological breakthroughs, a thorough ethical (and emotional) and legal debate about privacy is needed which should influence future developments and implementations of IT. Models and EU provisions of privacy are presented and discussed. Whilst, alignment of the legal and technological conversations is desirable, we argue that we need to seek for the current meanings of the ethics that surround both the development and the appropriation by society of these technologies.

2. MODELS OF PRIVACY

Even if the concept of privacy has broad historical roots in philosophical, political, sociological and anthropological discussions (DeCew 2008), it constitutes a relatively new concept in the development of contemporary law (De Hert and Gutwirth 2006).

Among the different conceptions of privacy, two tendencies are distinguished: the descriptive one, which focuses on the specification of what is actually considered as private; and the normative one, which focuses on the value of privacy and on the ways it should be protected. Based on these two conceptions, some consider that there is no right to privacy and there is nothing special about privacy, because any interest protected as private can be equally well explained and protected by other interests or rights, such as the rights to property and bodily security. Others recognise privacy as a coherent and fundamental concept, with a moral or legal right that ought to be protected by society or the law.

Situated in this last tendency, two important theories have been influencing the meaning and value of privacy within the western political tradition, which are considered to be the most authoritative by several

¹ See e.g. Orwell, G. (1961). 1984. New York: Signet Classic.

authors (Pedersen 1999; Carew and Stapleton 2005; Joinson and Paine 2007; Margulis 2011; Rizza *et al.* 2012, forthcoming).

The first one, developed by Westin (1967), defines privacy as “*the claim of individuals, groups, or institutions to determine for themselves when, how, and to what extent information about them is communicated to others*” (*Idem*). This conception focuses on informational privacy (a subset of social interaction) and includes “*the voluntary and temporary withdrawal of a person from the general society through physical or psychological means*” (*Ib. idem*). For Westin, the concept of privacy, i.e. the need for the ‘opacity’ of the individual, is not an end in itself, but a means to achieve the overall end of self-realisation. According to this conception, Westin postulates four functions and four states of privacy, as presented in Figure 1.

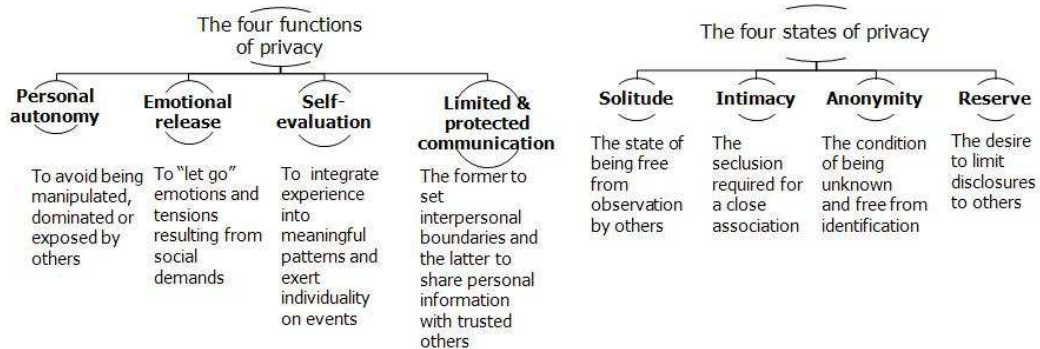


Figure 1. Westin’s conception of privacy (1967): the four functions and states of privacy

The second theory, developed by Altman (1975), defines privacy as “*the selective control access to the self*” (1975, p. 24). The social interactions, the social and physical environment and the cultural context are considered fundamental features to understand the different properties of privacy and the multiple behavioural mechanisms for its regulation. Carew and Stapleton (2005) show that in Altman’s theory, privacy has five properties (Figure 2) related to: 1) the individual and group levels in which privacy operates; 2) the difference between desired and current levels of privacy; 3) the impossibility to define an optimal level of privacy; 4) the dynamic process of interpersonal boundary control; and lastly 5) the bi-directional character of privacy. The main difference between these two theories results from the emphasis that Altman gives to social interactions, which leads to a more inclusive conception of privacy. Besides that, these two theories share several commonalities (see Margulis, 2011, p.15).

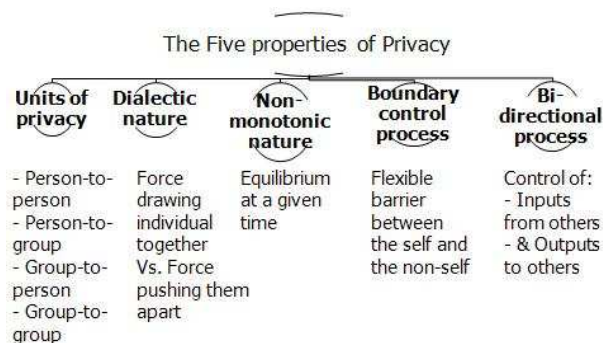


Figure 2. Altman’s conception of privacy (1975): the five properties of privacy

According to De Hert and Gutwirth (2006) the development of the democratic constitutional state has led to the invention of two complementary legal tools of power control: 1) the normative opacity tools that draw the limits of interference with individuals, and 2) the transparency tools that organize the channelling, control and restraint of power. For the authors, privacy is an example of an opacity tool, which sets normative limits to powers, while data protection can be mainly seen as a transparency tool, which regulates and channels necessary, reasonable and legitimate power.

Data protection is a pragmatic concept in its nature and a means to protect individuals' privacy (De Hert and Gutwirth, 2006; Poulet, 2010), by protecting the value and interest of privacy since it protects the value and interest of identity, security and freedom of information, among others (Andrade, 2011, p.98); yet, it constitutes a limited proxy to address other functions and properties of privacy. As we will see, much of the current EU legal discourses are based on data protection as a proxy for privacy protection.

3. LEGAL PROVISIONS OF PRIVACY

In this section we look at how models of privacy have been articulated in the EU legal systems for online communications. In the EU, personal data protection is both regulated and institutionalised (Strauss and Rogerson, 2002). The regulation has been implemented since 1981 with the convention for the "*Protection of individuals with regards to automatic processing of personal data*" by the Council of Europe. A set of European Directives have followed as a way to respond to the progress in the technological field (Figure 3).

| | |
|-------------------|---|
| The EU Directives | <p>The Directive 95/46/EC on the "<i>Protection of individuals with regard to the processing of personal data and on the free movement of such data</i>" (European Commission, 1995) aims to provide an uniform level of protection in the European Union and to facilitate the free flow of personal data in Europe;</p> <p>The Directive 2002/58/EC (<i>the E-Privacy Directive</i>) on the specific problems & risks of personal data processing in connection with electronic communication aims to provide an equal level of protection in particular of the right of privacy;</p> <p>The Directive 2009/136/EC on "<i>Processing of personal data and the protection of privacy in the electronic communications sector and Regulation</i>". It requires, for instance, the user prior consent before the installation of cookies on his/her computer.</p> |
|-------------------|---|

Figure 3. Personal data protection in Europe: The EU Directives

These Directives respectively aim to provide a uniform level of data protection in the European Union and in particular of privacy, as well as to facilitate the free flow of personal data in Europe (Strauss and Rogerson, 2002; Kuczerawy, 2010; KWR GmbH, 2006). These directives have been covering a set of principles presented in the Figure 4.

| | |
|--|--|
| Similar to the US "Fair Information Practices" | <p>Notice: "a data-collector clearly tells the subject exactly what information is being collected, how it is collected, how that information will be used, and with whom it will be shared";</p> <p>Choice: "allows consumers to actually exercise control over the use of their data"</p> <p>Access: "allows individuals to easily review the information that has been collected about them. (...) The privacy policy should describe how an individual could request a correction";</p> <p>Security: "requires data collectors to protect their gathered information, both during transmission and storage"</p> <p>Contact: "fair information practices require that collectors provide subjects with reliable "contact" information"</p> |
| Specific to the EU context | <p>Adequacy objectives/means: Personal data processing shall be accurate, adequate, relevant and not excessive in relation to the purposes for which it is processed;</p> <p>Duration: Personal data processed shall not be kept longer than necessary;</p> <p>Nature of the data: The grounds to rely on when processing personal data differ depending if the data is sensitive or not;</p> <p>Competent Authority: Processing shall be notified to and/or authorized by the relevant Data Protection Authority;</p> <p>Transfer: Personal data, after processing, shall not be transferred to countries outside the EU (and the EEA) without adequate protection, unless permitted by law and/or by the Data Protection Authority.</p> |

Figure 4. The main principles covered by the EU Directives

Some of these principles are identical to the "Fair Information Principles" or "Practices" implemented in the United-States in order to guide privacy policy in the IT private sector. The institutionalisation of personal data protection in each MS is ensured by the establishment of a data protection commissioner, assigned to a ministry or agency that implements at national level the set of regulations and principles (Strauss and Rogerson, 2002; KWR GmbH, 2006). Finally, the Directive 95/46/EC sets up the Working Party (WP) on the protection of Individuals with regards to the processing of personal data. The WP adopts working documents

to facilitate a uniform interpretation of the Directive in the MSs. It also provides expert opinion from MSs' level to the Commission on questions of data protection.

The recent revision of the e-privacy Directive and the current revision of the Directive 95/46/EC shed light on the difficulties to address the stakes related to technology pervasiveness and daily privacy concerns. Additionally, it addresses the difficulties to express privacy resonating the specificity of emerging Internet applications, and social networks, in particular (Poullet, 2010). The following section shall look at these difficulties, discussing the current legal framework.

4. TOWARDS A TERRITORY OF PRIVACY?

The advent and generalisation of “new” and pervasive IT such as social networks, radio-frequency identification, etc. are challenging the dialectics between technology and law. Rouvroy (2008) sheds light on the new interdependence between policy and technology, and the necessity of a dialogue between lawyers and engineers to embed legal principals in the technology itself.

In order to ensure proper protection of values such as privacy, an alignment of technology and regulation has to be sought (e.g. Poullet 2010; Van Alsenoy, *et al.* 2009). Poullet (2010) notes that the conception of “privacy legislation” with regards to the evolution of IT development in the last decades has already changed twice in the latter years, in order to better fit a technological evolution. He argues that ambient intelligence is originating new dangers for privacy (e.g. an “imbalance of power” among data processing agents and data providers, a “de-contextualisation” of data, the “obscurity” of functioning of infrastructures, as well as the “reductionism” of our lives to “profiles”, etc.) that require a third generation of legislation. Specifically, in order to accommodate the new realities of social networking applications, Van Alsenoy, *et al.* (2009) argue for a new legal framework that 1) governs the on-line social network users with regards to their “new” ability to distribute personal information to a large audience at great ease, and without needing a high level of technical proficiency; 2) could substantially benefit third parties who feel they have been wronged by information posted on an on-line social network. This new distribution of regulating power between law and technology has been attested by, for example, the EU, proposals for developing technology embodying “ethics by design” or “privacy by design” paradigms (European Commission, 2010, p. 12).

Other proposals place changes in regulation that currently implement traditional ethical concerns, such as Poullet's (2010) ideas of Internet as virtual dwelling: *“The right to a privacy compliant terminal with a transparent and mastered functioning by its user.(...) The right to have at disposal a terminal programmed by default to minimize the data sent and received to the strict minimum needed for achieving the purposes pursued by its user. (...) The rights of the user not to be submitted to unsolicited communications and advertisements, to refuse any intrusion into his or her terminal and finally to have the means to personally audit the privacy compliant functioning of his or her terminal (...)”* (pp. 27-28). Then, he proposes the concept of terminal equipment as a “virtual home” to support and respect this new right. Beslay and Hakala (2007) propose a vision of “virtual residence” (the “physical domain” under consideration is no longer the home but a virtual residence with digital boundaries) as a means of tackling new concerns about privacy, identity and security within an ambient intelligence space that encompasses physical, online and virtual lives, and the embedding of computing in everyday devices.

Technology is not to be taken for granted as far as protection of privacy is concerned and does not protect its users due, for instance, to either mistaken IT use, or to lack of control of published personal information (Walther, 2011; Rizza, *et al.* (2012, forthcoming). But, if technology constitutes a major challenge for privacy, it can also be an opportunity to interrogate what we as society, as technology users what present values do we want to preserve for the future, and in which ways the technology itself can help with.

Whilst, alignment of the legal and technological conversations is desirable, we argue here that we need to seek for the current meanings of the ethics that surround both the development and the appropriation by society of these technologies. In a recent interview, W. Gibson illustrates very well, the transition and unstable situation in which we are with regards to responsible innovation and technology: *“(…) No one legislates technologies into emergence—it actually seems to be quite a random thing. (...) In the postwar era, aside from anxiety over nuclear war, we assumed that we were steering technology. Today, we're more likely to feel that technology is driving us, driving change, and that it's out of control.(...)”* (Gibson, 2011).

In Orwell's novel, the main character Winston Smith, believes that his diary and the room he rents with his girlfriend are private and in believing that, he allows himself to express his true thoughts and desires. He is mistaken: these seemingly private spaces are surveyed. In a digital society, citizens take for granted that the IT they use protect by design their privacy and that in case of abuses with regards to their privacy the law protects them. As for Winston Smith in Orwell's novel they will find challenges to their expectations, once situations arise that make them wonder about all, the technology, the legal framework and the values they cherish and emotions that affect them. The latter is in need of major societal debate and reflection.

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TWO-DIMENSIONAL CODE GENERATING METHOD CONSIDERING DESIGN AND VISIBILITY

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ABSTRACT

Two-dimensional code typified by the QR code is now spread widely. The QR code is attached to printed materials such like posters and magazines, but it has problem that it is harmful to design of printed materials because they depict an inorganic pattern. In this paper, we propose a generating method of two-dimensional code which is easily recognized by users with minimum deterioration of original image and design quality. The results of experiments to extract embedded information from printed materials captured by cell phone attached camera indicate the effectiveness of the proposed method.

KEYWORDS

Two-Dimensional Code, Digital Watermark for Printed Material, Visibility

1. INTRODUCTION

In recent years, two-dimensional code typified by the QR code (Fig. 1(a)) and the Data Matrix (Fig. 1(b)) is spread widely and used in various situations. These two dimensional codes are generally attached to printed materials such like posters and magazines, but they are harmful to design of printed materials because they depict an inorganic pattern. To solve such problems the method is proposed which keeps design quality by embedding information invisibly with technique of digital watermarking (see e.g., Swason et al., 1998, and Solanski et al., 2006). For example, Moroo and Noda (2004) proposed a data embedding method for printed material by changing the value of yellow component. However, the method has problem that users may not notice the fact that some information is embedded in printed materials. Liu and Shien (2011) proposed a two-dimensional code with visual information by using digital watermarking technique. However the method is only useful for the case where a natural image is used as cover image.

In this paper, we propose a generating method of two-dimensional code which is easily recognized by users with minimum deterioration of original image and design quality. The results of experiments to extract embedded information from printed materials captured by cell phone attached camera indicate the effectiveness of the proposed method.



(a) QR code



(b) Data Matrix

Figure 1. Examples of two-dimensional code

2. PROPOSED METHOD

2.1 Generating Flow of Two-Dimensional Code

2.1.1 Inputting of Original Image

First we input an original image such as logo to generate two-dimensional code. In this study, the input image is confined to square binary image.

2.1.2 Color Setting of Code

We decide the color of the two-dimensional code to prevent the design of an original printed material from deteriorating. The value of the hue is used to the setting of the color and we denote it by h . Next, we colorize the inputted original image by using the value of the hue h (Fig. 2). When the input image is colorized, the value of the saturation and the brightness are adequately shifted whether the pixel of the input image is black or white.

2.1.3 Embedding Method

In our method, we embed information (bit sequence) into the image by small changing the value of h . We divide image into blocks (Fig. 3) and embed one bit information per one block. In this study, we set the size of block to 2mm square based on the result of preliminary experiment. Each block is further divided into two in the horizontal direction. The upper and the lower half of the i th block are denoted by U_i and L_i , respectively. The embedding of information (bit sequence) will take place using the following rules.

(a) If the value of Hue of i th bit is equal to 0, then the Hue values of all pixels within L_i will change to $h + \alpha m_0(h)$.

(b) If the value of Hue of i th bit is equal to 1, then the Hue values of all pixels within L_i will change to $h - \alpha m_1(h)$.

Here, α is the parameter of the embedding strength, and m_0 and m_1 are the maximum changing values in the case where the embedding bit is 0 and 1, which are decided by the preliminary experiment, respectively.

2.2 Extraction of the Region of the Two-Dimensional Code

The region of the two-dimensional code is extracted from a picture taken by a mobile phone camera in the following way.

[Step 1] The upper side of the region of the two-dimensional code is sought by moving from the center point of the top of the shot image toward the lower.

[Step 2] Moving toward the left from the point where the upper side is found, the point where there is a break in the side is the upper left corner.

[Step 3] We next use the same method as in step 2 to move toward right the side from the position where the upper side was initially found, and the point where there is a break in the side is the upper right corner.

[Steps 4]: Perform the same procedures as in steps 1, 2 and 3 in the reverse direction from the lower end of the image to get the lower left corner and lower right corner.

[Step 5]: End

To detect the side of the code, a 3×3 filter which is constructed by reference to the filter operator matrix for edge detection (Katayama A. et al, 2005) is used.

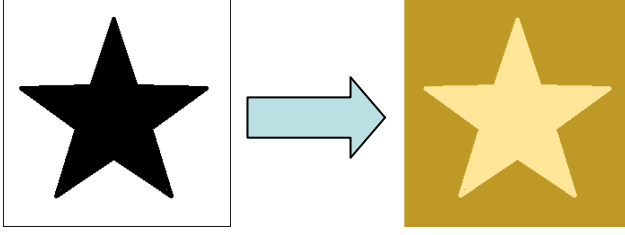
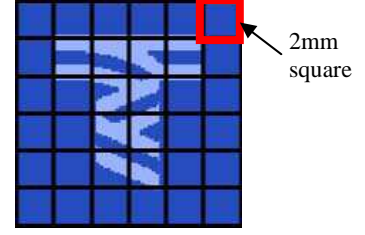
Figure 2. Colorizing the input image ($h = 45$)

Figure 3. Block partitioning

2.3 Embedded Data Detection Method

First we normalize the size of a detection target image. Next, the same block division is performed as when embedding. The i th block is divided into two in the horizontal direction, and the upper and the lower half is designated as U_i' and L_i' , respectively. Embedded data detection takes place in accordance with the following rules:

(a) If $0 \leq \overline{U_i'} < 180$:

$$b_i = \begin{cases} 0, & \text{if } \overline{U_i'} < \overline{L_i'} \leq \overline{U_i'} + 180 \\ 1, & \text{otherwise} \end{cases},$$

(b) If $180 \leq \overline{U_i'} < 360$:

$$b_i = \begin{cases} 0, & \text{if } \overline{U_i'} < \overline{L_i'} < 360 \text{ or } 0 < \overline{L_i'} \leq \overline{U_i'} - 180 \\ 1, & \text{otherwise} \end{cases},$$

where b_i is the i th detected bit and $\overline{U_i'}, \overline{L_i'}$ are the average Hue values of all pixels within U_i' , and L_i' , respectively.

3. VERIFICATION EXPERIMENT

In order to test the validity of the proposed method, we conducted an experiment of embedded data extraction from image data taken by a mobile phone camera. In this experiment, we first prepared three binary experimental images (256×256 [pixels]) (Fig. 4). Then we generated eight different types (Hue value = 0, 45, 90, 135, 180, 225, 270, 315) of two-dimensional code (Fig. 5) for each three sample images and printed out them whose size is 32×32 [mm] by using a Canon Pixus iP7100 inkjet printer. To take the images, we used a SHARP 831SH mobile phone with a picture resolution of 1536×2048 [pixel] (Fig. 6). We used the value 0.6 as the parameter of the strength of the embedding α . Figure 7 shows examples of a result of corner detection. Table 1 shows success rates of embedded data extraction. This indicates the effectiveness of the proposed method.

4. CONCLUSION

In this study, we proposed a generating method of two-dimensional code which is easily recognized by users with minimum deterioration of original image and design quality. The results of experiments to extract the embedded information from printed materials by using a mobile phone camera indicated the effectiveness of the proposed method. The method achieves high detection rate both without respect to the colors of a generated code and calibration patterns. We would like to make an experiment by using the pictures taken under various conditions.

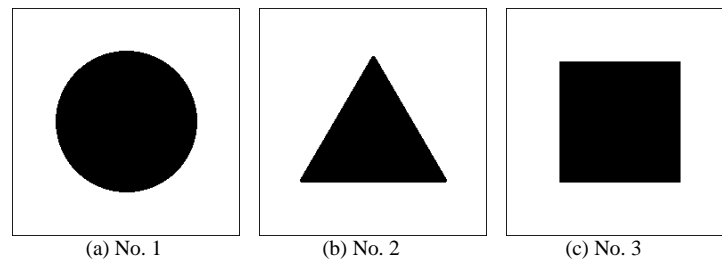


Figure 4. Experimental images

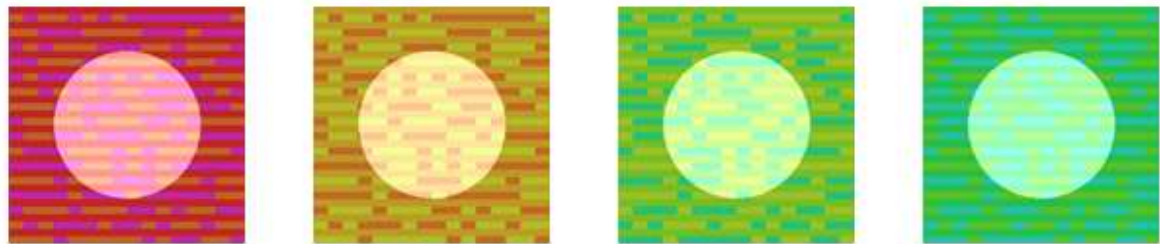


Figure 5. Examples of two-dimensional code generated by the proposed method



Figure 6. Examples of a picture taken by a mobile phone camera



Figure 7. Examples of a result of corner detection

Table 1. Success rates of embedded data extraction

| Hue | Image No. 1 | Image No. 2 | Image No. 3 |
|-----|-------------|-------------|-------------|
| 0 | 100 | 100 | 100 |
| 45 | 100 | 100 | 98.4 |
| 90 | 100 | 100 | 98.4 |
| 135 | 100 | 100 | 99.2 |
| 180 | 100 | 100 | 99.6 |
| 225 | 100 | 100 | 98.1 |
| 270 | 100 | 100 | 100 |
| 315 | 100 | 100 | 100 |

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COLLABORATIVE DEVELOPMENT FOR A NATIVE TECHNOLOGICAL ENVIRONMENT

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ABSTRACT

The following work describes an investigation that had the objective to determine a possible improvement to collaborative and component based methodologies, adapting it to a modular structure, applying optimization steps on those modules, and finally establishing a number of roles that will interact on the collaborative level, resulting in the definition of an improved component and collaborative based methodology for overall projects.

