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ICT AND CERTIFICATION AS FACTORS INFLUENCING DEVELOPMENT OF INTELLIGENT CITIES ON CLOUD COMPUTING STRATEGY

CERTIFICIRANJE I ICT KAO ČIMBENICI RAZVOJA INTELIGENTNIH GRADOVA UZ POMOĆ RAČUNARSTVA U OBLAKU

ABSTRACT

In this work, we discuss Information and communications technology (ICT) and certification as factors that influence the development of intelligent cities. Business Friendly Certificate (BFC), an internationally recognized quality standard is a process promoting favourable business environment in line with international standards contributing to creating cities with standardized systems for the provision of services and information to potential investors.
Business Friendly Certification is a process allowing the evaluation of the quality of service and information the cities provide to investors and businesses. Criteria of Business Friendly Certification can be seen as a reminder of what a city or municipality needs to develop as its own capacity and which operative segments of city or municipal organisations need to be functional. This process is expected to serve to increase competitiveness with respect to the cities and municipalities in the region inside and outside the country borders helping them compete with competitors that started reforms during the transition process much earlier.
In this work, we study the concepts of City Information Systems aimed at managing data and information flow in supporting investors and businesses enabling quick response to client request, faster and easier dealing with papers required for issuance of location and building permit, municipal requirements and other activities necessary to investors and businesses.
In 2013, eight cities from the Southeastern Europe, among which Croatia's Bjelovar and Ivanec, were certified as cities with favourable business environment.

Cloud computing along with Information and communications technology has now emerged to become a recognized method for dealing with given criteria at city or municipal authority level ultimately serving to all interested cities. Implementation of solutions that are continuously upgraded with innovative ideas is a process contributing to the development of project.

Keywords: *Certification, Information - Communication Technology, City and municipality, Cloud computing*

SAŽETAK

U radu se razmatraju certificiranjei ICT (informacijsko – komunikacijske tehnologije) kao čimbenici razvoja inteligentnih gradova. Međunarodno priznat BFC (Business Friendly Certificate) certifikat označava pozitivnu poduzetničku klimu grada u skladu s međunarodnim standardima, što znači da je u gradu koji je certificiran uspostavljen standardizirani postupak pružanja usluga i informacija potencijalnim investitorima.
Program i koncepcija certificiranja omogućava procjenu kvalitete usluga i informacija koje grad pruža gospodarstvenicima i investitorima. Kriteriji za certificiranje predstavljaju neku vrstu podsjetnika o tome što sve jedan grad/općina treba razvijati, kao vlastiti kapacitet, te koji operativni segmenti gradske/općinske organizacije trebaju biti funkcionalni. Ovaj proces trebao bi rezultirati povećanom konkurentnošću u odnosu na gradove/općine u regiji unutar i van granica zemlje i pomoći im u takmičenju sa konkurentima koji su znatno ranije počeli proces tranzicije i reformi.
U radu se razmatra koncipiranje informacijskog sustava grada u funkciji upravljanja podatkovnim informacijskim tijekovima koji će omogućiti potporu gospodarstvenicima i investitorima, a koja se očituje u sljedećim performansama: brzina rješavanja zahtjeva i izdavanja dokumentacije potrebne za davanje lokacijskih i građevinskih dozvola, komunalnih zahtjeva i drugih aktivnosti, koje su potrebne gospodarstvenicima i investitorima.
Tijekom 2013.godine uvjete za dobivanje certifikata grada s povoljnim poslovnim okruženjem ostvarilo je osam gradova jugoistoka Europe, među kojima su Bjelovar i Ivanec u RH.
Cilj istraživanja je pojasniti kako tehnologija računalstva u oblaku uz informacijsko-komunikacijsku tehnologiju zapravo rezultiraju prepoznatljivim načinom rješavanja zadanih kriterija razinama gradske ili općinske vlasti koji mogu poslužiti svim zainteresiranim gradovima. Doprinos razvoju projekta je svakako implementacija predstavljenih rješenja koja se sustavno nadograđuju novim inovativnim rješenjima.