KEYWORDS

Collaborative, Framework, Components, Methodology, Native Software Development.

1. INTRODUCTION

Software development methodologies have been substantially affected by online communities. Their influence on the developing process changed the way in which projects are being developed for web usage.

Collaborative based development has to go hand in hand with suitable methodologies and technological elements that may ensure a fluent and successful result. Part of these methodologies have been studied by our investigation group and tested on Content Management System (CMS) frameworks, in specific Joomla. As an inevitable result the progress of the collaborative methodology was improved during the last few months with the objective of obtaining a more flexible and optimized work methodology that will allow us to implement new technological functionalities, as well as increase significantly the feedback of the collaborative communities by introducing intelligent agents.

Roles will play a crucial part in the definition of this new working environment, establishing the dependency on well organized work groups and collaborative communities.

As a result we obtained an improved methodology, which is able to apply intelligent feedback to new breakthrough projects that are based on native software development, respecting the limitations of the components that form part of the final project and allowing the users of our methodology the opportunity to adapt the overall structure and obtain the most of the proposed work method.

In the following paper the specific details of the working methodology for collaborative and modular development oriented to native based software development is explained in detail.

2. ENVIRONMENTAL REQUISITES

The essence of a Framework is its ability to solve the largest amount of issues posed to it in a specific context, as well as comply with the requisites of this environment.

As an initial step of the adaptation of the original collaborative methodology, we pursued the possibility to increase its functional capabilities, translated in a better and optimized Framework, adapted to the most common requisites of a network based development methodology.

The following section describes the context requisites and the means used to solve some of the most common issues in a methodological development process as well as the development of a strongly dynamic Framework.

2.1 Native Context

By native we refer to the fact of developing a project in the basic requirements and available tools that offers a specific hardware element. E.g. the case of project development targeted to mobile devices, can be approached as a unified and adaptable project in which the developers dedicate their main efforts to create a single version targeted to various devices, or it can be approached as a distributed and pre-processed development in which the developer creates a specific original version, and from that he dedicates most of the efforts to adapt this original version to the rest of targeted devices, considering the limitations and potentials of each device, and creating a specific version for each.

For our investigation work we decided to apply the second alternative, and so we named it Native development, as it requires the creation of a native version of the main project on each device it is targeted to.

2.1.1 Native Development

Development of native based projects will represent in most cases the step in which many of the efforts will be applied to. Depending on the previous steps, the efforts may vary, but it will always represent the core work of the methodology.

Native development requires the developer to be aware, at parallel times, of the limitations of the main device in which he is developing the *Gold* version of the project, as well as the overall limitations that he may encounter in the devices for which the analysts planned to implement the resulting program.

The use of a proper Framework, together with an elaborate feedback database will determine the level of experience the developer will need to have for a proper completion of the project. Eventually, when we later describe the collaborative nature of our methodology, it will show how in all the development steps it will experiment a significant reduction in work effort.

2.1.2 Native Implementation and Maintenance

The last two general steps of the methodology are the implementation and maintenance. Once completed the *Golden* version of the project, the adaptation process begins by implementing and testing the version in all targeted devices.

By an exhaustive process of modifications, improvements, feedback with the Framework, and work optimization, the resulting versions for each device are obtained. Maintenance is a necessary step in any software project, and in this case there is no difference. Depending on the methods used for development of the variety of versions, modifications to the project may be extremely cheap or extremely costly. If there was a proper use of the proposed Framework, as well as a rich Application Programming Interface (API) database the modifications to the *Gold* version may easily be propagated to the other native versions. For our methodology we have been using a pre-process xml compiling for real time modification of the source code before compilation and deployment.

These precompiled steps will significantly affect the time cost of the maintenance process. Applied to component based development, each component will be dependable of this type of maintenance.

2.2 XML pre-processed Build

Apache ANT and Maven are well known compiling engines that allow a powerful set of administration steps in implementation and deployment.

In this section we will describe the use of a specialized step in ANT compilations, which has been used to allow the developers in our working methodology to implement modifications of various numbers of versions in the original *golden* version, without the need to create new independent versions.

2.2.1 Methodological Implications

By using a single source code for all the targeted versions, and allowing such tool to be used on all levels, from the specific source code of the project, to the API used by the project, the tedious work of creating a single version for every targeted device won't be needed anymore, reducing the development cost in time.

On the other hand, the implementation and maintenance will be significantly influenced by this method as the testing and modification to a problem may be propagated to all versions with a single change. The implications in time cost are significant in the test cases obtained from our investigations.

3. COLLABORATIVE FRAMEWORK

In this section we will describe the collaborative nature of the methodology, and how its adaptation from a component based methodology together with the community characteristic resulted in an improvement of the standard development process.

3.1 Components Methodology

Our investigation follows the work that took place by our team on the possible use of a more adaptable methodology for CMS projects, in concrete Joomla. From this work we extracted some of the most useful characteristics that we successfully acquired from exhaustive Return on Investment (ROI) studies from practical work.

Components were one of the main aspects that we extracted from our previous work. The components based methodologies define a number of steps in which to follow and ensure a proper component recycle for future projects. Its implications on collaborative projects have been substantial and can be further studied.

In our case, we adapted this concept to a Native project environment, as it was explained in the previous section. But the question is how it differs from a non native environment. We considered that project should be targeted on various environments regardless the technological difference of each, and that the solution that we chose to implement is the native based development. In effect this method differs from our previous practical work, as CMS uses generic script based encoding, which in turn can be read by much of the available devices in the market. But as we argued before, the downside is the generalization of the resulting product, and the high probability of not using to the fullest of each device potential.

Components methodology applied to native development changes the working method of a project life cycle. The need for motile native contexts as well as the limitations of each device will require that the components created, for future reuse, comply with much of the characteristics of each native technology, forcing a developer team to acquire enough expertise so it can target a larger group of devices.

The cost is greater in the beginning for a developing team, but with time a team that makes a constant use of this methodology, will find that the developing cost is reduced exponentially, as more components are available in each native technology, and the tedious work of creating new components subsides.

3.1.1 Collaborative Roles

The roles that were mentioned in the previous section are the Global Project Manager (GPM) and the International Communications Manager (ICM). These two roles we originally created to solve some of the problems that we encountered when implementing the methodology on practical cases.

For the evolution of our methodology, we obviously have to consider the implications of adding the Native requisite to the formula. Collaborative component sharing on Native components for each different technological context requires roles to allow a fluent transition of knowledge from one global team to other global teams, and ensure the health of a consistent component database.

We translate the entities that played a role in CMS development, and adapt it to multi-platform (multi-version) projects that will need this approach to improve the development process. As a solution for part of the difficulties that we encounter, we decided to add a new role to the overall methodology, and describe its impact.

On the developing level, professionals with experience on multi-platform development should have a better communication with developers in other global groups. Thus we introduce a role similar to the GPM,

but on a more technical level, Components Technological Manager (CTM). This new role will have a greater technological level, and will be in constant collaboration with the other two global roles, for which main role is to maintain a global consistency of the components. By distributing the work, and creating a specific role for components managing, we charge more collaborative work on the GPM and ICM, and more development work on the CTM.

The main concept is that the creation and maintenance of a component can take place in any of the global groups, but that the managing of the component, which include version control, documentation control and etc., should be under the supervision of one of the groups, allowing for a change of responsibility in case the group wants to resign from it. This main rule ensures a better quality control, and allows an improve feedback.

3.2 Collaborative Native Component Development Process

As a consequence of applying this proposed and improved methodology on a number of development projects, we obtained results regarding costs, organization, functionality and quality. Generally the most valuable constant to be studied and judged is the time cost value. By this variable it is decided if the methodology is worth the effort. The results confirm that our methodology had obtained a number of variables favorable to our interests.

First is the overall project development process. As it was stated before, our prediction was that the first cycles would cost more than the following, and that these cycles will affect the developers experience as well as the tools functionality. With each cycle we observed on the developer's level an improvement in much of the common tasks, as it is the acquisition of requisites for the project, the design towards targeted devices, the development technological issues and even in later cycles the implementation and maintenance was influenced positively.

On the framework level, the feedback obtained in the initial cycles from the communities on components was crucial for a smooth starting, and with time the information started to flow on both channels, from the community and to the community. The local and global components database was enriched with every cycle, reducing the developing cost in time. In organization techniques, we noticed a difficulty to adapt the existing developing teams to the new working environment. The aggregation of a new role, in some cases three for those teams with no experience with the previous methodology, resulted in the first cycles a fall in productivity.

After a few cycles, the teams were able to put aside much of the issues encountered in other areas, and dedicate more time to organization issues. It is then when we started to notice an improvement in the functionality of the team, and the resulting project. Quality and functionality of the resulting product was always part of our concern. Those necessary requisites will define the methodology.

As it was stated on the very first cycle there was no improvement in quality and functionality of the resulting product. There was even a downgrade in functionality as the users of the methodology sorted themselves to adapt into the new Framework.

Once products were created, the results started to differ. Many quality issues were immediately solved by using collaborative components from the communities, and other developers group. There was a case of mutual feedback, as a component was modified for better results. Eventually on later projects the process became stable and improvements were reduced to a constant, but the quality improved significantly compared to previous versions.

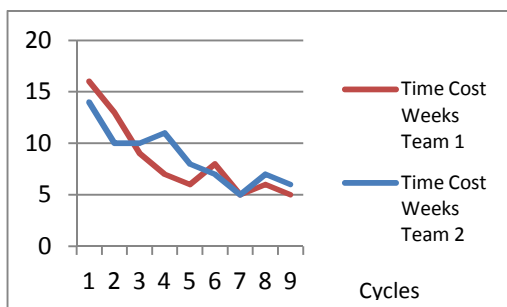


Figure 1. Project development time cost two teams.

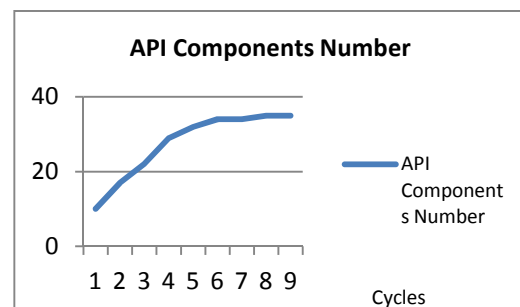


Figure 2. Components database evolution.

4. CONCLUSIONS

From the results we obtained a number of improvements. These improvements implied that the crucial points on which we worked to find better functionalities were accurate, and in a multiple variable system, the optimization of these limitations resulted in a well based working process.

Being a methodology, it will be constantly subjected to improvements, and is it on those grounds that reassuring that it are dynamical and adaptable for modifications it can certify that it may cover most of the common issues in collaborative project development.

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Reflection Papers

COMBINING COMMUNITY DETECTION METHOD AND TEXT MINING TO INVESTIGATE THE INTERACTION INSIDE SNS AS LEARNING COMMUNITY

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ABSTRACT

We propose a method for analysis and investigation on communication inside SNS using combination of community detection approach and text mining technique. By this method, we can carve out important part (sub-network) from whole communication network, and observe what the communication is like inside each “learning community”.

KEYWORDS

Network Analysis, Community Detection, Text Mining, Learning Community, Social Network Services

1. INTRODUCTION

Recent years the Social Network Services (SNS for short) are introduced into educational institutions such as universities, colleges, etc. From the viewpoint of education and learning, the use of SNSs in universities has much significance. In the theory of “Situating Learning”, the learning is placed as a process of a learner to construct knowledge through participation into (and interaction with others inside) some communities (called “communities of practice”). SNSs have functions to support communication between users, and promote the formation of communities. Students live their lives as the member of those communities, and learn many things from the interaction inside the communities. So, social network services in educational institutions can be regarded as environments to support learning activities. The methods of social and complex network analysis are used to analyze the communications inside SNSs.

In this paper, we propose a visualization method using combination of community detection approach and text mining technique that can be used in addition to the network analysis technique. By this method, we can carve out important part (sub-network) from whole communication network and investigate what is the communication like inside each “learning community” or “community of practice”.

We have placed a SNS operated in alliance project of universities, as the target and the example of analysis and visualizations in this paper. Users of this SNS are students and teachers from six colleges and universities. This SNS was launched in April 2009, and still in service. Number of registered user at June 2010 (one year and two months after launch) was about 7000, and about 2000 users were active.

2. NETWORK ANALYSIS BASED ON INDEX VALUES

Most SNSs have a couple of function to support communication between users. “Friend” “Blogging” “BBS”(Bulletin Board, Discussion Forum) are the most common tools in SNSs. Regarding such communications as the formation of links (some relations) between users, we can acquire the network structures of the communications inside the SNS.

By the analysis of these networks, we can get the information on the state and characteristics of the communication. The indexes of network, i.e., the density, average path length, cluster coefficients, and

assortative mixing by degree, are measure to see the quantitative and structural characteristics of the complex networks (Watts 1998) (Newman 2002). Those index values varies as time passes (i.e., the network grows) and we can guess the structural changes of communication inside SNSs by observing the variation.

For our example in Figure 1, the variation of average path length in “Friend” relation network (Figure1, left side) suggest that many users began using SNS in June 2009 and registered other user as “friend” each other soon after that (July). Also variation of indexes of BBS network (Figure1, right side) suggest that there are some group of users that began use of BBS in characteristic way (maybe discussion by some central characters and many relatively passive participants) between September and October 2009.

However, those indexes of network cannot necessarily give enough information of what is going on inside the communication in SNS. The analysis using those indexes targets at whole network (i.e., university wide or larger). The scope of this analysis is too wide in some sense for our purpose, because we often want to see what kind of groups the users (students) are forming and what part of the whole communication network is growing or actively working as a “learning community”. In other words, focusing on important and characteristic local part of communication and carving out corresponding sub-network is necessary.

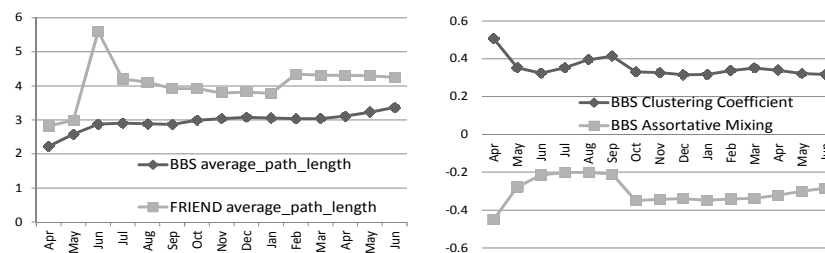


Figure 1. Variations of Index Values of Communication Network inside SNS (since April 2009): Average path length of BBS and “Friend” network (left), Clustering Coefficient and Assortative mixing of BBS network (right)

3. APPLICATION OF COMMUNITY DETECTION AND TEXT MINING FOR VISUALIZATION OF LEARNING COMMUNITY

In the context of network science, the word “community” refers the small part of network (sub-network) more densely connected internally than to the rest of whole network. The detection of communities in some network is a classification or a clustering of the nodes based on structural information of the network. Community structures are often seen in real world networks (e.g., social network of course) and such structures are formed according to what nodes in the network have in common (function, affiliation, social attribution etc). So the nodes in the community can be said to “share” the characteristics of the community.

In many community detection algorithms, the network is divided into the small sub-networks (communities), and each node is supposed to belong to a community. In the most popular strategy to detect community structure, a function to evaluate accuracy of community division called “modularity Q ” is defined, and the combination of communities and nodes included in each community to maximize Q as optimal division (Newman & Girvan 2004). We use this community detection technique to split whole communication network into sub-networks and to identify and investigate in which part the important learning activities and interactions are going on.

3.1 Community Detection for Students’ Communication Network to Visualize Learning Community

Here we propose to use combination of community detection technique to acquire sub-network and text mining technique for observation and analysis of learning community. By applying the community detection algorithms, a communication network (of “Friend” relation, or “Blog” and comment relation, or response relation on “BBS”) in SNS is divided into communities. Each node in original network belongs to some community, so by comparison of member nodes of community, we can trace, identify and compare respective communities over time.

Figure 2 shows the example of visualizations of communities detected in BBS network of August, October, and December 2009 in our target SNS. The variations of index values of this network are already shown in Figure 1. We have used the edge-betweenness community detection method (Girvan & Newman 2002) and R+igraph for visualization (Csardi & Nepusz 2006). We have colored nodes according to the community detected inside each network. Here we can compare communities between those networks and point out two obviously growing parts (communities) and one disappeared (merged with other) community as marked in the figure. These can be regarded as the growth and merger of the learning communities. In this way, we can focus on some local part of interactions inside SNS by using community detection technique (See Figure 3, left side). Analysis based on index values is applicable to sub-network (community), for example, centrality measure of the node can be used to know who plays the key role in the community.

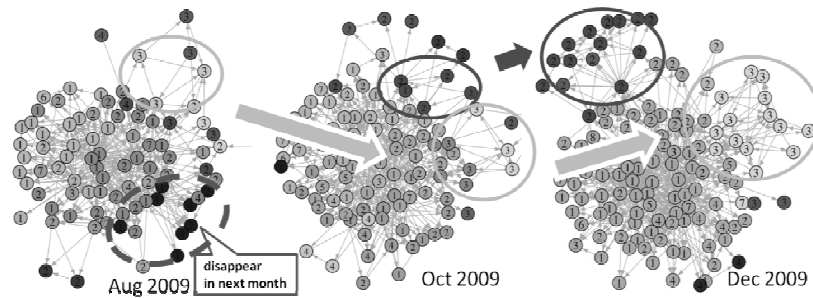


Figure 2. Visualization of communities inside students' communication network (in BBS) and changes of communities over time

We can acquire more information from each community (See Figure 3, right side). As referred to above, a community is a sub-network of original network and nodes in one community can be expected to share something in common. So the list of nodes (students here) may help teachers/instructors to understand what the community is like (especially what commonality is shared), especially if the instructor can combine it with the other information of each student, like department or club which the student belong to.

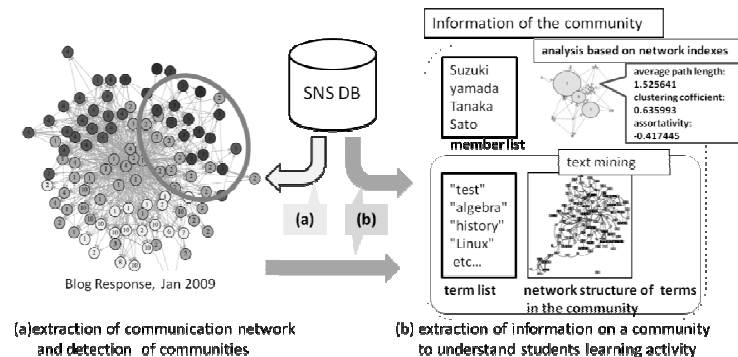


Figure 3. Outline of community detection and extraction of information of a community in students' communication network

Text mining approach can also be applied to investigate the communication inside community. We can extract text bodies of communication (comments on blog article or response message on BBS) between the members of the community, from the databases of SNS. Those texts are the entity of communication, and include all of what the members discuss about. So picking up important words (using TF/IDF weight, for example) from these text or use of automated summarization technique will help the teacher/instructor to understand what is discussed in the community. Also the network structure of terms can be obtained, by placing the co-occurrence of terms in a text body as the link. The information of term network will be help to understand how the discussion develops inside the community.

3.2 Community Detection inside Term Network for Visualization of Context

Same community detection technique described in previous section can be applied to the network of terms (important words). The co-occurrence of words in some text can be regarded as the relation between words and this means that someone used (referred) those words in same context. So each community inside term network corresponds to the context of topics in communication. Figure 4 is an example of visualization of communities of terms. Such visualization can offer information of the range of the content or storyline of discussion.

Statistic information on terms (for example, number of times a student used the term) in a community is difficult to give intuitive interpretation. Principal component analysis on frequency of the use of each word by users may give some indirect information between the community of terms and the student.

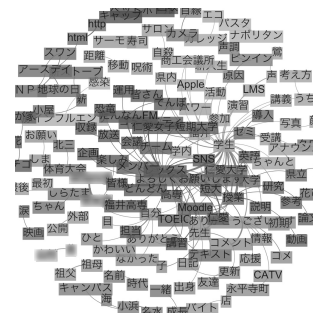


Figure 4. Visualization of term network

4. CONCLUSION

Here we have proposed the combination of community detection and text mining for analysis and investigation of the interaction inside SNS. By the analysis of the sub-network of communication network and mining the text bodies between members of the community, we can acquire much information of the communication of a specific part (as learning community) which we are focusing on.

If the analysis and visualization here can be automated and can be used as a function of SNS or some web-service, teachers/instructors will become able to grasp and facilitate the learning activities of students (and formation of learning community) easily. We are planning to design and build such service.

Also, the condition of growth and decay of learning community is not known. We expect that the analysis of actual data based on the method proposed in this paper can give the basis for that theoretical inquiry.

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IMPROVING TECHNOLOGICAL TEACHERS SKILLS FOR ONLINE EDUCATION

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ABSTRACT

The incorporation of new Information and Communication Technologies (ICT) in education systems requires the development of new teaching and learning strategies. The emergence of new communication tools is a challenge for teachers and students, while the traditional learning and teaching process is becoming one in which virtuality acquires a relevant role.

In 1998, World Education Report UNESCO, "Teachers and teaching in a changing world", described the impact of ICT on conventional methods of learning and teaching. It also predicted the transformation of the learning and teaching process and how teachers and students access to knowledge and information.

This work attempts a theoretical approach to educational change in the learning and teaching process, starting from an analysis of the information and education society that may lead us to know what and how to teach.

It is basic to develop new virtual educational models. And so it is known how ICT determine the emergence of new methods of educational interaction. The addition of these new tools can be understood as an element to achieve new educational models, especially in Blended-Learning.

KEYWORDS

Teaching-learning process, knowledge society, Blended-Learning, educational methodology

1. INTRODUCTION

Today's society is producing large-scale changes due to the emergence and widespread use of ICT in educational systems environment, creating the need to rethink education.

Thanks to both ICT and the media we have access to a huge amount of information. The new possibility of access to information leads to not only specialists in each field and obtain the knowledge needed to transmit information, but any person in any area of our society can generate this function. In this sense Castells[4] states "*Internet is the fabric of our lives at this time. It is not the future. It is present. Internet is a medium for everything that interacts with the whole of society*".

The effects, in this emerging information society, are manifested in a special way in the educational world, which forces us to rethink essential components of the educational process: from the basic training of teachers in ICT, how to teach and how to learn, until the revision of the classrooms and infrastructure, and the means used for this.

For several decades, it began to speculate about the impact the ICT revolution could have on education. This speculation has become in recent years, especially since the development of the Web, in a great movement that is transforming education in many parts of the developed world.

Nowadays, the education system cannot be excluded from ICT. We can't act without thinking about them, should be used to promote, facilitate learning and the means to support the development of knowledge. We have not forgotten that students grow up surrounded by all kinds of technology, which can be accessed from different spaces, from home, from cafes or from mobile devices. This contributes to the understanding, managing and mastering of them. So, if we use these learning environments enriched by the widespread use of ICT, the conjunction are those who can truly transform the quality of education.

Keep in mind that the incorporation of ICT in the classroom does not mean avoiding the notion of effort. The new computing resources may contribute to the development of cognitive abilities of students, but never in the absence of personal efforts.

Therefore, in this new learning environment is need a plan to train teachers containing a new perspective of technology to know the resources available and who has sufficient educational skills for transmission

2. THE NEW EDUCATION ERA

The incorporation of ICT requires changes in the educational model. The teacher changes from being an exhibitor to a guide, ceasing to be seen merely as a storehouse of knowledge. Now there are enough ways to get the volume of information required in which the teacher must be able to help students to find and to select the appropriate information. We go on from a culture based on the book and in the text, to a multimedia culture, where we have not read something to know it, but we have to interact it, to see it or to hear it.

And of course we have the possibility of education, so online or blended learning model, where time and space do not matter to create learning communities where everyone, teachers and students can generate new knowledge.

The teacher can no longer be immersed in the traditional pedagogy, he will need to be aware of all the possibilities that ICTs offer in order to make more appropriate, successful and attractive the learning process of students. The current task of the teacher should contact the students to learn by themselves and to generate their own knowledge where the figure of the teacher will act as a mentor, facilitator or mediator to ensure that teaching strategies become learning strategies, Garcia-Valcarcel[6].

With this approach we must raise the ICT in education technology like tools that help us in the teaching-learning process, where teachers should not feel frightened by this change because they will still be those who control the educational process.

Marqués[7] or Adell[1] offer us some of the main functions of ICT in educational settings nowadays, where activities should be centered and have a sense in the student activities and they must use the ICT tools in a naturally way:

- Half of speech to write, to draw or to make presentations or websites.
- Didactic way to lead a training tutorial, to be a learning guide and to motivate the student.
- A tool for information processing center.
- Generator of new training scenarios closer to reality.
- An instrument to manage administrative and tutorial information.

3. TEACHERS TECHNOLOGY SKILLS FOR UNIVERSITY EDUCATION

The Conference of Rectors of Spanish Universities (CRUE) first published in 2004 the report "*ICT in the Spanish University System*." Their results showed that Spanish universities were committed to the implementation of Information Technology and Communications (ICT) in their main activities: training, research and management. However, despite the significant progress detected, was missing a more formal planning in deployment that would favor a more effective use of ICT.

However, in the latest survey by the CRUE[5] noted that all indicators have shown a significant improvement in the last five years. Thus, there is a reduction in the ratio of students per computer, with an improvement of 26%, there is an increasing number of multimedia projectors, which means that 64% of classrooms have a projector and one of each ten classrooms has a whiteboard (up 166% compared to 2006). Also has increased the possibility of autonomous connection of students to the Internet, which has risen from 45% to 62%, and the availability of computers with free access for students, which has been reduced from one computer for every 40 students in 2006 to a computer for every 32 students in 2010.

Still, the university has the challenge of providing initial and ongoing training to teachers to facilitate their integration to new social and labor demands. The main proposals outlined by Cabero[3] and Salinas[8] to carry out the universities in the incorporation of ICTs are:

- Create innovative teaching programs at universities in the teaching–learning processes.
- Change university structures, with regards to ICT in the organization and management bodies of the universities.
- Train their teachers in order to incorporate into their classes the new learning tools in a new e-learning teaching.

We emphasize that the success of any innovation in education depends largely on teaching performance, which in turn it is determined, mainly, by training, which should focus on the following aspects:

- Training should focus on broader issues than just training in Hardware and Software. The issues should focus on issues of teaching and learning methodologies.
- There is no single level of training of teachers, but teachers may have different skills and abilities to achieve in terms of the needs that arise.
- It is important not only to the management and understanding of ICT, but that teachers understand that ICT allow you to build different things and different scenarios for student learning.

Teachers must develop new skills, abilities and knowledge, but we must also bear in mind that these new skills are not acquired in overnight, or seminars, or training programs. These skills are gradually acquired by the teacher, to the extent that their relationship with ICT is narrower, progressive and planned.

3.1 An Experience in the Pontifical University of Salamanca

The Pontifical University of Salamanca, through his School of Teaching “Luis Vives”, gives 187 subjects in his online platform. The School wanted to create a learning environment for his more than 3000 students based on Internet technologies which satisfied the next objectives:

- Easy way to create the subjects from the existent resources.
- Reuse of the subject contents.
- An easy and safe inscription and authentication from the students.
- The presence of an activity community in order to solve problems and to generate new ideas.

Moodle was the selected platform in order to achieve their objectives. So that, the School elaborated, Arranz[2], a plan for his teachers in order to give them the necessary training about how to manage within the platform, and about the tools that the platform gives them to play the online role. The plan, as an educational methodology, was established in four steps, and it has gone on during four years (a step each year):

- Training of trainers workshop: To train trainers how to teach through the platform.
- Basic level seminar Moodle platform: Basic tools to teach and to manage students.
- Middle level seminar Moodle platform: To complete the platform tools.
- High level seminar about Moodle platform: To all the teachers that want to incorporate to online education.

All the courses are 20% classroom and the other 80% online using, of course, the Moodle platform. The work environment will allow participants to be virtual and therefore students not only learn about the capabilities of the tools of work, but the advantages and disadvantages posed by virtual workspaces.

3.1.1 Results

As a result of the delivery of these courses, the following results were obtained by comparing the academic year 2005/2006, which was when the platform was introduced with the last academic year 2010/2011:

Use of the platform by the teacher: It shows a clear increase of 67% in the number of teachers who use Moodle: in 2005-2006 were 46 teachers who used it, and in 2010-2011 the number is 77. The total number of teachers that work in the School is 87.

Using files with students: In the 2005-2006 academic year shows that the most common file type is the Word file with 61% of all files, over 50%, which is a fairly important. The following highlights Power Point files and HTML files, with 12% each one and less used files such as PDF, with a 8% use and latter a 7% use web links or multimedia files.

However, in the 2010-2011 academic year are more divided, because teachers use other types of files. They are not based solely on the Word type (31%), which have been halved, but also the type used Pdf (39%) which have experienced a considerable increase from 8% to 39% and HTML type have also increased their

use from 12% to 18%. Finally, we highlight the Power Point type (7%) and web links and media (5%) who have suffered a slight reduction in their use over the academic year 2005-2006.

Activities requested to students via platform: In the academic year 2005-2006 the total number of activities conducted via platform was 128. However, in 2010-2011 the total number of activities amounts to 8430. With this increase can be deduced that teachers are involved in the use of Moodle, have acquired the necessary experience and know the tools available to make the best use for the benefit of student learning.

Finally, it should be noted that the current course teachers have requested more tasks to be performed via the distribution platform over total number of activities that students must perform.

4. CONCLUSION

Online training can be understood as a new form to build knowledge through using ICT. Blended Learning mode supported online has become an indispensable tool for developing the methodologies what we need to the introduction of new degrees in the Pontifical University of Salamanca.

It confirms that teachers show concern and interest in the use of ICT in teaching and express positive views on the importance of using ICT in the teaching – learning process. But it is clear that not all teachers have the same knowledge in the use of ICT, so it is necessary to train and support them in order not to lose interest and end up showing resistance in using them.

Each teacher, knowing his subject and supported in their online experience, should design the most appropriate activities with the most appropriate ICT tools. The teacher who begins to use the online training is slowly discovering and implementing new strategies.

In order to get a high student participation in online activities that we design, it will depend on good planning and to follow some appropriate strategies for motivation.

As a final conclusion we can say that with the use of ICT in education can be achieved arouse interest in students and teachers in scientific research and enable the enhancement of creative skills, imagination, communication skills and can access more collaborative amount of information and providing the means to a better development of individuals.

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AN OER COLLABORATIVE ENVIRONMENT: OPENSCOUT TOOL LIBRARY AND COLEARN COMMUNITY

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ABSTRACT

The purpose of this paper focuses in analyses of collaborative environment that has been building into the OpenScout tool library by a Portuguese language community interested in discussing of technologies and education. This research aims to understand the architecture of this process and highlight characteristics of OER [Open Educational Resource] when it transforms itself from artifact towards a collaborative environment.

KEYWORDS

Collaborative Environment, Open Educational Resource, Colearn community, OpenScout tool library

1. INTRODUCTION

COLEARN - Collaborative Open Learning Community - is a Portuguese language community interested in technologies and education which was founded in 2006 during the OpenLearn Project (The Open University – UK). It is currently based at OpenScout Tool library Social Network (<http://openscout.kmi.open.ac.uk/tool-library/pg/groups/839/colearn/>) with 125 members from 26 different academic groups of research focused on educational tools for learning, research and professional development, from Brazil, Spain, Portugal and England. The topical trends discussed by Colearn are: OER [Open Educational Resource], Social Media and collaborative learning. Its aim is to provide to them a 'concerted cultivation' (Thomas, D. & Brown, J. S., 2011) for both general attitudes toward Collaborative Learning and specific approaches to skills or area of interest. Its current project, which started in October 2011, focusing on producing an Open Educational Book collaboratively about Web 2.0 and OER in learning and professional develop.

This study in development aims to provide a partial analysis of the architecture of this process and highlight characteristics of OER when it transforms from artifact towards a Collaborative Learning Environment [CLE]. The key question of this investigation, which has being emerging from this movement focuses on: "Might OER be a CLE?" If it is, "should it provide opportunities of use, re-use, remix and sharing during its creation?" "Are these opportunities important requirements for creating CLE based on OER?"

The analysis of this study aims to provide reflections about creation of Open Educational Resources. The main hypothesis of this investigation assumes that the perspective of CLE embedded through the OER design is essential for providing more opportunities for creating and sharing knowledge and practices.

2. CASE STUDY

The OpenScout project stands for "Skill based scouting of open user-generated and community-improved content for management education and training". It is an European project started in September 2009 and has duration of three years providing education service in the internet that enables users to easily find, access, use and exchange OER (<http://openscout.net/project>). The main framework is the OpenScout Portal (<http://learn.openscout.net/>) an interface to learners, training and education institutions. The OpenScout tool

library (<http://openscout.kmi.open.ac.uk/tool-library/>) has been envisioned as an ecosystem of people, stories, and resources (Mikroyannidis, A. et al., 2011). Therefore it aims to bring together people and their experiences in using learning resources. Also it aims to support case studies and learning scenarios, provided by different backgrounds and stages of the lifecycle of learning resources, including adaptation, collaboration and communication tools, in a perfect articulation with the OER principles of use, re-use and sharing contents, including multilanguage access. It is based on Elgg (<http://elgg.org>), open source social networking framework, which provides the functionality and infrastructure for users to expand their learning and social ties, in a public or private way.

OER are teaching, learning or research materials that are in the public domain or released with an intellectual property license that allows for free use, adaptation, and distribution (<http://www.unesco.org/new/en/communication-and-information/access-to-knowledge/open-educational-resources/>). It includes learning resources (full courses, course materials, learning objects, tools, online learning communities, etc.), resources to support teachers to use and re-use OER and resources to provide quality of education and its practices. The OER movement is based on the principle that knowledge is as public good. It is rooted in the philosophy of openness, which considers knowledge a collective social product and, therefore, a social property (Downes, 2007 in Mikroyannidis, A. et al., 2011). The term was lined up at UNESCO's 2002 Forum on the Impact of Open Courseware for Higher Education in Developing Countries.

Colearn is based on a public space network as well as structured around participation, collaboration and participatory nature of the collective (Thomas, D. & Brown, J. S., 2011). Colearn as a community of practice has clear objectives: to connect people; organize and share actions, discussions and reflections; provide resources and support its participants in their current projects. During the period of 2006 to 2010 Colearn community was interacting in the OpenLearn Collaborative Environment denominated LabSpace, which is based on Moodle. Since 2011, the community Colearn has been using the OpenScout Tool Library in order to understand OER tools and social networks.

2.1 Collaborative Learning Interaction

Collaborative learning interactions of Colearn Community in the OpenScout Tool Library started in October 2011 from three main current actions. The first action is to understand OER and the openness philosophy including the social network environment the OpenScout Tool Library for searching, sharing and recommending tools.

The second action is to produce short multimedia OER (image, video and maps) and reflect on the process of OER production, particularly on the importance of collaboration.

The third action is to plan and develop OER chapters remixing and reusing multimedia OER (image, video and maps).

The initial challenges observed during this period by the participants are to apply tool library widgets and functionalities as well as understand how to use personal learning environments and social media interfaces for enriching the process of information dissemination and social network.

2.1.1 Discussion

All these three actions have been providing not only collaborative reflection about the meaning of OER but also an important opportunity for producing OER collaboratively, particularly when participants share their production under Creative Common License with comments, and other colleagues can reuse ideas (what?), tools and ways to produce (how?) as well as expected outcomes (why?).

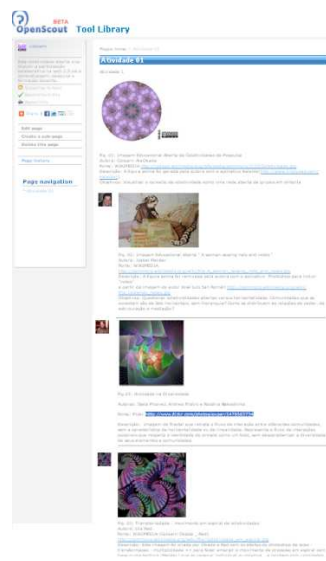


Figure 1. Tool-library producing short multimedia OER

Figure 1. shows a sequence of short multimedia OER productions elaborated by different participants. These four images were the result of reusing ideas, content and strategies that were shared previously by participants. It is possible to observe that the high level dissemination of OER practices might happen when participants move from producing individual representations towards sharing open exploitation (Van Dorp, C. and Lane, A., 2011).



Figure 2. Tool-library Google analytics data

Figure 2. shows data from Google analytics during the period from 26 October 2011 to 26 January 2012. The OpenScout tool library had 1.411 visits, which 568 were from Brazil 412 from United Kingdom and 81 from Portugal. The OpenScout tool library, which is a collaborative open environment about OER tools is open for everybody. It is possible to observe, however, that 40% of OpenScout Tool-Library interactions were by Colearn's participants. This process which includes different levels of collaboration is enriched when participants have common objective and exchange their experiences and understanding openly.

During this study in development is possible to observe important issues such as: interactivity, collaboration, co-authoring, set of tools for repurposing, ubiquitous condition, different meanings in different contexts, where the culture emerges from the environment – and grows along with it (Thomas, D. & Brown, J. S., 2011). Based on the diagram from Pierre Dillenbourg (2000), which shows us what is specific to virtual learning environments, we are repurposing it into our concerns.

Table 1. OER learning environments

| What is specific to virtual learning environments? Dillenbourg (2000) | What is specific to CLE based on OER? Colearn Community |
|---|---|
| The information space has been designed | Open reusable information space developed continuously |
| Educational interactions occur in the environment, turning spaces into places | Educational interactions occur in the OER, turning resource into environment |
| The information/social space is explicitly represented | The information/social space is explicitly represented by context and meaning |
| The representation varies from text to 3D immersive worlds | The representation varies from diversity of open reusable elements |
| Students are not only active, but also actors. They co-construct the virtual space | coLearners are not only active, but also co-Authors. They co-construct the OER. The environment should be able to provide it under open licence |
| Virtual learning environments are not restricted to distance education. They also enrich classroom activities | CLE based on OER are not restricted to VLE. Their aims as open social networks are to be interactive and enrich formal, informal and non-formal education |
| Virtual learning environments integrate heterogeneous technologies and multiple pedagogical approaches | CLE based on OER integrate heterogeneous technologies and multiple pedagogical approaches |

3. CONCLUSION

In the backstage of this process a different approach emerged in project: the claim of a resource to transform towards a collaborative environment, an open technology-enhanced learning environment, where we should be able to access, reuse and recreate digital artifacts of users' ongoing OER experiences.

A critical issue when we consider OER as a CLE is to enlance clear objectives and learning proposals in an ongoing process. Innovation can emerge, resulting in an ecosystem that involves a core of competences and skills. Colearners as co-Authors can then co-create their OER environments and contribute to open learning movement by 'opening gates' for providing information, access, literacy, practice and research.

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EXPLORING INITIAL EMOTIONAL RESPONSES OF WEB-BASED LEARNING SYSTEMS FROM AN ASPECT OF VISUAL FACTOR

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ABSTRACT

Recent advances of the broadband Internet and multimedia contents let web users demand from web pages not only cognitive usability but also related feelings. Drawing on existing theories of cognitive psychology and human-computer interaction, a research model has been developed to explain the relationship between the visual factors and aesthetic impression of a web page according to users' emotional responses. In order to further understand users' feeling and preference, an investigation of web-based learning system were explored. The investigation has two phases: 1) 15 adjective pairs were classified into two major visual factors; order and complexity, through semantic difference survey and factor analysis. 2) Multi-dimensional scaling analysis was then used to define a perceptual map of four groups. The results of the study revealed how visual complexity and order influence users' initial emotional responses to produce the first impressions.

KEYWORDS

Web-Based Learning System, Multidimensional Scaling analysis, Visual of Order and Complexity.

1. INTRODUCTION

In recent years, more and more people are learning skill and obtaining information through learning websites or forum of share information on the Internet. However, web users are starting to demand from web pages are not only cognitive usability but also related feelings. The quality of studying environment has been overload by excessive information and chaotic visual design of web pages. As users are presented with many choices of different websites on the Internet, they can switch from one website to another effortlessly. Bucy (2000) argues that emotional responses may determine which interfaces (websites) people choose to use as they seek pleasure or enjoyment.

The affective aspects of user interface design have received increasing attention. A human being's affective system is judgmental, assigning person's positive or negative dimension to the environment (Norman 2003). Therefore, affect is closely linked to feeling, cognitions, and motivations. This new perspective emphasizes the user's subjective experience with the web page interface. Recently research has been conducted on applying aesthetics to interface designs (Liu, 2001). It was also found that visual complexity and order were closely related to emotional responses and usability. However, not enough empirical or theoretical studies have been performed in the area of visual complexity and order to web design and web-based learning system (e-learning platform).

In order to identify major factors for the aesthetic of web pages, we need to investigate semantics of aesthetic dimensions and web users, as well as each group's characteristics of visual design elements. Therefore, the goal of this study is to identify the major factors of user's perception and preference on web-based learning system in the first impression, and to investigate the relationship with aesthetic and web page design types.

2. METHOD

In order to achieve our goal, we propose three consecutive studies: An exploratory survey of semantic differences with web pages (stimuli), a study of emotional semantics (adjectives), and will do an experimental survey with stimuli and pairs adjective.

2.1 Survey on Web Page Stimuli

Investigate users' perception and preference which affect how to select the web pages of web-based learning system. 115 undergraduate students (50 males and 65 females) were asked to write down approximately 10 web-based learning systems for image editing software to which are they visited or used frequently. The participants were also encouraged to explain the reasons for their selections. Ninety-one percent of the subjects were aged from 19 to 25, which corresponded to the main age groups that participated in online learning. Then, according to summary of amounts of web-based learning systems, nine web-based learning systems were selected for the following studies. In this survey, stimuli subject was limited in image editing software, such as Adobe Photoshop, and catch main web pages for stimuli. Note that this experiment focuses on the first impressions and let user absorbed in layout of static visual stimuli on a web page, hence acoustic and animated stimuli are ignored. Therefore, the nine most visited frequently websites were decided from 44 primary websites summarized.

2.2 Survey on Semantic Adjectives

In second survey, 115 students (same as last survey) were asked to write down 10 emotional adjectives (feelings) which define a good web-based learning system, such as beautiful, comfortable etc. Summing up all of the adjectives collected from students, the total number was 110 adjectives in preliminary phase. Then, five professional web designers were asked to screen for suitable 15 adjectives pairs, producing 30 adjectives from preliminary phase, for expressing the measurement of web-based learning system.

15 opposite adjective pairs are as followed: exciting-unexciting, interesting-boring, creative-traditional, attractive-unattractive, satisfied-unsatisfied, refined-rough, various- uniform, varied- monotonous, aroused-un aroused, professional-amateur, clear-confused, easy to understand- not easy to understand, organized - chaotic, simple-complex, and regular-irregular. All variables have high reliability coefficients and Cronbach's alpha was 0.8695, which is larger than 0.7 within goodness of fit (standardized item alpha is 0.8721), derived from a reliability analysis.

2.3 Experimental Procedure

Next stage of we are doing, the participants consisted of 50 female (53.7percent) and 43 male (46.3 percent) undergraduate students (different from the previous two surveys). All Participants will be required to be familiar with basic computer functions and never use stimuli before this experiment. They participated voluntarily in the study.

In order to clearly investigate user's perceptions, we will develop a system for online survey. The nine web pages were used as stimuli in the survey. On each survey page, one of the nine web pages that were developed in this experiment was shown at the left side, and the 15 aesthetic adjectives were shown at the right. They were asked to mark their first impressions about the web page along the seven point Likert scale. The survey procedure ended when the users finished filling in the questionnaire for all nine pages. All participants were asked to look at one of the nine web pages on computer screens. Participants were asked to view each web page for same amount of time (20 seconds). Those stimuli were told not to click on the links on the web page.

2.4 Analysis Method

Factor Analysis of the collected data was performed to separate several main factors for adjective pairs. In addition, multidimensional scaling (MDS) was conducted to convert the resulting similar data into a

perceptual space representation to further describe each group's features. The multi-dimensional scaling procedure used in this study was SPSS ALSCAL as many previous studies (Qiu & Li, 2008). Perceptual map gives us a direct and obvious view about the relative position and intimate degree (the closer in distance, the more intimate in relationship) but it is not accurate enough for us to get the classification of web-based learning systems. Therefore, drawing on the existing literature, five expert designers were invited to identify the number of links, number of graphics, and the amount of text as webpage design factors for further analysis.

3. RESULTS AND DISCUSSION

The data collecting from the SD survey were processed by factor analysis. The result, as shown in Table 1, reveals that the 15 opposite adjective pairs were used to configure the impression under e-learning websites. They can be classified into two main factors with 60.386 of variance explained. A principal component analysis was used on classification. The analysis result showed two main factors with eigenvalues larger than 1.0, with explained variances being 43.74% and 16.65%, respectively. KMO is 0.916 within high acceptable limits. The factor loadings of the two factors for the variables are plotted against each other.

Table 1. The factor loading of 15 adjective pairs were cluster to complexity and order factors.

| Factors | Adjective | Factor | Loading value |
|-----------------------|--|--------|---------------|
| Complexity | exciting-unexciting | 0.83 | 0.18 |
| | interesting-boring | 0.81 | 0.08 |
| | creative-traditional | 0.78 | -0.14 |
| | attractive-unattractive | 0.78 | 0.22 |
| | satisfied-unsatisfied | 0.77 | 0.18 |
| | refined-rough | 0.77 | 0.04 |
| | various- uniform | 0.75 | -0.05 |
| | varied- monotonous | 0.74 | -0.22 |
| | aroused- un aroused | 0.69 | 0.16 |
| | professional-amateur | 0.61 | 0.39 |
| Order | clear-confused | 0.16 | 0.82 |
| | easy to understand- not easy to understand | 0.08 | 0.79 |
| | organized -chaotic | 0.16 | 0.77 |
| | simple-complex | -0.34 | 0.67 |
| | regular-irregular | 0.08 | 0.64 |
| Eigenvalue | | 10.652 | 4.054 |
| Percentage | | 43.74 | 16.65 |
| Cumulative Percentage | | 43.74 | 60.39 |

One interesting finding of the first impression is related to the salient visual feature in determining the web users' emotional responses. In addition, the visual order and complexity to web users' pleasantness was largely dependent on the web users' initial impression. This finding is close related with Kaplan and Kaplan's (1983) contention that the preferred environment tends to be high in at least one of the qualities from preference framework (both complexity and order).

As above discussions, given the ample evidences and theories in environmental aesthetics and preference research (Arnheim 1966) that visual complexity and order are the prominent factors shaping aesthetic experience and eliciting human emotional response. Therefore, visual complexity and order are two main important webpage design features that influence users' initial emotional responses and aesthetic impressions toward a new website. This study also provides layout standard examples of web pages design at different visual complexity and order levels to web page designer and system engineer.

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TOWARD A UNIFIED FRAMEWORK FOR WEB SERVICE TRUSTWORTHINESS

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ABSTRACT

The intrinsic openness of the Service-Oriented Computing vision makes crucial to locate useful services and recognize them as trustworthy. What does it mean that a Web service is trustworthy? How can a software agent evaluate the trustworthiness of a Web service? In this paper we present an ongoing research aiming at providing an answer to these key issues to realize this vision. In particular, starting from an analysis of the weaknesses of current approaches, we discuss the possibility of a unified framework for Web service trustworthiness. The founding principle of our novel framework is that “hard trust” and “soft trust” provisioning techniques should be embodied in a unified hybrid model.

KEYWORDS

Web Service, Service-Oriented Computing, Trustworthiness

1. INTRODUCTION

The Service-Oriented Computing (SOC) paradigm envisions a large, open and dynamic computing environment where anyone can publish his own services, for instance on the Web by using Web services (WS) as fundamental building blocks. SOC is triggering a radical shift to a vision of the Web as a computational fabric where loosely coupled services interact publishing their interfaces inside dedicated repositories, where they can be searched by other services or software agents, retrieved and invoked, always abstracting from the actual implementation. In order to realize this vision, several challenges must still be addressed. In particular, consensus is growing that this “service revolution” will not eventuate until we resolve trust-related issues. Indeed, the intrinsic openness and dynamism of the SOC vision makes crucial to locate useful services and recognize them as trustworthy. What does it mean that a WS is trustworthy? How can a software agent evaluate the trustworthiness of a WS?

This paper presents an ongoing research aiming at answering these key questions through a unified framework for WS trustworthiness. The framework is “unified” because of one of its founding principles: “hard trust” and “soft trust” provisioning techniques should be embodied in a unified hybrid model in order to benefit from both the ideas. The ultimate goal is to enable a software agent to evaluate the trustworthiness of a WS in all the possible scenarios.

The paper is organized as follows. The motivation behind the need of a novel framework is given in Section 2, where current approaches are classified with emphasis on their weaknesses. Starting from these considerations, in Section 3 we discuss what the founding principles of a new rationale should be.

2. TRUST BASED WEB SERVICE PROVISION - STATE OF THE ART

Many studies in literature have tackled the problem of automated trust provisioning. For space limitation, the literature is not fully cited, but just few notable works are mentioned and organized in a rationale-based classification. Interested readers can find the extensive analysis in (Dragoni et al., 2011) and (Miotto, 2011).

Direct Experience (DE): in this class of approaches (Jonker and Treur, 1999), the service consumer trusts a WS because of its good past experience with it. This let the user make up his own evaluation about

the WS usage experience, making the trust score be perfectly fitting his needs. But in an open system like in SOC, where everyone can publish his (even malicious) code, the blind execution of a service can be risky. On the other hand, a paranoid user may unconditionally distrust a service even if it was actually good.

Trusted Third Party (TTP): TTP approaches build the WS evaluation with the help of a third party, be it either a community or a central authority. The main advantage of TTP approaches, as opposed to direct experience based ones, is the chance to obtain a trust score before using a WS, avoiding the blind execution.

- **Social (TTP_{Soc}):** the trust rating of a WS is driven by a community. There exist different sub-categories, on the basis of how the trust score is computed and how the community acts in the system: **reputation** (Xiong and Liu, 2004), **recommendation** (Balabanovic and Shoham, 1997) and **referrals** (Yolum and Singh, 2005) approaches. The key drawback of all these cases is that a poor community would lead to a badly working system, leaving the user in the same vulnerable position as DE approaches. Furthermore, a new service may hardly obtain social consent if no one takes the risk of the first execution.

- **Matchmaker (TTP_M):** a matchmaker is an entity responsible for matching a consumer policy to a service offer. The trust score is then related to the user's needs. The underlying architecture, centralized (Galizia et al., 2007) or distributed (Olmedilla et al., 2004), can determine different pluses and minuses. The former is affected by all the shortcomings of a centralized system. Moreover, consumers and providers have to register to a matchmaker and disclose their policies, far from the SOC vision. Distributed matchmakers allow the providers to keep their sensitive data locally. But the problem is moved to trust an agent. Furthermore, no one knows if the offer will be respected by the provider.

Hybrid (HY): these approaches are based on a combination of well known methodologies. In socio-cognitive approaches (HY_S) (Castelfranchi and Falcone, 1998), the degree of trust is a function of the subjective certainty of the pertinent beliefs. It is based on a multi-agent system, where agents beliefs are built out of DE, reputation, categorization and reasoning. Even though the trust computation is accurate and suitable for the user's own beliefs, the method inherits the known shortcomings of the adopted beliefs. Moreover, agents must conform to a standard model to communicate. Studies such as (Vu et al. 2005) propose trust & reputation methods (HY_{TR}) for assessing the quality of online services by combining constituent techniques in a single integrated framework. But they still suffer of the main limitations of constituent methodologies. Direct experience & reputation (HY_{DR}) models (Ramchurn et al., 2003) combine agent's direct experience and the WS reputation to assess the overall rating. Anyhow, it does not provide a complete solution to the problem.

Automated Trust Negotiation (TN): this class of approaches aims at establishing mutual trust between consumer and provider. Trust is achieved because the access control policy of the requested service is compliant with the access control policy of the service consumer (Koshutanski, 2003). The key limitation of TN approaches is that they are not fully *WS aware*, in the sense that WSs are treated as single services while, in practice, a WS is rather a set of operations that can be accessed only through a suitable conversation. This limits most of the current TN approaches leaving open the question of their applicability to real domains.

3. DISCUSSION

Out of this analysis it is possible to highlight some main issues affecting current approaches for automated trust provisioning in SOC.

- **Unconditional Trust/Distrust (DE):** user constrained to a “take it or leave it” philosophy for some WSs.

- **New WS Ramp-up (TTP_{Soc}, HY_{DR}):** new WSs have a difficult social consent escalation.

- **Community Dependency (TTP_{Soc}, HY_{TR}):** the system works well if the community is big and active. How to bootstrap the community?

- **Centralized (TTP_M, some TTP_{Soc}):** this architecture embodies many drawbacks: central authority can result a single point of failure, great scalability demand may make the system hard to maintain, same result may not be good for everyone, trust is computed in a black box and it may require sensitive data disclosure.

- **New User Ramp-up (some TTP_{Soc}):** the user needs a long interaction with the system in order to be “known” and receive worth suggestions.

- **Hard Setup (TN, HY_S):** approach can be valuable, but difficult to install in the real world, so less incisive.

Soft Trust VS Hard Trust

Along the lines of (Rasmusson and Jansson, 1996), the previous classes of approaches can be narrowed down to two main families: **hard trust**- and **soft trust**-based ones. **Soft trust** is a user's belief of a WS trustworthiness based on the past experience of the user or of a society with the WS. This allows malicious users to be identified and put aside. All the community dependent approaches are based on this notion. However, if someone does not take the risk of a WS first execution, then no one will be able to decide its trustworthiness before the invocation. Techniques based on a **hard notion** of trust, such as TN or TTP_M, do not depend on a "social control philosophy". They derive the trustworthiness of a service from a non-functional contract. Hard trust is then a user's belief of a service trustworthiness based on a guarantee that the service will be trustworthy. Nevertheless, it demands the user to be certain the WS will behave as stated.

In light of this analysis, a new framework addressing the listed issues has been conceived. The new rationale is founded on two principles:

(1) **soft** and **hard** trust based approaches collaboration. As analyzed, hybrid approaches turned to improve the constituent methodologies by mitigating their shortcomings. With hard trust techniques, the user will manage to assess the trustworthiness of a WS by means of a non functional contract, without previous experience. Then, malicious users/WSs bypassing the hard trust mechanisms will be put aside from a community.

(2) definition of **trust** and **trustworthiness**, two terms often interchanged, although they have different meanings. Loosely speaking, trustworthiness implies that something is worthy of being trusted. An informal definition may be: "*A service is trustworthy if there is sufficient credible evidence leading a user to believe that the service will meet a set of given requirements.*" Trust merely implies that one trusts something whether it is trustworthy or not, perhaps because one has no alternative, or because one does not even realize that trustworthiness is necessary, or because of some other reasons. Thus, based on definition, the framework should support 3 concepts: (1) a set of given requirements that the service must meet during its execution, (2) a credible evidence that can be checked by the user to determine WS trustworthiness, (3) a notion of sufficient evidence, i.e. a "quantity of evidence" that a user needs to believe the service trustworthiness.

To support these principles, existing techniques can be merged in a unified framework. **Hard trust** can be achieved adopting TN methodologies specifically addressing Service-Oriented Architectures (SOA) and WS (like the one of (Dragoni et al., 2009)). This will let the consumer negotiate an agreement with the provider that will then be used to **automatically** monitor and assess the experience with the WS. The negotiation assumes, by the way, that the user (or agent) already has an idea about which WSs are better than others to negotiate with (negotiating with all the possible WSs would be rather inefficient). Thus a preliminary ranking and filtering of the whole set of WSs is necessary. To fulfill this, the Evidence Supplier (ES) has been conceived. This entity, querying different sources based on existing methodologies, is in charge of collecting, ranking and filtering WSs based on user's needs. The user can, for example, assign different weights to different sources.

Sources are *reputation*, *QoS matchmaking* and *direct experience*. Reputation meets the **soft trust** need along with the direct experience (obtained by monitoring the agreement during the service usage). QoS matchmaking lets the user set his preferences under the qualitative p.o.v. This, again, is mapped to the **hard trust** notion. The agreement monitoring will provide feedbacks useful to the *reputation* community and to the local tracking of the direct experience.

This way the user can define the *set of requirements* the WS must meet by means of the QoS preferences and the agreement negotiation. The agreement becomes *the credible evidence to check*. *The quantity of evidence* can be set distributing different weights to the sources queried by the ES and specifying different rules in the contract negotiation (further details in the original paper of (Dragoni et al., 2009)).

4. CONCLUSIONS

This approach should overcome quite well the issues listed in the analysis. The user should *always be able to make up his trust belief* by negotiation or by querying the ES. The only situation where the user concerns are not answered is when none of the sources is available and moreover the provider does not have TN support. Nevertheless, the missing social experience with the WS and the provider's neglecting behaviour towards the trust precautions may classify the WS/provider as untrustworthy.

The *new WS ramp-up* issue is mitigated by the possibility of relying on community independent sources that will encourage consumers to try new WSs without anyone's previous experience. Concerning the *community dependency*, as mentioned, a community does not born big and active. The bootstrap is then a critical factor, that in this framework is addressed by the possibility of agreeing on a contract: the interaction between consumer and provider can be **automatically** monitored and verified, and the feedbacks will help the reputation system to become more reliable over the time. This synergistic work among the components can help the whole system achieve a “stable” state faster, making easier to install it and take off.

It is then uncoupled by a *central authority*. This does not mean that central authorities are useless and not considered, but just that the system does not rely only on that and thus is less prone to global failures.

Finally, the user has the freedom to setup his own preferences on many features, making the *score fitting* his needs. Further details on the ongoing research can be found in (Miotto, 2011).

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SUSTAINABILITY AND E-SOCIETY THE CITIZEN'S ONLINE BULLETIN BOARD

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ABSTRACT

In the digital age network technologies enable public administrations to be closer to citizens, establishing profitable modes of interaction and dialogue. Is it achievable for public institutions to facilitate interaction among citizens and educate them to sustainability?

KEYWORDS

Horizontal communication, civic engagement, e-Government

1. INTRODUCTION

Social evolution generates new needs that are often strongly correlated to the territory in which the population lives. Consequently communities are invested with new tasks. It follows that people ask institutions to assume the role of communication facilitators among citizens when it is mediated by network technologies. This would allow them to feel closer to each other, members of a community democratically engaged to reach a sustainable development. It is possible to think about a virtual bulletin board for an ecological market, in which the exchange is regulated by a virtual currency, that could be represented by drops of water. This system combines the value of the object with the need of water that is necessary to produce and trade it. Hoekstra and Chapagain (2008) have shown that visualizing the hidden water use behind products can help understanding the effects of consumption of water resources and can consequently educate to manage better the globe's freshwater. In addition an ecological market could be an opportunity for who wants to help protecting the environment and promoting the culture of reuse. It could be even a form of social solidarity. To public administrations and to local authorities, who are already involved in improving interaction between institutions and citizens through the net, is required a further step towards the community. It seems opportune for institutions to assume the function of facilitators of interaction among citizens. The citizen's online bulletin board was created for this purpose. It is a virtual space offered by the municipality that allows the community to interact facilitating the management of everyday life in their territory. Every citizen becomes an advertiser. He has the ability to publish advertisements offering and requesting services regarding his personal or family needs. Let's imagine a person who goes on holiday and is looking for a dog sitter, preferably close to home. Or a student who wants to give private lessons during summer time or someone who wants to exchange his old bicycle with something else or even someone looking for a collector of comics. We can conceive that needs are many and the list will be categorized in order to facilitate reading and searching.

2. THE CITIZEN'S ONLINE BULLETIN BOARD

2.1 Territoriality

The citizen's online bulletin board is a service offered by the Region Friuli Venezia Giulia to its citizens, in collaboration with municipalities on its territory. It is accessible from the site of each municipality that requests it. In the homepage of the site appears the link "online bulletin board" from which you access a page that lists in the middle column all the ads published in reverse chronological order. There is the possibility to detail the search by selecting the category of ad.

2.2 Certain Identification

The citizen can insert his request/offer from the municipality's site, taking responsibility for what he writes. He is identified through the Card of Regional Services. Please note that this system allows the municipality to provide the service without being responsible for what is published or what may arise as a result of contact between advertisers. Certain identification increases the sense of security and responsibility of citizens.

2.3 Organization of Categories

Categories are organized in accordance with a system of meanings. There are three levels of categorization indicating respectively: 1. type of need (look for / offer) 2. type of service/contact (e.g. ecological exchange or occasional accessory job) 3. sub-categories (e.g.: dog sitting)

The following services have been activated :

Ecological Exchange: The exchange of used goods and services among members of a community could be considered an ecological service if it offers citizens the opportunity to adopt ecological behavior and to assess the environmental impact of goods. This service could be named ecological exchange. It promotes the development of a culture of sustainability and creates occasions to meet and socialize.

The European Union in the Sixth Community Environment Action (Decision 1600/2002/EC) describes the measures that have to be taken concerning sustainable development. As regards waste prevention, it invites institutions and communities to adopt strategies and behaviors that promote reuse and recycle. Objects unused by owners that could become refuse can be used by other community members. Already active in many Italian towns, the ecological exchange service was created to offer citizens the opportunity to exchange unused objects or goods. In accordance with a methodology already established and adopted by some municipalities the exchange is regulated by a virtual currency. It combines the value of the object with the need of water that is necessary to produce it. Three different values will be assigned to goods: 1, 2 or 3 drops of water. They will be the virtual value proposed by the advertiser. Every advertiser has an online card of drops. Who withdraws the object will see his heritage of drops reduced of the proposed value, who delivers it will see the value increased. Every advertiser has three drops as a credit. It is necessary to begin the exchange.

Many Italian towns have already adopted an ecological exchange service, providing a room to accommodate goods and human resources to manage the service. Some municipalities have taken the service online, creating a site where you can see the goods, but the service is always managed by the staff.

The citizen's online bulletin board frees rooms and resources dedicated to the management of the service because the exchange takes place directly in homes or in the places in which the advertisers have decided to meet. They will also have a new and enjoyable opportunity of socialization.

Giveaway: The giveaway service has been activated to allow the members of a community who don't use the ecological exchange service or who have used it, but haven't found a new home for their goods, to offer them as gifts.

Second hand goods on sale: Who prefers to cash its goods can utilize the second hand goods on sale service.

Lost and found: The lost-found service allows citizens who have lost or found something to get in contact with each other, by placing an advertisement in its sub-category (animals, bicycles, bags, keys,

jewelry, sunglasses, wallets, cell phones, etc.). Some Italian municipalities have set up a lost property online service that provides a list of all the objects found and deposited at the town hall. The system, which is activated through the site's bulletin board, allows citizens to act autonomously, without requiring any intervention by the Municipality.

Occasional accessory job: The Enabling Act No 30/2003 introduced in Italy the so-called occasional accessory job. It covers performances of work carried out so infrequently that are not related to contracts of employment because of their features: occasionality and desultoriness. Previously this kind of job wasn't regulated. The above law and subsequent amendments provide the insurance coverage with INAIL and the social security coverage at INPS, which recognizes the occasional accessory job for the purposes of pension rights. In addition to the modality of payment of this job performance, which occurs through the so-called voucher, the legislation identifies providers, those who can play an occasional accessory job, the customers, those employing providers, and the activities connected with this typology of work. The occasional accessory job service activated by the Municipality through the bulletin board is designed to put customers in touch with employment providers through advertisements of work. The subcategories have been identified in reference to the activities that can be considered occasional accessory job: Supplementary tutoring, Domestic work occasional accessory, Babysitting, Dogsitting, Jobs such as gardening, cleaning and maintenance of buildings, roads, parks and monuments, Activities carried out in the stables and riding schools, Delivery door to door and street vending of newspapers and magazines, Sport, fair, cultural or charitable events or emergency or solidarity jobs, More. The service provides an opportunity for citizens to solve problems related to the management of their daily life by using skills that are available in the territory in which they live and of which they are not often aware of. The contact is offered by the Municipality.

2.4 Dating and Attachments

Ads show the publishing date automatically. Every ad remains on the bulletin board for a maximum of two months or for the time indicated by the advertiser. It will be automatically removed when the request is satisfied. It is possible to insert hyperlinks and georeferences in the advertisements and to attach text files, images and videos.

2.5 Contacts

The advertiser can be contacted by the reader of the ad in the following ways: telephone / mobile phone, e-mail, social networks, Contact me: leave your data (the advertiser can remain anonymous asking the reader to provide their own address in a special area. This content will be sent via reserved e-mail to the advertiser). The site offers the opportunity to report abuses and to make suggestions for the creation of new categories and for the implementation of new services.

3. DISCUSSION

As previously mentioned the European Union encourages governments to take actions to promote sustainable development. The adoption of a system for the ecological market could lead to the reduction of waste and could facilitate the absorption of the concept of reuse, helping people to change their behavior to the benefit of the community, creating social growth.

A system for the electronic management of the problem of ecological market gives advantage to municipalities, which must not provide places and human resources to carry out the services but only an electronic management tool, because the work is done downstream from the citizens themselves. However the municipality offers people the security in the exchange through a system of certain identification and the ability to report abuses. It also offers the opportunity to make suggestions in order to improve the service. You might think that a system of this type, which creates contacts between members of a community, allows municipalities to become facilitators of communication among citizens.

Since the digital divide has not yet been completely overcome in the territory in which this service is activated, access to the system is precluded to those who have little experience with technology or who have an attitude of complete rejection. By 2013, the optical fiber will be stretched over the whole territory of the

Friuli Venezia Giulia Region. In addition, to increase the skills of the citizens, the Region finances basic computer courses. With regard to the attitudes of rejection towards the use of technology, we may assume that the interest in the use of the offered services and its playful modality (think of the system of water drops as a virtual currency) can produce feelings of acceptance and later attitudes of familiarity in the use of technology. These positive feelings/attitudes could improve the dialogue mediated by network technology between citizens and public administration and could promote a more fruitful cooperation also in other areas.

As for the occasional accessory job service, the online bulletin board system offers citizens a quick and efficient contact between customers and suppliers, as well as the possibility to identify and request new work that arises in the territory. The latter can be regulated and included in the voucher system. INPS also has the possibility to advertise this system through the bulletin board and find a way to control the use of vouchers.

The analysis of data from the bulletin board will permit to answer the research question, offering the possibility to verify if and how the service is used. It will provide answers on the characteristics of citizens who use the service, for example, to which age groups they belong. It will be possible to detect which categories contain more ads and which are the most requested services, also in reference to the territory that has expressed them. Since the advertiser can make suggestions on the inclusion of new categories or services, it seems possible to mention the co-design of public services.

One might venture that municipalities by providing citizen's online bulletin board, can contribute to educate citizens to sustainability. In fact this system leads citizens to a positive approach, encouraging the reuse of goods and the better management of fresh water, thanks to the understanding of the value of the latter in reference to goods. The adoption of such virtuous behavior through this tool could be fun and create moments of entertainment and collaboration among the citizens by creating feelings of serenity.

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E-DONORS CONSULTING SYSTEM TO SATISFY THE SERIOUS HEALTH REQUIREMENTS OF PEOPLE WHO STRUGGLE WITH POVERTY IN SRI LANKA

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ABSTRACT

This paper investigate the financial disability of middle class people and the poor community in overcoming from the serious health issues in Sri Lanka. As a developing country Sri Lanka has serious anomaly in resource sharing among population with regards to Health requirements. This paper discuss about the urgent need of finance for middle class people and the poor community and the constraints they have in getting the supplement of finance and also the current methods they use to acquire finance to satisfy their serious health requirements. Also this paper intends to propose a web based solution to reduce the anomaly of resource sharing, specifically the finance. The proposing solution will have a common forum to meet the middle class people and poor community with the donors who are willing to make financial assistance, specifically to satisfy the serious health requirements of middle class people and poor community.

KEYWORDS

E-Donors, Donor consultation, e-Health, Health Donation

1. INTRODUCTION

The main area of this investigation will base with the issue of “Health Standard of Sri Lanka”. As a third world developing country Sri Lanka faces numerous issues with respect to the health sector. Poor facilities & low quality of health standards have made the inhabitants of the country to risk its citizen’s lives for living. Abnormality of jeans, bad health habits, continues working environments without work life balance, and road accidents are most commonly identified reasons which people get entangled more into the health sector & seek more services & assistance beyond their capacity.

In general, the income generation of the middle class is very minimal. By the Human Development Report 2010, it is evident that they are in the marginal level of satisfying their basic needs. In such a scenario, health is an additional burden to them. In case of an emergency health requirement, they will obviously face financial difficulties which would make them mentally dejected.

On the other hand it is worst when it comes to the poor community. The poor community is financially impotent. Fulfillments of their basic requirements are even below the required level. Therefore it is obvious, that it is a critical issue when they fallen into a serious illness. Therefore, more prominently the solution domain of this research will target the poor community as well as the middle class people of Sri Lanka. ICT can play a major role to assist these two communities to uplift their financial confidence to overcome the Health hassles.

2. UNIQUENESS OF THE RESEARCH

When the middleclass people and poor community needs assistance for their health problems, nowadays there are several solutions to fill the need of health consultation. As an example, they can admit to public hospitals to get treatments and also they have opening to e-health facilities to get treatments without

travelling from one location to another. But this study attempts to analyze the financial constraints with respect to fulfilling their serious health requirements.

3. EXISTING SOLUTIONS FOR THE ISSUE

This paper focuses on how to assist poor community and middle class people to eliminate their life risks due to health issues. As per the preliminary study, people use alternative methods to get financial assistance to cure diseases. Following points are the most commonly used methods to gain financial assistance for health issues.

- i. Request donations from presidential fund of Sri Lanka
- ii. News paper articles publish incidents, relating to parents struggling with their child or children who suffer with cancer, Thalassaemia and etc.
- iii. Public verbal announcements to gain help.
- iv. People appearing at public places with basic medical evidence and ask for financial help to recover.

However, in addition to the above methods, globally there are many donation distribution systems. But they are not significantly assist in curing illnesses. They are mainly focused to donate food, blood, stationery, houses, other equipments and etc.

4. CURRENT SITUATION

The modes this paper introduces in the section 3 are not 100% successful and not even 50%. The main reason for that is middle class people and poor community fail to prove their factual requirement to get the attention from the donors. And also the evidence they provide is not strong enough to prove the illness, that illness is a true one but not pretended. Therefore, there is a need of proving the medical evidence and these should bring to the donor community in a trust worthy manner. And also it is a must to allow the Donors to seek about the needy people and their background in an easy but standardized way.

The main Literature of this paper tries to ensure an honest and trust worthy method to populate about needy people and to provide a secure way of supporting them financially by the people who are willing to support. The ultimate intention is to bridge the gap between people who struggle with serious Health issues due to financial inability and the Donors who are willing to contribute finance to neutralize the situation by a new compassionate environment.

5. THE RESEARCH METHODOLOGY

This research consists with various aspects which covers all type of stakeholders of this solution. Quantitative and Qualitative aspects as majorly plays an important role and also the Humanitarian aspects affiliates with both Quantitative and Qualitative aspects in a considerable way. Increasing the donation capacity according to the seriousness of the illness, Increase the number of needy people to accommodate with donations, increasing the number of donors, are some of quantitative aspects to be covered and also as qualitative aspects protecting the privacy of patients, confirming the truthfulness of the illness, confirming the truthfulness of the donation & etc are to be covered. Exploratory research was selected as the best suited type of doing this research to identify the problem clearly before moving to the implementation of the aimed solution. Exploratory research method will deepen the comprehension about the matter that the research is trying to address.

6. THE PROPOSED SOLUTION

As the resource sharing for health requirements of Sri Lanka in a poor and unequal level the proposing solution must be done in a step by step manner. Because various problems are there to solve in order to

facilitate the middle class people and the poor community in a highly satisfied way. When the technology is used to fulfill a humanitarian aspect it is more crucial because every thing is intertwined with human feelings. Satisfying the need without disturbing the sensitive feelings of the needy people is one of utmost objective of the proposed solution. The proposed solution is a Web application which builds a forum to meet the patients and the Donors within a secure and trust worthy environment. Following facilities will accompany by the proposed solution,

- i. Request to have donations
- ii. Enter True details of the patient in to the system
- iii. Request to offer donations
- iv. Submit patient details to the Bank
- v. Verifying patient details by the Bank
- vi. Verify the status of each patients donation
- vii. Handover the Donation from the Bank to the Hospital

The proposed solution will involve various stakeholders such as patients from middleclass and poor community, Donors, Patient administration Officers, Administrator as the key authority at Ministry of Health, Authorized person from the Bank.

Proposed solution must have a patient administration officer to key in the truth details and true medical reports in to the system. And it will give an opportunity for the Donors to get to know about the basic details of the patients with a confident mind about the truthfulness of the illness. An authorized bank partner must have a record of each registered patient and must track on the donations which offer by the donors with respect to each patient. When the status of the donation is in a satisfactory level according to a patient requirement bank will precede the donation to the respective hospital authority.

6.1 Issues of the Proposed Solution

Publishing patient details at a web presence is not a simple task as any other thing. So it is much considerable to certify these details by a well recognized authority and release to the web for donor reference. Therefore the Director of the Hospital has been identified as the most suitable authority for this as that role is a compulsory one at any government hospital.

And also publishing patients medical history and some of personal details is another crucial thing to be consider because it directly fallen under the privacy of the respective patient.

Prioritizing the illness is another key concern of this content. It is proposed through the paper to have an option to search on illnesses, based on the choice of the donor as by age, by region and by illness.

As the proposal the donation handling done by the bank partners and they see the exact fluctuation of donations regularly. There is a concern of situations where if the donation level of a particular patient has exceeded what is the option available to manage the overflow. In such a situation bank may decide to transfer the overflow to another seriously ill patient who needs to do an immediate operation.

The other key concern of this is to whom the high level authority power should be given. This paper suggests the ultimate authority should be given to the Health Ministry and as a focal point, ministry handles all functions and all important matters arise on the system.

Finally getting people attraction and making people to use it is another key concern with the proposed strategy.

It is too vital to consider these matters which should analyze further more in a next level of the research.

6.2 Benefits of the Proposed Solution

A patient as the beneficiary – The main beneficiary of this solution is the patients from middle class and poor community. By this system patients may have the opportunity to acquire donations in a reliable ways. Patients do not need to suffer by seeking assistance in public. They will have an opportunity to justify their illness by safeguarding their privacy.

Donors as the beneficiary – Donor community may provide with a well standard and authorized environment to offer donations according to their interest i.e. according to any illness they would like to contribute to recover. It will offer them a secured environment to contribute without any hazards. .

Government as the beneficiary – The ultimate beneficiary of the solution will be the central government, because when the financial assistance is smooth to cure the serious health issues, the health standard among the population may become high.

7. CONCLUSION

In a globalized arena people get connected with each other via technology. Humans must be hand in hand to give courage and motivation to helpless and hopeless people who do not see a future tomorrow. As this paper implies it is a timely requirement to give an aid to the needy people to cure their serious illness and remove the sufferance of their lives. The proposing e-Donor System through this paper presents this opportunity to the whole human community to experience it physically in an automated manner. This is the best evidence and it clearly substantiate that technology is an important tool that a society can use to serve the entire human community. It proves that technology can be used for human friendly services rather than simply giving entertainment to the people.

The proposed solution can clearly show that it is the best option to remove the gulf and bridge the gap between the donors and the needy people from middle class and the poor community and to normalize the anomaly of the donation distribution. This paper highlights that the proposed strategy will ultimately reduce the uncertainty of peoples lives due to bad illnesses and build a hope on them about a bright future without any health hassles.

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POLICY SIMULATION AND E-GOVERNANCE

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ABSTRACT

The paper describes the Future Policy Modelling Project FUPOL (www.fupol.eu), an Integrated Program (IP) selected under objective 5.6. ICT solutions for governance and policy modelling in the 7th call of the FP7 program. (ICT for Health, Ageing Well, Inclusion and Governance). The project duration is four years (October 2011 – October 2015).

It proposes a comprehensive new governance model to support the design of complex policies and their implementation, which is described in this paper. The proposed policy design and implementation model has a specific focus on the use of agent based simulations in the deliberative process of urban policies.

The project has currently limited its scope on urban policies, however the approach itself is generic and can be applied to the lifecycle of any policy.

KEYWORDS

E-governance, policy modelling, E-participation, agent based modelling, social media analysis, urban policy

1. INTRODUCTION

In 2010 the Major Cities of Europe Association (MCE) conducted a study on the "Citizen Web Empowerment in a network of European Municipalities: "value for citizens" in Web 2.0 projects [L.Buccoliero, 2010]. It studies the growing demand of citizen empowerment and benchmarks the degree of citizen empowerment across the network of European municipalities in four areas e-information, Web 2.0, e-consultation and e-decision. The major outcome is that e-information is sufficiently addressed, while Web 2.0, e-consultation and e-decision is not developed yet. Likewise the European Commission has conducted several studies and added a specific action to developed advanced ICT tools for policy modelling, prediction of policy impacts, development of new governance models and collaborative solving of complex societal problems. [EC Workprogram 2011]

Based on the above the FUPOL consortium has elaborated a comprehensive approach to further advance the research and development in simulation, urban policy process modelling, semantic analysis, visualization and integration of those technologies. The approach developed seeks the active involvement of all stakeholders including policy makers, civil servants, citizens and companies in the urban policy making process. The proposal has been funded under the 7th framework program of the European Commission and will be implemented 2011 – 2015.

The FUPOL consortium consists of 17 partners from Europe and China. It has a good balance of research partners, IT-industry, local governments and political cluster organizations capable to ensure wide-spread dissemination and exploitation.

The current political focus is urban e-governance, which is deemed important on a worldwide scale since the majority of the world's population is living in urban areas. In Europe currently more than 79 % of the population are urbanized and it is expected that it will further increase and reach 85 % by 2030.

2. FUPOL GOVERNANCE MODEL

The FUPOL governance model (see Figure 1) is based on the integration of the following major components:

2.1 Automatic "Hot Topic" Sensing

The political blogosphere is searched to find-out current "hot" political topics within a predefined scope (regional, national, EU) and weigh them according in a subsequent analysis. The information is harvested with a web-crawler, which starts with a list of predefined URLs to visit (seeds). As the crawler visits these URLs, it identifies all the hyperlinks in the page and adds them to the list of URLs to visit, called the crawl frontier. URLs from the frontier are recursively visited according to a set of policies. "Hot" political topics are extracted from the raw text data and clustered. A key feature is that the analysis will be based upon latent Dirichlet allocation (LDA), [Blei, 2003] and therefore relatively language independent to take into account cross border and European context.



Figure 1. FUPOL Governance Model

2.2 Deliberation and Stakeholder Involvement

After a "hot" political topic has been identified a deliberation on a possible new policy is initiated using multichannel social computing. This refers to an environment in which the various social Web 2.0 channels are integrated into a single social computing environment in order to reduce the workload of continuous interaction with large number of people.

The contributions are aggregated and summarized by the FUPOL software.

This data aggregation step is crucial for e-governance since it expresses the voice of the citizen. A feature called "opinion summarization" aims at giving the overall sentiment of a large number of opinion resources at various granularities.

The presentation and visualization is still to a large extent unexplored and a new research field. Results of the opinion extraction as well as the underlying raw data will be classified and linked with the topic, so users can drill down at any time to see the single stakeholder opinion. Likewise they will be linked with related results of a classical survey (if available).

During the policy lifecycle, the e-citizen feedback is crucial, but cannot be reduced to a single voting system where policymakers propose scenarios and users give their preferences in an online system. The FUPOL vision is to enable the e-citizen to participate to the policy management from the beginning (proposing ideas) to the end (giving feedback about the success or the failure of the policy). Since it is difficult to give a formal language in which ideas and feedback should be sent, we allow opinions to be expressed in free text (i.e. in natural language), possibly enhanced with a voting scheme to identify interesting content through crowd-sourcing. This type of system is called an Idea Management System (IMS) and is currently an active research area in Computer-Human Interaction.

2.3 Scenario and Simulation

The deliberation loop contains a component to simulate the potential impact of a new policy. The result of the simulation is visualized and provided as a feedback to stakeholder. The scenarios and their potential impact over a timeline are simulated using available data and eventually data from other public administration obtained through data import facilities. For this purpose the integrated toolbox will also contain a repository, where public data from other governments can be found for certain policy domains as well as an input facility to retrieve those following the W3C recommendations on "Publishing Open Government Data". The methodology of simulation allows an organization to analyse the behaviour of complex systems in a flexible and detailed manner, and often in real-time. Simulation also allows for a quick implementation of adjustments in the modelled policy system, making it possible to analyse different alternative solutions in a relatively short time. It is intended to use agent based simulation (ABM) as the method of choice for the simulation component. It is therefore discussed in more detail in the following chapter.

3. AGENT BASED SIMULATION IN THE FUPOL GOVERNANCE MODEL

3.1 Definition

Agent-based modelling is a type of simulation, which allows a researcher to create, analyze, and experiment with agents that interact within an environment. Agents are typically components of the software representing social actors such as people of a certain group, political parties, companies or governments.

They interact in an environment in various ways and it is exactly this feature, which makes agent-based modelling very suitable for political and social processes. It means that agents can transfer information to each other and their future behaviour is based on this information. Transfer of information is understood in a broad sense and encompasses for example a message or observing the behaviour of other agents.

3.2 Advantages

In classical science the impact of changes on a system is explored with experiments. An experiment is defined as applying some treatment to an isolated system and observing the impact. The isolated system is compared with another system without or with another treatment. In social and political sciences, conducting experiments is normally impossible or undesirable. The reasons are as follows:

- a) creating two isolated systems is typically very difficult or impossible
- b) treating one system while not treating the control is often ethically undesirable.

Therefore classical experiments in political and social science are rare. Agent based modelling offers a convenient way out since the ethical problems of experimentation are not present. Moreover the experiment can be repeated many times to achieve optimized results.

3.3 Implementation

The simulation model is implemented as a software program. A well-known computer game which comes close to agent based simulation is “SIMS”. The agents and interactions in the simulation model program itself represents the processes that are thought to exist in the real social world [Macy & Willer, 2002]. It means the agents must be programmed with rules to react in the simulation environment as in the real world. Typically it is not a challenge to program the agents, the real challenge is to determine the rules and their properties. The environment in which the agents interact can be more or less neutral (e.g. a lattice) or it can have specific properties itself. It is expected that in FUPOL the environment should be spatially explicit, which means it should represent the geographical space in a GIS based format. The reason is that such an environment representation comes closer to reality of the urban challenges to be simulated.

3.4 Challenges

It is not sure, whether agent based simulation alone will be sufficient to model reality. It might be necessary to use different simulation technologies and mostly non-compatible set of simulation tools [Gilbert and Troitzsch, 2006]. Moreover most of the platforms cannot be used for policy decision makers due to complexity, heavy architecture and special knowledge on programming and mathematics.

In order to solve the shortcomings above the FUPOL consortium intends to elaborate a new policy simulator (see Figure 2) and to design a pilot solution of an integrated software environment. It will be accessible for the persons without specific knowledge in programming. This architecture will allow the integration of several simulation types, if required.

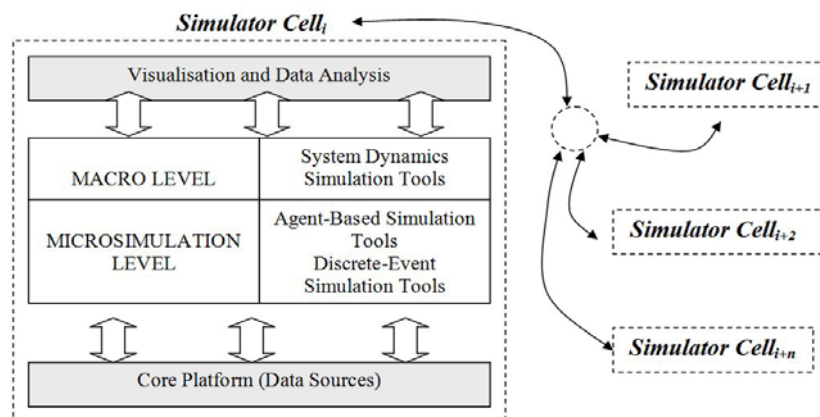


Figure 2. FUPOL simulator cell architecture

4. CONCLUSION

The FUPOL project proposes a comprehensive new e-governance model to support the whole policy design and implementation lifecycle, which is based on Web 2.0 technologies and simulation techniques. The advantages of the proposed model is that it will provide a better and more comprehensive understanding of citizen needs and as well as better forecasting to understand future trends. The use of agent based modelling to simulate policies offers a convenient way to experiment with policy alternatives.

A possible limitation is that some of the real policies to be modelled are found too complex for computer simulation, insufficient to model reality or difficult to calibrate.

Currently the governance model and simulation will be tested in cities with urban policies. The future application of the model and its ICT components can be further expanded to national and regional policy issues.

Research results will be published on the FUPOL website (www.fupol.eu) from June 2012 onwards.

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Posters

COMMUNITY WIRELESS NETWORK DEVELOPMENT IN BOGOTÁ-COLOMBIA

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ABSTRACT

The present paper illustrates the process of fully deploying a wireless network for the local community at Ciudad Bolívar (Bolívarwireless), an outer-city area with the highest poverty levels in Bogotá (Colombia). This paper shows implementation procedures and design stages for the nodes of the community wireless network. A mesh-based network topology and various Information and Communication Technologies (ICT) applications are employed. These applications are currently being used by the local community due to the service coverage now provided by the community wireless nodes. The performance of the nodes is evaluated and recommendations are provided. Conclusions are drawn in the final part of the paper.

KEYWORDS

Information and Communications Technology, Community wireless network, Mesh topology.

1. INTRODUCTION

The use of ICT is no longer associated with technological curiosity but with essential tools that help to build a nation's development. This reflection is founded on a report issued by the United Nations that shows a strong correlation between poverty and the number of ICT users in different countries (United Nations Conference on Trade and Development, 2010). Then it can be deduced that the coexistence of generalized poverty and ICT unequal access poses a major threat to social and economic development as well as to prosperity and stability of a nation. In this context, having a communications infrastructure is of vital importance in providing people with connectivity through ICT applications so as to satisfy some of their basic needs.

Because communications (immediate) future appears to be wireless, wireless solutions represent an alternative to democratize the access to communication services, reducing barriers and providing diversity, quality and affordable prices to users. Hence, Wireless Mesh Networks (WMNs) appear as one of the key technologies that will prevail over other wireless networks in the next decade (Pedraza, 2009). This will make dreams come true regarding long-lasting, simple, low-cost connections anywhere at any time. Consequently, this kind of networks will play a key role in the development of Internet's next generation. Functionalities such as self-organization will significantly reduce network implementation complexity as well as network maintenance; therefore, this networking concept requires minimal initial investment (Akyildiz & Wang, 2009), which is highly important in low-income communities like Ciudad Bolívar and some of the community wireless network projects (Abdelaal & Ali, 2009), (Ishmael, Bury, Dimitrios & Race, 2008), (Flickenger, Fonda, Forster, Howard & Krag, et al, 2008) and (Elianos, Plakia, Frangoudis & Polyzos, et al., 2009).

2. COMMUNITY WIRELESS NETWORK AT CIUDAD BOLÍVAR

This section presents all factors involved when designing and implementing the wireless community network. Some of the factors include *Bolivarwireless* coverage estimations, wireless-nodes structure, a web site, applications development, and community training to make good use of the network resources.

2.1 Community Wireless Network Design

In order to calculate the coverage of both the uplinks and downlinks of every node, the following expressions were applied:

$$P_{rx}|_{dBm} = P_{tx}|_{dBm} + G_t|_{dBi} - L_p|_{dB} - MD|_{dB} \quad (1)$$

Where:

P_{rx} = reception power, P_{tx} = transmission power, G_t = link total gain, L_p = link total loss, MD = design margin.

From equation (1), and considering that average reception power should exceed router sensitivity, -97 dBm at the lowest connection speed in this particular case (1 Mbps), table 1 shows the minimum average reception power guaranteed within each node's maximum coverage and the maximum number of users that might be served by each node under the worst conditions.

Table 1. Minimum average reception power and maximum number of average users for each node.

| Node | Node Name | Minimum P_{Rx} (dBm) | Approximate Users Number |
|------|------------------------|------------------------|--------------------------|
| 1 | Los Alpes | -60.21 | 13 |
| 2 | Barrio Bella Flor | -64.47 | 9 |
| 3 | Ispa Potosí | -76.59 | 11 |
| 4 | Barrio La Estrella | -73.12 | 10 |
| 5 | Jerusalén Canteras | -61.34 | 13 |
| 6 | Ispa Jerusalén | -74.89 | 12 |
| 7 | Fundación Bella Flor | -65.09 | 10 |
| 8 | Taller de Mis Sueños | -60.13 | 11 |
| 9 | Arborizadora Baja | -72.65 | 13 |
| 10 | Paraíso Mirador sede A | -57.26 | 13 |
| 11 | Paraíso Mirador sede B | -70.67 | 9 |

2.2 Description of the Nodes Implemented in the Community Wireless Network at Ciudad Bolívar

Figure 3 shows one of the nodes implemented to provide coverage to the community at Ciudad Bolívar through *Bolivarwireless*. The components involved in the external implementation of the wireless nodes are basically the following:

- Nanostation 2 *Access point*.
- Omnidirectional antenna with 15 dBi gain.
- Electrical discharge protector.
- *Pigtail* cable to connect the *access point* to the omnidirectional antenna.
- Pole.

Nodes, like the one shown above (Fig. 3), had a captive portal previously developed and installed. The node's firmware also had the routing protocol called B.A.T.M.A.N (Murray, Dixon & Koziniec, 2010) installed.



Figure 3. A Bolivarwireless implemented node.

3. CONCLUSIONS

- A free-access wireless network was successfully deployed in the locality of Bogotá called Ciudad Bolívar. The network offers different services that facilitate information access to all inhabitants of the surrounding area through ICT applications. Similarly, by working with non-profit and public organizations it was possible to promote wireless connectivity at Ciudad Bolívar in order to serve the community.

- Home-made antennas at the location of the community wireless-network users allowed wider network coverage, up to 40% wider.

- It is necessary that non-profit organizations such as Universidad Distrital continue to lead this kind of social initiatives that allow massive network access throughout the entire locality since the nodes implemented in the present work represent only the starting point and, most importantly, set an example to other institutions that may contribute to reduce the so called “digital divide” in this locality.

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IMAGE OF THE WEEK

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ABSTRACT

The need for additional education in the Field of Radiology and Diagnostic Imaging has become quite evident in the Medical Graduate Course, at the Federal University of Minas Gerais (UFMG), in Belo Horizonte, Brazil. Many graduates do not feel secure interpreting ordinary examinations and are not used to more advance imaging techniques. We decided to create an interactive, case-based, online educational complement, which we called the “Image of the Week Project”. We utilized the Problem Based Learning teaching model and e-Learning methods. It consists of a page on the University’s Faculty of Medicine website where, every Monday, we post a new case report with an image, a brief description and a multiple choice question with 4 options. The visitor who answers the question correctly gains access to the case discussion, with more information about the disease being presented. From January 1st to December 1st, 2011, the site received 44,039 visits, mostly from medical students and physicians, who in turn use it for Continuing Medical Education. The “Best Case of the Quarter” is being published in the Medical Journal of Minas Gerais. The project has introduced the possibility for further changes to the manner in which radiology and diagnostic imaging are taught and presented, in the curriculum of our graduate medical course.

KEYWORDS

Teaching, teaching materials, problem-based learning, diagnostic imaging, scientific communication and diffusion.

1. INTRODUCTION

The graduate medical course at the Federal University of Minas Gerais – UFMG, in Belo Horizonte, Brazil, has been through some changes in recent years and has become more interdisciplinary and oriented towards theory and practice association. However, our current radiology course is still mainly based on traditional teaching methods.

Furthermore, the need for additional education in the field of diagnostic imaging in our curriculum is evident. Many graduates do not feel secure interpreting ordinary examinations like chest or abdominal radiographs and are not used to more advance imaging techniques, such as magnetic resonance imaging or scintigraphy (Cremesp, 2011).

The PBL (Problem Based Learning) teaching model is being adopted at many Universities, particularly by medical courses (Hoffman, 2006; Macallan, 2009). It originated at McMaster University in Hamilton, Ontario, Canada, in 1969, and is based on the educational theories of Vygotsky, Dewey and others (Norman, 2008). Its main objectives consist of self-directed learning, problem solving and team work. The use of this method in medicine is very appealing because it stimulates the student's clinical interpretation, critical thinking and autonomy in his/her studies - a skill set which is essential to any good medical professional.

Electronic learning or “e-Learning”, refers to the provision of education and training on the Internet. Different experiences around the world have shown that e-Learning methods are of great value in complementing the teaching of radiology and medicine, as a whole (Jurasszovich, 2000; Zajacsek, 2006; Ketelsen, 2009). The Internet offers numerous advantages compared with other mass media: it provides access to a large amount of information previously known only to individual specialists; it is flexible, permitting the use of images or video; content can be accessed from different locations; and it allows for linking to Web sites on a specific subject, thus contributing to a greater expansion of knowledge (Pinto, 2008).

Several journals make use of e-Learning strategies and feature interactive clinical cases on their websites (e.g. Image Challenge - New England Journal of Medicine, 2011). These pages present real clinical cases, whether associated with images or not, and challenge the visitor to make the diagnosis.

2. OBJECTIVE

Our objective was to develop an educational complement to our current radiology and diagnostic imaging course that would be interactive, online and case-based, while making use of the PBL method and e-Learning resources. This complement would be open to the public, available to any of the medical graduate course students, as well as interns, residents, professors, students of other Universities and anyone else interested in using it. The cases presented would be derived from our University Hospital and Ambulatories, and would therefore represent the epidemiological context that our students deal with on a daily basis while also reflecting the diagnostic resources available.

3. METHODS

The project consists of a page on the UFMG Faculty of Medicine website: www.medicina.ufmg.br/imagendasemana. Every Monday, a new case report is published containing an image (e.g. radiography, tomography, scintigraphy), with a small case description and a multiple choice question with four answers.

The visitor marks the answer he/she thinks is correct and then clicks on the button "Check answer". The alternative selected is saved to the site's database. The percentage of visitors who select each option is then shown next to the alternatives. If the visitor selects the wrong answer, he/she must choose another option.

When answering correctly, the visitor gains access to the case discussion (which was hidden before), with a brief theoretical review of the matter being presented.

Each of the four alternatives is discussed separately. The image is analyzed and there is a brief discussion of the case. More information about the imaging technique is also shown and the "relevant aspects" are listed at the end, that is, items containing the essential information that the visitor should retain from that case.

Also listed are references and suggested reading from books, websites, articles or other relevant materials on the subject. The visitor can post comments or questions at the end of each page and may also access prior cases through a page listing everything previously published. There is also a possibility to filter these cases based on the diagnosis or imaging technique used.

Currently, most of the cases are being written by graduate students from our University who are participating in the project as volunteers. They actively seek out cases and images with the help of colleagues, interns, residents and professors. Each case has a professor of medicine as a supervisor and the text goes through several revisions before being published. Visitors to the web site also send a few cases.

4. RESULTS

In order to track the number of visitors, and other relevant data regarding site traffic, we use Google Analytics®. From January 1st to December 1st of 2011 the site received 44,039 visits. The rate of visitors has increased steadily. In February, the site was visited 3,014 times, whereas by November this number had increased to 5,260. During this period, 54% of the visits came from Belo Horizonte, with the remainder from other parts of Brazil (42%) and the world (4%). Half of the visitors entered the site directly (by typing the address or through a "favorite") and the rest through an Internet search or via a link on another site. Each visitor viewed about 3.16 pages and spent about 2:20 minutes on the site.

In August 2011, we performed an online survey in order to better understand the profile of our visitors. The survey consisted of an online form that popped up during the visit. The filling out of the form was optional. We received a total of 273 responses: 53% from medical students and interns, 25% from physicians, 5% from residents, 7% from university professors and 20% from others.

About 80% of the visitors accessed the site weekly, or three times a month, and about 70% accessed it over ten times. Two thirds informed that they always or usually read the case discussion after answering the question. Half of the visitors rated case difficulty as medium, and one third, as difficult.

Analysis of the data showed that at least one third of our visitors are qualified physicians who use the site as a resource for continuing medical education (CME). This was unexpected at first, but perceived as very positive, since evidence suggests that CME seems to be effective in the acquisition and retention of knowledge, attitudes, skills and behavior, as well as enhancing clinical outcomes (Marinopoulos, 2007).

A partnership with the Medical Journal of Minas Gerais was established earlier this year. In each quarterly edition, we publish the "Best Case of the Quarter", which has served as an incentive to the students who send in their cases.

5. CONCLUSION

The 'Image of the Week Project' has been very well received in the academic community. The site is regularly accessed by medical graduates, residents, physicians, professors and the general public. We suspect that part of this success derives from the fact that the pages are published in Portuguese and that they reflect the cases and diagnostic resources we deal with on a daily basis.

Only a few visitors, however, send their cases to be published and we are still seeking strategies to encourage more participation. Fortunately, the project currently has nine medical students from different years on the medical course who are responsible for obtaining and preparing the cases. The students have shown significant improvement in their theoretical knowledge and practical skills, as well as in their research, writing and synthesis abilities.

The creation of the 'Image of the Week Project' is only the first step towards the enhancement of teaching on our radiology and diagnostic imaging course. Though it is being well received, further evaluation of the actual benefits from the students' perspective will be necessary to bring about more profound changes to the course itself.

Nevertheless, we believe that developing and publishing quality, free and scientifically-proven interactive medical cases that associate theory and practice, and which also challenge the reader's clinical interpretation and thinking, represents a great advance towards the democratization of knowledge and optimization of medical teaching.

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INTEROPERABLE FRAMEWORK FOR SMART CARD-BASED AUTHENTICATION OF FIRST RESPONDERS

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ABSTRACT

The goal of this paper is to analyze the complexity of the authentication protocol that includes the use of smart tokens for authenticating first responders at disaster incident sites. The findings are then used to develop a standards-based interoperable framework that will facilitate performing authentication using a combination of identifiers, attribute and deployment authorization information.

KEYWORDS

First Responders, Authentication Protocol, XML Schema, SAML, Identifier, Attributes

1. INTRODUCTION

First Responders or Emergency Response officials (ERO) are a critical human resource for performing emergency operations (e.g., search, rescue, first aid etc) in both natural and human-inflicted emergency incidents or disasters. However in order to ensure that the services rendered by them are effective, safe and well-coordinated, it is necessary that there should be a reliable process in place for authentication of EROs and for subsequent authorization for appropriate activities. Although technologies such as Smart Cards or Smart identity tokens [1] are available for reliable authentication, the set of credentials that are needed for EROs should not only include a unique identifier but a combination of: (a) Identifiers (IDs), (b) Attributes (A) and (C) Deployment Authorizations (DAZ) [2]. This combination is needed due to the fact that (a) the ERO at an incident site may hail from different jurisdictions, (b) their qualifications, certifications and licenses must be assessed for performing some key services involving human lives and (c) their presence at the site should carry the stamp of authorization such as invitation from incident commander or a permanent mutual aid agreement. The objectives of this short paper are the following:

- Analyze the complexity of the authentication protocol involving authentication of First Responders
- The need for an interoperable framework for reliable authentication of first responders when disaster incidents involve first responders from multiple jurisdictions
- The role standards can play in the realization of such an interoperable authentication framework

2. AUTHENTICATION PROTOCOL FOR FIRST RESPONDERS

Before we proceed to analyze the complexity of authentication protocols for authenticating EROs, we have to look at examples of 3 categories of credentials mentioned in the last paragraph:

- The Identity information may contain beside his/her full name, a pseudonym consisting of a large number or a combination of letters and numbers. The verification of identity information is critical for unambiguously identifying a person.
- The Attribute information can be of several types: It may (a) convey authority, for example reliably establishing that a specific person is a law-enforcement official or (b) convey a functional capability - a medical physician or (c) convey certification such as a pilot. The attribute information plays a very important role in the authentication of a first responder as it involves capability, expertise

(competence) and authority to perform a specific function at the disaster site – such as making an arrest, administer medical treatment or fly a rotary aircraft to evacuate victims.

- The verification of deployment authorization is critical, as deployment of authorized persons is essential for ensuring effectiveness of disaster relief mission, for command and control assignments as well as for accountability and attribution.

The complexity of the authentication protocol involving the 3 types of above credentials is revealed by looking at some of the elements of authentication use cases as follows:

- Authenticating using Identity Information on the Smart Card: If a X.509 public key certificate is used as an Identifier, then authentication of identity involves a challenge-response protocol in addition to certificate path validation. If a biometric data is used as an Identifier, then the protocol involves collecting a live biometric sample, processing it and comparing it with the stored biometric on the smart card.
- Authentication using Attribute Information: Authentication of attributes of EROs conveying authority or capability have to be performed by accessing the remote Attribute Data Repository either maintained by the organization that issued the credential to the ERO or by an independent Attribute Authority.
- Authentication using Deployment Authorization: Verification of deployment authorization may again involve access to a designated URL containing either: (a) an incident-specific invitation by the incident commander or (b) a previously executed mutual aid agreement with the jurisdiction from which the ERO hails from.

3. INTEROPERABLE FRAMEWORK FOR AUTHENTICATION

When an authentication station at a disaster incident site wants to retrieve an attribute pertaining to a first responder, it has to communicate with an attribute repository maintained by the Jurisdiction (e.g., county) that issued the credential to the first responder or by the agency that is in charge of emergency services for that state. For this exchange to take place between any authentication station and any attribute repository, the following requirements must be in place: (a) A common messaging protocol for Sending the “Attribute Query” and a common messaging protocol for “Attribute Query Response”, (b) A common platform-neutral encoding of the contents of the “Attribute Query” and “Attribute Query Response” and (c) A common platform-neutral data structure for storing the Attribute information in the Attribute Repository or the ability to support the common platform-neutral messaging protocol for retrieving information irrespective of the native format used for representation of the data in the Attribute repository.

4. ROLE OF STANDARDS IN AN INTEROPERABLE FRAMEWORK

In this section, we describe how we have leveraged several standards for designing an interoperable framework for authentication of first responders at disaster incident sites. For identification tokens we have used the standard ISO 7816 Smart card carrying the standard X.509 V3 public key certificate as identifier. As far as Data Structure for Representation of Attributes is concerned, we designed two types of XML Schemas for representation of attributes for first responders. These are: (a) Attribute Schema that is specific to a class of First Responders (e.g., EMS, Fire Fighters, Search and Rescue etc) and (b) Generic Attribute Schema that can be used in sending the necessary information under “Attribute Query Response”. The attributes of a first responder were classified under the following six headings: Education, Training, Experience, Physical/Medical Fitness, Certification and Licensing. Since each of these attribute classes may have different parameters (e.g., Education will have Highest Degree as a parameter while Experience may have Number of years as a parameter), re-usable XML subschemas were developed for each class of attributes. Further for each type of first responder (e.g., Hazmat officer), there are mandatory and preferred requirements associated with each attribute class (e.g., minimum education, minimum number of years of experience etc). A separate subschema was created for capturing these distinctions as well. As far as the Messaging Protocol for Querying and Retrieving Attributes is concerned, SAML Query and SAML Response protocols were utilized for querying and obtaining attribute information from attribute repositories

maintained by jurisdictions who issued credentials to first responders. Last but not the least, we addressed the issue of Standardized Representation of Deployment Authorization information for all categories such as: (a) Emergency Management Assistance Compact (EMAC) – an global agreement executed among several emergency management service jurisdictions in various counties and states. Signatories to the compact can request emergency assistance from any other signatories in the compact irrespective of the location. (b) Mutual Agreements – these are bilateral agreements between two emergency management jurisdictions using between two adjacent counties located across neighboring state borders and (c) Emergency Request Responders – these are the emergency management jurisdictions which are not found in EMAC or in mutual agreements but who have responded to an adhoc one time request for this particular disaster incident.

5. BENEFITS AND CONCLUSIONS

An interoperable framework for authentication of first responders facilitates reliable authentication of first responders from any command jurisdiction to any other jurisdiction irrespective of the county and state where the jurisdictions are located. The use of standards based representation of attribute information and deployment authorization information together with the use of standards-based messaging protocol for querying and obtaining the information provides the incident commander with all the information needed for proper assignment of functional responsibilities to the first responders responding at a particular disaster incident site. In addition, the interoperable framework has the following additional benefits: (a) Emergency Management community can plan for, request and trust resources (Human & Equipment) needed for emergency assistance, (b) Receive personnel resources that match requests and (c) Appropriately manage officially dispatched first responders

The limitation of this interoperable framework is that there is no practical way to retrieve and verify attributes of a first responder directly from the source that issued a particular certification or licensing attribute. This is due to the fact that these attribute authorities are so diverse and many of them either do not maintain an electronic system or at best maintain only a proprietary information system that does not provide an interoperable interface. For example the Emergency Medical Services Authority of a state may have issued a Paramedic Certification and the state's Department of Motor Vehicles Administration may have issued a Heavy Vehicle Driver's License but these two department may not have a secure interface to support adhoc queries from all incident commander jurisdictions for retrieving attribute information for a particular first responder who needs to be immediately authenticated at the incident site.

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ETHNOGRAPHY AND DATA MINING AS MARKETING RESEARCH METHODS FOR TOURISM CASE OF SAIJOJI-TEMPLE AT MT. DAIYUZAN

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ABSTRACT

This paper is based on research into requirements of the tourism industry regarding local development by using method of ethnography and data-mining. Pursuant to discussions of policy, the center formed a committee to investigate the needs of the tourism industry, with research to be directed by the committee chairman.

KEYWORDS

Ethnography Data-mining Tourism Marketing

1. INTRODUCTION

This paper is based on research into requirements of the tourism industry regarding local development around the *Ashigarakami* Region Prefectural Administration Center. Pursuant to discussions of policy, the center formed a committee to investigate the needs of the tourism industry, with research to be directed by the committee chairman.

The first part of the paper will identify the methods of investigation employed, and the second part will identify the selection process of locations for research. The third part of the paper discusses the results of the investigation, and the fourth suggests policies based on the findings.

2. THIS PAPER IS BASED ON RESEARCH

There were two aspects of the investigation. One was an ethnographic study of the tourist population, and the other was data mining for other cultural and linguistic information.

2.1 Ethnography

Ethnography is a sub-field of cultural anthropology that emphasizes interview-based methods of research into society and culture. Ethnographic methodology has been commonly applied to cultural geography, folklore, sociology, and other areas of cultural research. It has been ascertained that this methodology is the best possible way to examine the center's research subjects.

2.2 Data Mining

Data mining is a way of gleaning intelligent, useful data from unorganized or seemingly random data. Text mining is a more specific technique that involves word and sentence analysis in large bodies of text. In our case, text mining is used to divide Japanese sentences into words and then count and analyze the individual words. In some cases, the results can be categorized according to author data such as age or gender; more commonly, text mining involves numeric analysis of word repetition in order to identify topics and concepts of particular importance at given places and times.

By combining text mining with ethnographic research, we are able to analyze linguistic data provided by tourists with great statistical objectivity. Ethnography is often viewed as a subjective study field, but this combination of techniques can compensate for subjective bias. Moreover, the statistical data provided through the combination of methods may be valuable to the tourism industry in areas other than marketing.

In this study, the KHCoder software program was used for data mining. The program was developed by Dr. K. Higuchi, an associate professor at Ritsumeikan University.

3. OBJECTS OF INVESTIGATION

The Ashigarakami Region Prefectural Administration Center planned this investigation and formed a marketing research committee to investigate hidden demand in the tourism industry.

The committee undertook investigations at three locations: Saijoji-temple at Mt. Daiyuzan, Seto house, and the Yabusame festival. Among these, the investigation at Daiyuzan was the most fruitful because most of the visitors to Daiyuzan were not locals; i.e. they were real “tourists” who intentionally journeyed from distant locations. This seems to indicate that there is an exterior touristic demand for the temple, which could theoretically be expanded with proper marketing techniques. In this paper, in order to represent the merits of the research techniques employed, the discussion of results will be limited to the example of Daiyuzan.

4. RESULTS

The Saijoji-temple at Mt. Daiyuzan is a famous tourism destination to which many people come to offer prayers. As previously noted, most of these visitors travel to the temple from outside areas. We could get enough data from the investigation as the ethnography research. In short, this investigation is the core of this project.

4.1 Results of Investigation of Saijoji-temple at Mt. Daiyuzan

The investigation was held on 4 December 2010.

Because of a typhoon a few days earlier, the red leaves of autumn had gone. Therefore, visitors were fewer than previously expected.

4.2 Analysis of Investigation of Saijoji-temple of Mt. Daiyuzan

Table 1

| Male n=26 | | Female n=16 | |
|--------------|------|----------------|------|
| do | .546 | beautiful | .294 |
| nothing | .533 | exist | .286 |
| good | .515 | look | .280 |
| tourism | .486 | Mt.Fuji | .235 |
| go | .486 | good | .200 |
| now | .333 | difficult | .188 |
| Hakone | .333 | today | .182 |
| nice | .321 | child | .177 |
| nothing | .300 | become | .167 |
| come | .286 | much | .167 |

Table 2

| 30's n=5 | | 40's n=4 | | 50's n=14 | | 60's n=18 | |
|-------------|------|-------------|------|--------------|------|--------------|------|
| money | .400 | particular | .333 | nature | .368 | no | .652 |
| enjoy | .333 | happy | .333 | hot spring | .333 | good | .400 |
| search | .333 | Nara | .286 | good | .310 | do | .387 |
| look | .286 | Kyoto | .250 | exist | .308 | go | .375 |
| Nagano | .286 | buffet | .250 | do | .300 | today | .333 |
| Hakone | .250 | show | .250 | tourism | .290 | come | .333 |
| person | .250 | apearently | .250 | until now | .286 | travel | .300 |
| like | .231 | place | .250 | future | .273 | conduct | .286 |
| place | .200 | nephew | .250 | look | .250 | future | .280 |
| able | .200 | next week | .250 | beautiful | .214 | before | .278 |

First, attribution analysis was performed. This showed an age tendency toward the elderly. However, families were also common, and a number appeared to have journeyed from the same prefecture. This seems to be a good indication of the temple's attractiveness for tourism.

For want of space, not all words found to occur frequently through text mining of the ethnographic study can be shown. Common nouns such as nature, fountain, red leaves, hiking, car, child, couple, view, history, etc. were used often. The proper nouns Hakone, Kyoto, Nara, Mt. Fuji, Nagano, and Chugoku were all common as well.

These frequently used words were then analyzed in terms of gender. As shown in table 1, females tended to speak more often of Mt. Fuji, and males of Hakone.

Table 2 shows word frequency according to the subjects' age. Unfortunately, the results of this table are not particularly valuable because the sample population did not vary enough: Most of the subjects were more than 50 years old. However, it is perhaps interesting that younger people displayed a tendency to use concrete proper nouns, while elder people tended to use abstract words.

5. MARKETING STRATEGY

Based on this analysis, a marketing strategy can be formulated. As a logical premise, we can say that if a person who visits area A also enjoyed area B, where he or she has been or wants to go, there are probably other "potential guests" among the visitors to area B who would consider visiting area A. Tourism promotion relies on this assumption, with well-documented positive results.

In this investigation, we found that the word "Kyoto" was often used. It might be beneficial to use this as a starting point for promotional efforts. Furthermore, after analyzing qualitative words from the original data, we found that with reference to Hakone words such as "good" and "fun" appeared frequently. Concerning Mt. Fuji, it understandably seemed that word results conflicted, as the subjects were not fond of climbing but did enjoy seeing the site.

Considering tourism development for this area, including Saijoji-temple at Mt. Daiyuzan, we can suggest a model case based on the analysis conducted so far. Something along the lines of "married couple comes by car, taking photos of Mt. Fuji and enjoying hot springs" might be effective for promotion.

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THE USE OF E-GOVERNMENT AMONG CITIZENS

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ABSTRACT

The aim of this paper is to explore the implementation of the e-government initiative in Saudi Arabia, and to assess its impacts and benefits for the citizens. The paper focuses on a historical overview of the evolution of e-government as a concept, and it assesses its advantages and disadvantages for developed and developing countries. It also observes its cycles or stages of development. Therefore, a quantitative study in this paper was applied in order to identify how citizens utilised from the services provided by the e-government. This paper also focuses on issues such as national culture and education as some of the most important factors related to e-government in Saudi Arabia in order to assess the satisfaction among Saudi citizens towards the services provided by the e-government. Based on the findings from this paper, suggested recommendations for the improvement of e-government services have been presented to place the e-government in a wider theoretical framework. Finally, we covered some of the recent literature review on the evolution of e-government in general and particularly in Saudi Arabia, we also covered the steps which required to traverse before yielding salient long-term benefits to citizens of the country.

KEYWORDS

E-government, Macroeconomic, Technological characteristics, Policy-makers.

1. INTRODUCTION

E-Government (electronic government) also known as online government is digital interactions between a government and citizens (G2C), government and businesses/Commerce (G2B), government and employees (G2E), and also between government and governments /agencies (G2G). Essentially, e-government is can be defined as the use of information and communication technology to improve on the services offered by the public sector (Jeong 2007). There has been a variety of reasons for the adoption of e-government as a mean of conducting country policy and providing services for the citizens. The most popular rationale behind the adoption of e-government relates to the main democratic principles such as accountability, transparency, and civic engagement in the public affairs. In this sense, the whole concept of e-government is not only related to the technological advancement of national governments as service providers, but also to the idea of bridging the gap between members of the public and policy-makers. It is also an attempt to increase government awareness among citizens. The reasons for using e-government in many countries are specifically related to cost-reduction, effectiveness, and performance of the public sector.

Many researchers focused on the origin and the evolution of e-government, and there is a widespread opinion, that the latter is a result of e-commerce, and, despite the variations, there are three main stages of its evolution – publishing, transaction, and integration (Al-Shehry *et al.* 2006). The publishing stage is the primary one to enable citizens to obtain contact details and other general information from the government websites. The transactions stage enables citizens to download forms and to receive feedback from government agencies on a number of issues related to benefits, immigration, health care, financial aid, etc. Whereas the integration stage is the most sophisticated one and allows citizens to upload applications online, and to apply for personal documents online (Al-Shehry *et al.* 2006). The following table provides a summary of the evolution cycles of e-government been found in the literature:

Table 1. Evolution of the cycles of e-government in literature (adapted from Al-Shehry *et al.* 2006)

| Model and Author | Perspective | Stages |
|--|---|---|
| Deloitte Research (2000; cited in Silcock, 2001) | Eminence of web-based applications and portal technology | (1) Information publishing (2) Official, two way transactions (3) Multi- Purpose portals (4) Portal personalization (5) Clustering of common services, (6) Full integration and enterprise transformation |
| Howard (2001) | Capabilities of the web technology | (1) Publish (2) Interact and (3) Transact |
| Lyne and Lee (2001) | The degree of organisational and technological complexity and the degree of integration in terms of data and service delivery | (1) Cataloguing (2) Transactions (3) Vertical integration (4) Horizontal integration |
| Moon (2002) | Technological characteristics | (1) Simple information dissemination (one-way communication) (2) Request and response (Two-way communication) (3) Service and financial transaction (4) Integration (horizontal and vertical integration) (5) Political participation |
| Al-Dosary and King (2004) | The degree of organisational and technological complexity. | (1) Initial stage (2) Developing stage (3) Advanced stage (4) Optimal stage |
| Reddick (2004) | Technological characteristics | (1) Cataloguing of information online (2) Transactions |
| UN (2004) | Technological characteristics | (1) Emerging (2) Enhanced (3) Interactive (4) Transactional (5) and Seamless or fully integrated. |

In this paper we are focusing on the third category of e-government interactions which is government to citizens (G2C). This paper explores the usage of e-government services among Saudi citizens, in order to assess the awareness among Saudi's toward using e-government. The main challenges that are facing the e-government in KSA and general recommendations have also been presented in this paper.

2. RELATED WORK

Large part of the literature on e-government in Saudi Arabia tackles the multiple challenges related to the implementation of e-government (Betrah 2010, Alshehry 2008, Alsheha 2007, Al-Rasheed 2001). As these authors have shown, most of the challenges related to the implementation of e-government in the country are connected to accessibility, technology, education (levels of literacy) and culture. In 2004 Ndou's study investigated this topic and points at some macroeconomic, as well as political factors, which can be an obstacle to the adoption of e-government in developing countries. Her study offered probably some of the most useful insights on the opportunities and challenges from the adoption of e-government in the developing countries such as Saudi Arabia. Ndou (2004) classified several opportunities, related to the adoption e-government in developing countries such as cost reduction and efficiency gains, transparency, anti-corruption, accountability, and increased legitimacy of the government. Main barriers have also been identified such as e-readiness, telecommunications, computer literacy, culture, and resistant to change (Ndou 2004). In an extensive study on the transformations towards e-government in Saudi Arabia, Al-Shehry *et al* described some of the structural challenges to the implementation of e-government.

The transformation towards e-government in Saudi Arabia started in 2001, when the first e-government initiatives were launched as part of the overall information technology plan for the country (Al-Rasheed 2001). There were three main objectives on which the government programme focused – e-readiness, e-society, and IT training. One of the instruments, through which e-government was launched, was the “Yesser” programme, which was designed to facilitate the work of businesses and public organizations, in relation to the citizens. Its overall aim was to facilitate the transition towards e-government, by supporting

public organizations with data, knowledge, training, and expertise, it had a tremendous impact on the cross-sectional integration of the government agencies, and has enhanced the role of the government as a provider of services for the citizens (E-government program 2011). Before “Yesser”, there have been some government initiatives, which enabled citizens to use services electronically, such as the E-payment gateway “Sadad”, the Smart Cards, and the Ministry of Interior Government portal. The idea behind the adoption of e-government however, was to make all these services work coherently, as part of a larger electronically enhanced network (E-government program 2011). One of the latest accomplishments of the “Yesser” e-government programme has been the “Yesser Data Centre”, which “conducts the intermediate operations and common national e-applications in order to facilitate transmission and integration of data between government agencies, which help streamline of e-government service delivery” (E-government program 2011). It is one of the three centres in Saudi Arabia, designed to guarantee the protection of all e-government services.

3. METHODOLOGY

One of the most key set of decisions to be made in conducting any research such as the one being undertaken here is the research design and methodology that will be adapted. Therefore, a sufficient number of Saudi students must be questioned, the participants will be females and males of different social backgrounds and different academic disciplines. Each participant filled a questionnaire with 29 multiple-choice questions, specifically designed to meet the objectives of the study. There will be questions related to the quality and accessibility of services, provided by e-government. Only few of the questions will be open-ended. Questionnaires are one of the most popular tools of quantitative research, and in the study of popular attitudes and behaviour if designed properly; because it is easy to code and to interpret especially in the later stage of data processing. Three hypothesis were proposed in our work, firstly the demographic variables of age, region, education, gender, marital status and computer knowledge will differ between usage of e-government among citizens, secondly the use of e-government is limited due to it awareness among the general population of Saudi Arabia. Finally the e-government portal is not pretty well designed which lead to confusion and lack of interest among Saudi citizens.

4. CONCLUSION

E-government in Saudi Arabia was launched in order to boost the economy of the country and to enhance its public sector in terms of accountability and transparency. Its adoption in 2001 reflects the ambition of the government to introduce modern and innovative methods of integrating its citizens to dialogue with the Government. As an initiative, it has several advantages, as well as disadvantages. In the case of Saudi Arabia, its advantages have been related to cost reduction and effective time management, as well as civic participation and democratic reform, these advantages are as follows:

- Saving Time and cost reduction: E-government reduces cost and time spent moving from one office to another in search of information and services.
- The benefit of e-government for Saudi women and people with special needs: Woman and people with special needs find a more secure way of sharing their views and getting information.
- International trade benefits: E-government provides a chance for foreign investors to know more about the country, and it opens the country to democratization and transparency.

Although e-government in Saudi Arabia was launched a decade ago, there are some areas which still exist where lack of internet access or low levels of literacy remain a barrier to its smooth operation. In addition, from a technological point of view the Saudi government needs to improve the accessibility of its website, and to ensure higher levels of awareness among Saudi citizens. These disadvantages are as follows:

- Unexpected cost: Reorganization of the existing system, as well as the training of personnel and the introduction of new equipment. This has led to unexpected costs.
- Internet Usage and Illiteracy: Implementation of e-government in Saudi Arabia is connected with the low number of internet users in the country and the low levels of literacy. In 2005, only 2.3 million people were using the internet in the Kingdom.

- Accountability in developing countries: Al-Sheha (2007) suggested that Saudi Arabia, like many other developing countries, faced the impact of the lack of monitoring agencies and bodies.

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INCREASING MOODLE RESOURCES THROUGH CLOUD COMPUTING

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ABSTRACT

The increase of higher education offer is a basic need of developed and emerging countries. The offer of higher education, by means of Distance Learning, based on the Internet, is one of the most efficient manners for the massification of this offer, as it allows ample coverage and lower costs. In this scenario, we highlight Moodle, an open and low-cost environment for Distance Learning. Its utilization may be amplified through the adoption of an emerging Information and Communication Technology (ICT), Cloud Computing, which allows the virtualization of Moodle sites, cutting costs, facilitating management and increasing its service capacity. This article diffuses a public tool for automatic conversion of Moodle sites, such that these may be hosted on Azure: the Cloud Computing environment of Microsoft.

KEYWORDS

Moodle; Cloud Computing; Moodle on Azure

1. INTRODUCTION

In the scenario of Distance Learning environments, the Moodle stands up. The Moodle has been used successfully by major suppliers of mass higher education, such as the Open University of Lisbon (UAB, 2011), Open University UK (Open University, 2011) and the Universidade Aberta do Brasil (UAB, 2011).

This poster addresses the basic concepts of Cloud Computing, highlighting its relevance in the Education context. It also describes a public tool, opened and free of charges, which can convert Moodle environments automatically, enabling them to run on Azure, the Cloud Computing environment of Microsoft. This tool has been developing since 2007, by LTIA (Laboratory of Applied IT), of UNESP – State University of São Paulo, Brazil. It is an operational solution, available for free to the public on CodePlex (2011), being frequently updated and in constant process of improvement.

2. CLOUD COMPUTING, AN INTRODUCTION

Cloud Computing is a service accessible on the Internet. It is a new computing model, in which physical and local resources are converted into scalable resources, also virtually available. Taurion (2009) defines Cloud Computing as any service that is not executed on the user's computer, but can be accessed from anywhere, often without the need of installing applications on his/her machine nor paying for software licenses. Cloud Computing is allowing “digital assets” to gradually be transferred to major “virtual data centers”, by means of services rendered by companies, such as IBM, Dell, Sun, Google, Accenture, Microsoft and others, which assume the responsibility for storage and operation, and making data, software and applications available to corporate users.

Cloud Computing definitions give us indications leading to the identity of services already on Cloud Computing. To be able to use the service directly from our web browser, without installing local applications and to use these services from any computer are clear indicators of a service based on Cloud Computing. We can cite some examples, such as MSN Messenger, Facebook, LinkedIn, and Live@Edu. Today, practically all social networks adopt this technology.

As per Sun (2009a and 2009b), the main advantages of migrating to Cloud Computing are associated to the easiness to develop, reduce operational costs and improve performance, with emphasis on Interoperability – capacity to develop on different software platforms; High Computing Capacity – HPC (high processing

computing) capacity; Security and Storage Capacity – with data on Cloud servers; Reduction of Operational Costs – by paying per use and not for licenses; Transformation of Fixed Costs into Variable Costs – by payment on demand or usage; and swift system implementation.

For organizations, these advantages represent liberty and flexibility. Freedom to disconnect from physical aspects of data center maintenance and flexibility due to interoperability, the capacity to be integrated with systems of different platforms (Windows and Linux; Linux and Windows), which seems to be an intrinsic quality of Cloud Service Platforms.

For personal users there are only advantages: better performance, independence from client software (installed on the pc) and the possibility of access from any computer, as the structure on which the applications are set is totally transparent to them. As we can see, personal users have already been employing Cloud Computing for some time, for instance, on social networks and services, such as Google Docs or Skydrive, storage applications and file sharing.

2.1 Strategies for Cloud Computing Usage

As per Polze (2009), Cloud Computing implementations can be classified according to three broad strategies. Infrastructure as a Service (IaaS) or outsourcing of equipment used in operations, including storage, servers and network components, as Amazon Web Services and VMware vCloud. Platform as a Service (PaaS) or delivery of operational systems and associated services, through the Internet without download or installations. All personal computer resources are transported to the Internet, from where they are made available to clients and users, for instance, Google AppEngine and Windows Azure Platform. Software as a Service (SaaS), where all software, including the operational system and data are implemented on Cloud, as on productivity applications (Microsoft Office Live and Microsoft Business Productivity Online Standard Suite; figures management (FlickR); e-mail (Google Mail) and storage (DropBox, Microsoft Mesh, SkyDrive, Gladinet). This is a didactic classification.

Cloud Computing environments can also be classified according to access and location (Taurion, 2009), defining Public Clouds - available to any Internet user, as Amazon Elastic Computer Cloud, Google App Engine and Microsoft Windows Azure, it can access and use a public Cloud; as Private Clouds: personal Cloud environments, which can only be accessed by a limited number of users; and Hybrid Clouds, also known as “virtual private clouds”, which offer services executed on a Public Cloud, but within the VPN limit (Virtual Private Network).

3. THE MOODLE ENVIRONMENT

Moodle is an Open Source Course Management System (CMS), also known as a Learning Management System (LMS) or a Virtual Learning Environment (VLE). According to Moodle (2011a), it was created in 2002 and became very popular among worldwide educators for online creation of online dynamic web sites for their students. To work, it needs to be installed on a web server somewhere, either on one of its own computers or at a web hosting company.

Pursuant to Moodle (2011a), the environment is present in 223 countries, at 72,104 sites, hosting 5,849,933 courses, for 57,218,721 users and 1,294,441 instructors. The first ten countries classified by Moodle utilization can be seen in Table 1.

Table 1. Top Ten Countries using Moodle. Source Moodle.org/stats

| Country | Registers |
|-----------------|-----------|
| United States | 12,508 |
| Spain | 6,398 |
| Brazil 5 | ,266 |
| United Kingdom | 4,148 |
| Germany 2 | ,975 |
| Mexico 2 | ,930 |
| Portugal 2, | 244 |
| Colombia 2 | ,089 |
| Australia 1,775 | |
| Italy 1 | ,720 |

3.1 The Moodle Tool on Azure

The development of a tool for conversion of Moodle to the Cloud environment by LTIA – Laboratory of Applied Information Technology, of UNESP – State University of São Paulo, started from developing a Proof of Concept (PoC), which sought to explore the possibilities of adaptation of an existing system, originally conceived for Unix and Unix-like, installed on a private network infrastructure, to a Cloud platform, in which case is Azure of Microsoft. This successful initial effort, resulted in the development of a tool that allows automatic conversion of Moodle original versions to run on Azure, with minimal alterations to the original Moodle, denominated MoodleBuild Toolchain (Moodle, 2011b).

This tool, currently named Moodle on Azure is open and public, being available at <http://moodle2azure.codeplex.com>. It enables educational institutions to migrate their distance learning infrastructure based on Moodle to the Cloud/Azure environment. This version has arisen a lot of interest in the community of Moodle users, as shown by data on downloads - 518 downloads since February/2011 (average of 52/month).

The current version available for download of Moodle on Azure is capable of converting original Moodle environments up to version Moodle 2.x.x. It has limitations, as it allows implementations on Azure on only one instance, that is, it is implemented on only one virtual server on the Cloud, replicating the basic physical situation – one environment running on one data center. Currently, the LTIA is working on the development of the multi-instance version, through which Cloud computing will be used in its full potential. This version will be available by March 2012.

The LTIA is also researching the impact of Moodle on Azure, when used to convert Moodle environments highly customized by users, as it is the case of traditional users of the environment.

4. FINAL COMMENTS

We believe we have been able to approach the technological revolution, Cloud Computing, emphasizing its advantages for educational institutions and their personal users. A potential that is more evident to the users of the Moodle environment, an acknowledged solution, widely used by educational institutions, which can greatly benefit from migrating to Cloud Computing.

The description and diffusion of the Moodle on Azure tool, by LTIA/Unesp, can be a real contribution for users of the Moodle environment, who being able to automatically migrate their environment, may enjoy the advantages of Cloud Computing environments. Limitations of the current version and the plans for a future development of the tool complement this study.

The site address, <http://moodle2azure.codeplex.com>, where this tool is publicly and freely available has a forum, where adopters may interact and contribute to the new developments.

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INFLUENCE OF HUMAN BEINGS ON VIRTUAL PETS

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ABSTRACT

This research, I will seek to find an answer to questions in relation to what type of virtual pet students prefer from among the four types mentioned; whether students are attached to their virtual pet or not; whether a virtual pet can be a comfort to them or not, etc. in order to explore possibilities of the relationship between humans and virtual pets as well as to find ways to use virtual pets in the field of education. The results showed that the high-frequency conversation group was more favorable toward pets and received stronger comfort from pets. The inverse was found to be true for the low-frequency groups. Furthermore, the result that 85 percent expect a virtual pet to have a conversational function shows they expect a virtual pet to become their conversation partner. It is also assumed that due to high expectations for a virtual pet to have a conversational function, uncomfortable conversation with a virtual pet might have led to a lower mood. Accordingly, virtual pets that converse with more fluently would be expected in the future.

KEYWORDS

Pet, Virtual, Virtual Pet, Conversation, Classification of virtual pets.

1. RESEARCH OBJECTIVE

In our modern world, as human relations become more attenuated because of the falling birthrate, the aging population and the trend toward nuclear families the number of children who constantly feel lonely is increasing. In the survey 'Child Poverty in Perspective: An Overview of Child Well-being in Rich Countries' conducted by the United Nations Children's Fund (UNICEF) in 2007, that 30 percent of Japanese children aged 15 agree with the statement 'I feel lonely'. This striking result makes Japan the highest-scoring country. In most countries, the percentage of 15 year-olds agreeing with the statement is 10 percent or less. Japan is also well known for its high suicide levels. According to data from the World Health Organization, it ranks the ninth-highest among 101 countries in the world after Lithuania, Belarus, Russia, Kazakhstan, Hungary, Guyana, Slovenia, and Latvia, which are countries in a state of chaotic internal turmoil. In Japan, 24 out of 100,000 people commit suicide. Against this background, I took up the notion of the 'pet' for consideration as a potential way to comfort and heal people in Japan where the suicide rate is so high.

According to the 'Survey of Public Opinion Concerning Animal Welfare', people who find difficulty having a real pet are those living in collective housing, with good access to the Internet. So virtual pets which they can adopt online, with a view to examining the outcome to determine whether a virtual pet would produce positive effects on those people who decide to adopt a pet in this manner.

Various virtual pets have been developed: The first type is called non-interactive virtual pets, mouse action is necessary for petting, feeding. The second type is called a blog pet, which can be added to one's blog site. On the blog site, the blog pet randomly picks up some information from blog entries, all of which are archived, and displays it on the screen using a speech bubble as if the pet were speaking itself. The third type is called a learning-type virtual pet. It is only necessary to enter and archive every word or phrase in each situation to create a corpus of memorized sentences and phrases that correspond on a one-to-one basis, which are then displayed as dialogue. This creates the feeling of communicating with a real pet. If a word or phrase not memorized is typed, the pet will elicit more information by responding with the phrase 'I don't understand what you are saying!'. The fourth type of virtual pet interacts with an avatar (your representation in cyberspace), by talking, playing, etc. with each other. When one types 'I'm back!', the pet will respond 'Welcome back home!' The pet can always respond, even to a typed phrase not memorized which make this virtual pet different from the second type. Furthermore, the pet can understand some phrases such as 'Come over here,' 'Sit down,' 'Shake hands,' 'One more,' etc. and respond in action to each phrase. In these respects, it differs from the other types of virtual pets (Kanoh, Terashima: 2009).

Within this research, I will seek to find an answer to questions in relation to what type of virtual pet students prefer from among the four types mentioned; whether students are attached to their virtual pet or not; whether a virtual pet can be a comfort to them or not, etc. in order to explore possibilities of the relationship between humans and virtual pets as well as to find ways to use virtual pets in the field of education.

2. RESULTS AND REVIEW

2.1 Changes in Mood before and After Making Conversation with a Virtual Pet

I have conducted the variance analysis to see if there is any gender gap in the feelings of companionship before and after making conversation with a virtual pet. The result shows that there is no change in the feelings as a whole (without distinction of sex); however, Figure 1 shows that there is a certain gender gap in the feelings at the beginning ($F(1)=4.26, p<.05$) and ending of conversation ($F(1)=11.41, p<.01$): male students report higher feelings of companionship than female students at the beginning of the study, but by its completion, the level of attachment reported by males drops below that recorded for female students. Further, Figure 2 shows the breakdown of the existence of real pets, indicating that more male students have a real pet than female students do ($X^2(1)=10.31, p<.01$). This may be one of the reasons why the feeling of companionship among male students resulted finally in a lower score, since the male student who has a real pet might have expected as much companionship from a virtual pet as he received from the real one, but such an expectation did not materialize.

2.2 Frequency of Conversation and Conversation Time with a Virtual Pet

Next, I have conducted the variance analysis to see if the length of conversation time with a virtual pet has an effect on the person's mood over the duration of the communication. The difference in the feelings of companionship between the beginning ($F(4)=4.58, p<.01$) and the end of the conversation ($F(4)=3.56, p<.01$) is dependent on the length of conversation time.

In observing relationships between the frequency of conversation and the degree of attachment to a virtual pet, I have used a chi-square test. As a result, a highly frequent conversation group (6 times or more) indicates a stronger favorability rating, and a low frequent conversation group (5 times or less) weaker favorability rating ($X^2(5)=14.045, p<.05$).

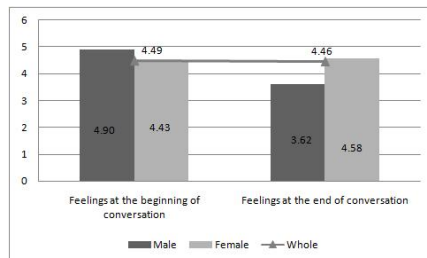


Figure 1. Changes in Mood by Gender (Average Scores)

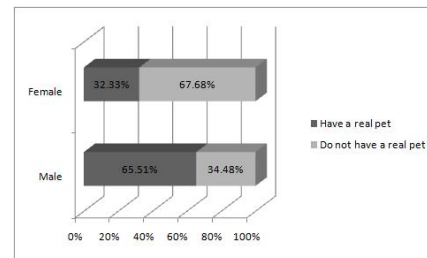


Figure 2. Breakdown of Existence of Real Pets

2.3 Expectation of Virtual Pets

Next, I conducted a survey on what expectation students have of their virtual pet. I asked the students to respond 'yes' or 'no' to three statements regarding whether they expect to: (1) engage in a conversation with their pet, (2) be able to control the pet's movement with the mouse cursor, (3) be able to express feelings and ideas through an avatar (alter ego) together with the pet.

The result in Figure 3 shows that 85 percent expect a virtual pet to have a conversational function; on the contrary, however, 41 percent do not expect it to function with an avatar.

With a chi-square test, I have studied the relationship between the ‘gender gap’ and the individual factors of conversation, mobility and the avatar. Likewise, I considered these three factors in relationship to the ‘existence of a real pet.’ As a result, there is a significance in the relation between the question ‘Do you expect to be able to control the pet’s movement with the mouse cursor?’ and the ‘existence of a real pet’ ($X^2(1)=5.06$, $p<.05$). Also, the result in Figure 4 indicates that students who have a real pet expect more mobility of a virtual pet than those who do not have a real one. Other combinations by gender or the existence of a real pet do not show any significant difference (n.s.).

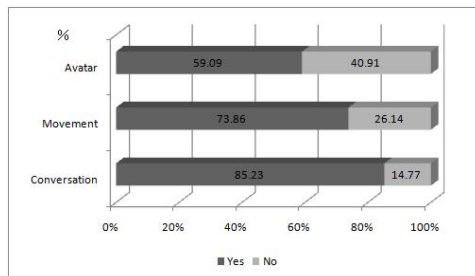


Figure 3. Expectation of Virtual Pets

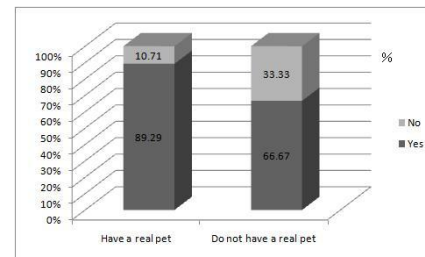


Figure 4. Relationship between Mobility and Existence of Real Pets

2.4 Node Analysis of Dialogues

While conducting this survey, I noticed that some students felt uplifted after making conversation with a virtual pet, while others felt down; therefore, I have compared samples of each dialogue. It became evident that a critical factor in the responses is whether the students were successful in establishing interpersonal communication with their virtual pet during conversation. The dialogues when students felt down, there is a gap in their conversation with their pet, since the pet is entirely unable to respond with the words the owner wanted to hear. In contrast, in dialogues where students felt uplifted, there is good communication, and furthermore, the pet can give its owner some comforting words such as ‘Welcome home, my dear master,’ a phrase that might come from an elegantly dressed maid in a café, where the maids treat their customers as masters.

For further understanding of the communication between the pet owner and the virtual pet, I have carried out a text-mining approach using “Trend Search” software to analyze the words exchanged between them. The result of such mapping is shown in Figure 5. The color density of each frame surrounding a node represents the word frequency. The stronger the color of the frame the more frequently the node in that frame appears linked with other words. This software program extracted three main keywords: ‘word,’ ‘dumpling,’ and ‘like.’ Among them, the ‘word’ is most frequently connected with other keywords, as shown in the phrase, for example, ‘I don’t understand the word. Please say it again with another simple word.’ Thus, this keyword appears many times in the speech of the pet, indicating that the pet is asking its owner the meaning of ‘word’ again and again during conversation. It is quite understandable why the pet owners experienced frustration with their virtual pets.

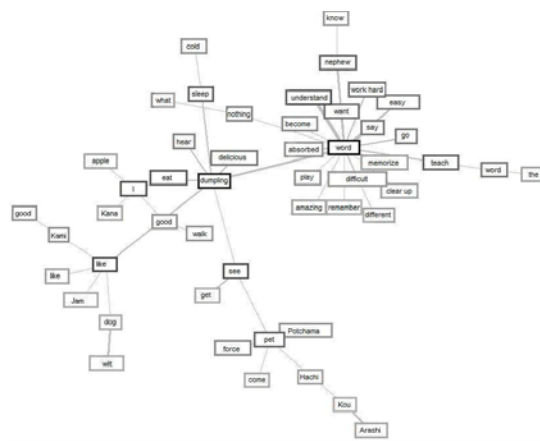


Figure 5. Node Analysis of Dialogues

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THE POSITIONING OF THE INFORMATION ARCHITECTURE ON THE DEFINITION OF THE IT SERVICE STRATEGY

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ABSTRACT

The Information Technology Infrastructure Library – ITIL - provides a framework of best practices for managing IT services. The study of this framework, as regards the definition of the IT Service Strategy, allows us to see that it does not have space in its body for Information Architecture. One of the goals of the Information Architecture is to organize the information for decision making and so it has much to contribute to this strategy. The proposed contribution of Information Architecture in defining the strategy of the service that this paper presents evidence the perception that the concepts of Information Architecture are present in the strategic decisions of the IT services management. This proposal contributes to the union of bodies of knowledge to facilitate the creation of the strategy for the services.

KEYWORDS

Information architecture, service management, infrastructure, IT services, ITIL, Service Strategy

1. INTRODUCTION

The primary goal of IT service management is to ensure that there is an alignment to business needs and provide support effectively. To understand the significance of this management is necessary to identify the object of the service and how it can assist the providers in their delivery.

As a framework, the main goal of ITIL is to provide a set of practices for managing IT services, tested and proven in the market, which can serve as benchmarks for both organizations that already have IT operations in progress and intend to undertake improvements, as for the creation of new business (FERNANDES, 2008).

According to Alison Cartlidge et al (2007), "a service is a way to provide value for customers by facilitating the desired results for them without the ownership of specific costs and risks." Therefore, this value should be identified by the client, this allows customers motivated to obtain new services according to the results, explaining the relationship between service value and how this service makes it easy to obtain the desired result.

The concepts related to the Service Strategy to compose the first of the five books of the third version of ITIL. Service Strategy provides guidance on how to design, develop and implement a good management of services, making it a strategic asset and not just an organizational capacity. Service management can be defined as "a set of specialized organizational capabilities that provide value to the customer in form of services" (IQBAL; NIEVES, 2007).

2. INFORMATION ARCHITECTURE

According to (REZENDE and ABREU, 2003) is needed to adequately plan the information architecture of an organization and say:

"[...] The information architecture can be defined as a particular form of use of the information technology adopted by a company to achieve certain goals or perform certain tasks. This architecture must include the business functions at the top, the information systems at different levels and information technology [...]"

Information architecture, in the organizational context, is defined by (ABELL and WINGAR, 2005) as a set of strategies and plans that consistently provide safe and efficient access to content, highlighting the work of many information professionals that act in the management of corporate informational environments.

3. THE PROBLEM

Analyzing the ITIL framework it is clear that it was not built in compliance with the concepts of Information Architecture mentioned above. Thus, there is possibility of contribution of Information Architecture in the development of IT Service Strategy? How the information architecture can facilitate the organization of information so that companies achieve their strategic goals?

4. PROPOSAL

Considering the authors already cited in this study, we developed a proposed modification of the ITIL framework including a process called Information Architecture that will relate to the model shown in Figure 1.

4.1 The Proposed Contribution of the Information Architecture in the Strategy of the Service

The steps for defining the strategy of the service defined in the ITIL framework are: define the market of the service, improving the supply, develop strategic assets and prepare for implementation (CARTLIDGE et al, 2007). This requires understanding the customer and their needs, the opportunity, the space service, the critical success factors and prioritization of investment for this service. At this point the Information Architecture of the service provider needs to be taken into account, because as in (MCGEE; PRUSAK, 1994), the Information Architecture will help to identify needs and information requirements of each service, planning and identification of sources of relevant information to the service and decision making inherent in the strategy to be adopted, as shown in Figure 1.

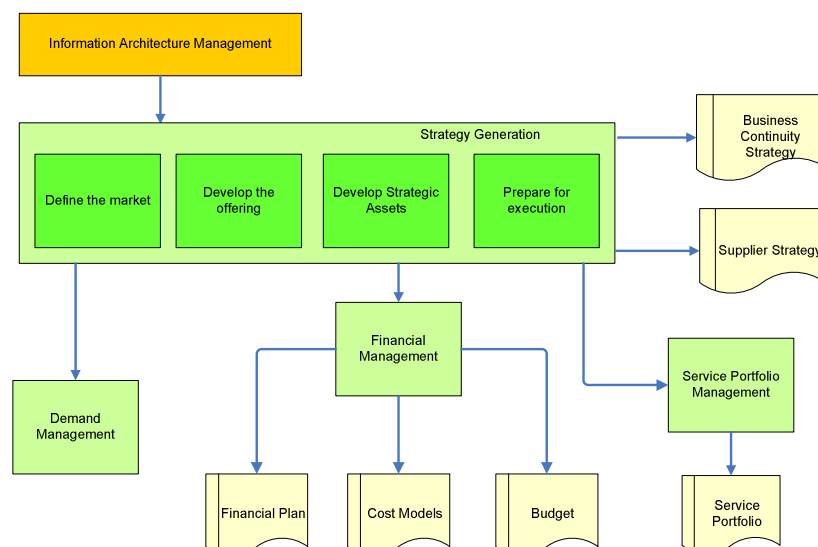


Figure 1. Proposal to Service Strategy Process

From diagnosis until the publication of results in all stages of the assessment tasks are present tasks of the process of information management (MCGEE & PRUSAK, 1994) that involve actions such as identifying information needs, organization, development of information products and their dissemination. Management as a process by McGee and Prusak (1994) implies a set of logically connected tasks that, in general, cross functional boundaries and has a direct responsibility.

Thus the formulation of the service strategy of the Information Architecture will have the role to guide how to identify service needs, how to organize information relevant to the service and how to produce inputs of information appropriate to implement the service.

Thus the service strategy will be better able to design services that improve the use of IT resources and meet the strategic goals of the organization.

5. CONCLUSION

This study suggests the perception that the concepts of Information Architecture are present on the needs of IT service management, but ITIL does not even describe them.

The service strategy can improve the use of IT resources through the use of the process of Management Information Architecture when realize the identification of service needs, the organization of relevant information to the service and the production of appropriate information spaces.

The proposed contribution of the Information Architecture of the ITIL framework, apparently, can contribute to the union of bodies of knowledge; allowing the creation of the strategy of the services takes place in a more effective and efficient and, then, it enables organizations to plan more adequately their demands and spending on IT services.

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Doctoral Consortium

TOWARDS AN IMPROVED RFID ANTI-COLLISION ALGORITHM

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ABSTRACT

RFID is an emerging auto identification technology that provides great features to ambient intelligence environments. It poses a number of research challenges such as interference decrease, security over the RF channel and throughput increase. When there are more than one tag responding to a reader, a collision can occur decreasing system's throughput. That is called "the tag collision problem". This problem is going to be analyzed in order to optimize system throughput. Reducing the total number of collisions, average throughput can be improved, and power consumption decreased. Thus, main anti-collision algorithms are presented and analyzed.

KEYWORDS

RFID, passive tag, anti-collision algorithm, tag collision.

1. INTRODUCTION

A radio frequency identification system (RFID) is an auto identification method that reads codes stored into small tags using radio frequency waves (RF). The main idea of this technology is to attach a tag to the objects that want to be monitored and identified without an existing line of sight.

This technology fits very well into ambient intelligence philosophy which is a model of human-computer interaction. This paradigm is also described as ubiquitous computing and it could be defined as "machines that fit the human environment instead of forcing humans to enter theirs". If every object in the world is tagged, everything could be identified, creating tremendous benefits in a very different kind of applications like traceability of goods, baggage management, livestock tracking, and supply chain management. This fact made RFID a unique technology making ubiquitous identification possible.

RFID is increasingly being used as an auto identification (autoID) technology and is coexisting with actual technologies like bar codes. RFID not only has the same functionality as bar codes but also improves it as well. It does not require human intervention to scan an object and RFID tags have much more storage memory (64 bits, 96 bits and some kind of tags have more) than bar codes. As passive tags are much cheaper than actives and do not use batteries they are spreading in tracking and controlling applications.

In this document a survey of RFID anti collision algorithms is presented with the main objective of improving one of the methods to get a better performance on its execution. This is going to be performed analyzing different algorithm behaviours and developing a new algorithm that minimizes the main problem presented in the next section. The rest of the document is organized as follows: Section 2 defines RFID technology and what the research question is. Section 3 describes the existing solutions for that question. Section 4 presents work done and research objectives and Section 5 contains conclusions.

2. RFID TECHNOLOGY CHALLENGES

An RFID system is composed of three main components (Finkenzeller-2003):

- One or more tags, also known as transponders. These include a microchip and a patch antenna and are attached to the objects to count or identify. Tags can be active or passive. Active tags are battery

powered. Passive tags obtain power from reader's signal and their main purpose is to store data and communicate with the reader. They need a stronger signal from the reader and answer weaker than active tags reaching less distance.

- A reader or transceiver. This device is made up of an RF module, a control unit and one or more antennas. It offers a bidirectional communication with tags, a basic processing of the received information from them and data transfer to external subsystems.
- A data processing subsystem. Connected to the reader, it can implement a final application or store identified tags into a database.

With RF signals, RFID sends energy to tags and in the meanwhile, each tag answers their unique identification code (ID) backscattering those signals. The reader collects that information and sends it to the data processing subsystem.

2.1 The Research Questions

RFID systems allow multiple configurations. The coexistence of more than one reader or more than one tag with the same identification zone leads to some problems known as "the reader collision problem" and "the tag collision problem" (Yang et al.-2010).

When reader's interrogation zones intersect can interfere with one another. Interference detected by one reader and caused by another one is referred to as reader collisions (Engels & Sarma-2002). On the other hand, "the tag collision problem" occurs when there is one reader and more than one tag. As all tags transmit in the same channel, an arbitration method must be used. Otherwise without any coordination, collisions may occur and messages from different tags may cancel each other out at the reader. That leads to a retransmission of tag IDs, which results in a loss of bandwidth and an increase of delay in identifying all the objects. To avoid it, a multi-access protocol is needed. It can be defined as a special case of multiple access communication problem, but anti-collision protocols that solve network collisions cannot be directly applied to "the tag collision problem" (Abraham et al.-2002). There are various constraints which make this problem unique:

- Power source: Passive tags do not have batteries so they need to be powered by reader's signal.
- The number of tags is unknown.
- Tags cannot communicate with each other. The reader has to control the collision resolution process.
- Limited capabilities and memory of the tags. Therefore the resolution protocol has to be simple.

Various multi-access procedures have been developed in order to separate the individual participant signals from one another in the same channel. There are three different procedures:

- Space Division Multiple Access (SDMA): These techniques reuse channel capacity in spatially separated areas. In RFID, it can be used with an electronically controlled directional antenna on the reader. It points the beam at different zones to be read.
- Frequency Division Multiple Access (FDMA): These techniques split up the transmission channel into different carrier frequencies that are simultaneously available. In RFID it can be used with tags that have a freely adjustable harmonic transmission frequency.
- Time Division Multiple Access (TDMA): These techniques use the entire available channel divided between the participants chronologically. In RFID are the most used techniques.

3. TIME DIVISION MULTIPLE ACCESS ANTI-COLLISION TECHNIQUES

In RFID systems, TDMA procedures are the largest group of anti-collision methods. There are two main types of protocols in RFID: Aloha based protocols which are probabilistic and Tree based protocols which are deterministic.

3.1 Aloha Based Protocols

Aloha is a probabilistic communication protocol that is the origin of all these protocols. It has evolved into slotted-Aloha where time is divided into slots and improves its throughput. After that, framed-slotted-Aloha

(FSA) is developed. In FSA all nodes must respond choosing a slot into a fixed length frame (a group of slots). As the throughput of the FSA decreases with the increase of the total amount of nodes, a dynamic-framed-slotted-Aloha (DFSA) is developed. This one changes length of the frame on each read cycle adjusting to the amount of tags at any time. Because of the probabilistic nature of Aloha based protocols, a specific tag may not be identified for a long time, what is called “the tag starvation problem”. DFSA doesn’t work properly when tag population is larger than the maximum frame size available, because DFSA’s frame size is bounded. Enhanced DFSA (EDFSA) is developed to solve that problem. The main Aloha based algorithms applied to RFID are: I-Code and Q algorithm.

- **I-Code:** It is based in framed-slotted Aloha (FSA) concept. Reader transmits a command with the data requested (what determines the size of the slot), a random number for the tag to select a slot position and the frame length (Vogt-2002). Then tags start answering data requested in their selected slots. With the information of the slot population, the reader estimates a new frame length and chooses the optimal from specific ranges that have been found on experiments. This is a fast algorithm that doesn’t guarantee the detection of all the tags on each run.
- **Q algorithm:** EPC Class1 Gen2 protocol adopts a variation of DFSA algorithm, the Q algorithm (EPC Global-2008). The main difference with DFSA or I-Code is that Q algorithm is slot based, so the total length of the frame is calculated on each tag answer. Q algorithm uses 16 bits random numbers (RN16) instead of sending the tag IDs on each slot which improves security, privacy and reduces considerably the amount of transmitted bits. What makes this algorithm dynamic is the Q parameter. It is updated on each tag response and determines the length of the new frame (2^Q) used by tags to arbitrate their answers. Q is increased with a collision response or decreased with a success response. Also, slot duration is controlled by the reader and it doesn’t depend on any synchronized clock. Thus, the reader makes a slot finish its duration when the slot is empty, and makes the next slot start for reducing the waste of time caused by the empty slot occurring in the middle of a frame. An enhancement of these methods is proposed by (Kim & Kim-2011) where tags are divided in groups to improve throughput when the population is bigger than the maximum frame available.

3.2 Tree Based Protocols

The main characteristic of this kind of protocols is that all tags in the reader’s interrogation zone will be identified. These protocols usually have low complexity tags and work well with uniform set of tags but are slower than Aloha based protocols. The most known algorithms are: the Tree Algorithm, Query Tree (QT) and Bitwise arbitration (BTA).

- **Tree Splitting:** It uses a virtual tree to organize and identify each tag (Hush & Wood-1998). The reader starts identification, and all tags send their IDs. On each tag collision, the algorithm splits the set of tags in B subsets ($B > 1$). These subsets become increasingly smaller until they contain one tag. This algorithm doesn’t need clocking circuitry but they must maintain a counter, so if a tag get discharged, it loses cycle information. An enhancement of this algorithm is the Adaptive Binary Tree Splitting (ABTS) by (Myung et al.-2006) where it reduces not only collisions but also unnecessary idle slots with an additional counter.
- **Query Tree (QT):** Proposed by (Law et al.-2000). Reader starts arbitration sending a query (q). Tags matching that ‘q’ answer the reader. When a collision occurs, the reader adds 1 or 0 to q, obtaining 2 new queries (q1, q0) per collision and sending each at a time. In case of a single tag response, tag is identified and it will not respond until a new inventory round. The process need to go through all the possible q’s to detect all the tags.
- **Bitwise arbitration (BTA):** These algorithms operate requesting tags to respond bit by bit. ID-Binary Tree Stack (ID BTS) by (Bo-2006) uses a binary tree which height is the maximum tag ID. A path from the root node to a leave node represents each ID and using a stack the reader can store tags position on the tree. Another algorithm proposed by (Kim et al.-2007) is Bit Query (BQ) where tags answer to a query sent by the reader with their next adjacent bit to the requested prefix. If a tag answers successfully, the reader continues with that bit into the query, and if not it changes to a ‘0’ bit. Then the algorithm will come back to that node and change query to a ‘1’ bit continuing the identification process.

3.3 Hybrid Protocols

Combining advantages of Tree and Aloha, some protocols have been proposed that try to fully exploit their performances. There are mainly two kinds of this combination. One is using randomized divisions in tree-based algorithms and another is using tree strategies when a collision occurs in Aloha-based algorithm.

- **Aloha in Tree based:** Proposed protocols in this category are Tree Slotted Aloha (TSA) developed by (Bonuccelli et al.-2006) which uses a tree structure but in each node response tags are sequenced in slots as in a FSA. Query Tree Aloha by (Shin et al.-2007) that sends a prefix and a frame size to tags, and those that match the prefix answer using FSA. In (Namboodiri & Gao-2007) three Hybrid protocol are introduced: Multi Slotted (MS) that uses multiple slots per query to reduce collisions, Multi Selective Sleep (MSS) that sleeps identified tags of the previous protocol and the MS with Assigned Slot (MAS) which assigns slots in a query frame.
- **Tree in Aloha based:** Protocols proposed in this category are Framed Query Tree by (Shin et al.-2007) where the reader transmits a frame to tags and they choose a slot randomly. Within each slot, QT is used to identify tags. In (Eom & Lee-2007) Framed Slotted Aloha based is presented. The difference with FSA is that when tags are collided in a timeslot, the reader resolves the collision using Tree Algorithm. (Makwimanloy et al, 2011)

4. RESEARCH OBJECTIVES

Related to this research area, some RFID work has been done for 1 year in Mobility research group from DeustoTech. One of the topics of this research has been the traceability of medicines making drug containers ubiquitous by attaching them passive RFID tags on each (Moreno et al.-2011). Some identifying tests have been done in different scenarios to analyze different aspects of RFID taking advantage of the passive tags benefits: their low-price, the absence of battery, their long useful life and their small size.

Moreover, this research is gradually becoming more focused on the algorithms showed in the previous section. Each anti collision algorithm has its pros and cons and the research is being focused on improving some aspects. While the ultimate aim of a multi-access protocol is to increase throughput, minimize packet delay and improve stability, RFID collision resolution algorithms are focused on reducing total tag identification time and consumed power. Aloha based algorithms are used when there are not many tags in the interrogation zone because of the increase in the probability of collision, what decrease their speed. However, they are very popular in applications with few tags. On the other hand Tree based algorithms are much more effective when the number of tags is large.

Both types of algorithms have been researched extensively. One of the most important research issue in Aloha based is in DFSA algorithm estimating the frame size so that it improves its speed in large groups of tags because the throughput of these algorithms is maximum when frame size equals the number of tags. Nevertheless, further research is needed to reduce their tag and reader complexity and requirements. In case of tree based protocols, QT simpler tag designs are an advantage but when tag ID's size increases this issue becomes critical. Hybrid protocols are becoming very popular, and an interesting research direction is determining which combinations have a better behaviour in power consumption, average throughput, number of slots and identification time. To perform this, comparisons between specific algorithms have to be done as in (Bagnato et al.-2009). So each of the algorithms implemented must be compared with existing ones on the same conditions.

5. CONCLUSION

RFID is increasingly being used as an autoID technology because it fits very well into ambient intelligence philosophy. It is a unique technology that makes ubiquitous identification possible. Due to the restrictions imposed by passive tags such as low complexity and inability to communicate with each other, readers should take the brunt of anti-collision algorithms. These should improve some aspects like average throughput, power consumption, identification time, reliability and scalability.

The main objective of this starting research is to make a survey of different anti-collision algorithms to develop a solution for “the tag collision problem” improving some of the weaknesses of existing ones. If the total number of collisions is reduced, average throughput will be improved, and power consumption and identification time will be decreased. So as to reduce collisions estimation methods must be analyzed too and then an anti collision algorithm that matches application needs should be developed taking advantage of existing ones.

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