Ključne riječi: *Certificiranje, Informacijsko – Komunikacijska Tehnologija, Grad, Računarstvo u oblaku*

1. Introduction

In the period from 1992 until 2010, world population grew at 1.3 per cent per year and increased by one billion and a half to 7 billion people in 2010 where urban population increased by 45 per cent and reached 3.5 billion.

Nearly half the world population now lives in urban areas. Cities generate 75 per cent of the total energy consumption. On the other hand, 25 largest world cities produce more than a half of world wealth. UN experts estimate that by 2050 almost 70 per cent of people will live in cities. This shows how important it is to invest in multiple innovative solutions to guarantee a good quality of life and business opportunities in accordance with sustainable development

policies. Almost 80 per cent of the total global emissions are generated from cities. The world's towns and cities are the biggest polluters of our time [8].

This sudden growth in urban population has caused problems in planning, transportation, supply and delivery. City infrastructure that was designed for a significantly lower number of inhabitants has now become unsuitable. Aging utility infrastructure, often being completely inappropriate in terms of capacity for such a rapid growth in urban population, becomes an increasingly bigger problem for organising city life.

Those cities that in spite of this sudden increase in population wish to keep up with sustainable development principles and maintain good quality of life of their citizens, concurrently attracting new investors and companies to open new jobs, are seeking for a wiser approach to urban development planning using new intelligent systems for city infrastructure, transportation, energy consumption, goods delivery as well as a wider implementation of high technology and technology innovations aimed at improving the quality of life in general.

2. 'Smart'Solutions

Above described problems have led to a gradual development of concepts using **'smart'** solutions for city living conditions with implementation of information and communications technology that is inevitable in all segments at local, regional, national and internationallevels. Implementing innovative solutions to organise entire life of people in a city, from smart tech tools and devices to energy-smart homes or city districts, has brought us closer to creating a completely new concept of intelligent cities.
Intelligent cities deploy sensor networks, which are sending off all relevant information on infrastructure, utility systems, roads, bridges, large buildings, shopping centers or public buildings and halls. These sensitive nanosensor networks promptly report on all necessary information that may indicate a possible dysfunction in any part of the system allowing timely detection, intervention and repair avoiding serious consequences. Intelligent software solutions can control the entire city utility infrastructure in an integral manner (heating systems, transportation, traffic systems, supply or cleaning), linking to all relevant city services and interactively rescue services, alert systems and state hydrometeorological institutes. An integrated and coordinated way of managing the entire city and utility systems enable us to make significant savings, improve supply and increase efficiency of utility networks [3].

3. Intelligent Cities = Digital City

Digital cities offer wide area digital networks and application services enabling a variety of aspects of social and economic life.
Local government can benefit from building a digital city and obtain competitive advantages such as:
ɞ Cutting local government costs,
ɞ Increasing the quality of communication between local government and citizens,
ɞ Increasing the quality of life and satisfaction of citizens,
ɞ Providing a large number of activities and services for both citizens and business entities,
ɞ Speeding up local economic development,
ɞ Increasing citizens safety and protection,
ɞ Stimulating growth and use of Internet in massive scale etc.
Most present wide area networks in Europe support transmission rate of up to 20 Mbit/s.

Every digital city has its own architecture, organization and services. Infrastructure models are not unique and suitable for all cities. Cost of building a digital (intelligent) city is equivalent to constructing a few kilometers of high-road. A city with a million people can be transformed in an intelligent city for less than 50 million euros, with non-linear cost reduction for small-sized cities [3].

Integrating state cities into networks is the precondition for achieving good modern life. The fact that a number of cities in Croatia are using new ICT technologies that contribute to a significant increase in efficiency and transparency of local government – makes us happy.

4. Practical Example (Business Friendly Certification South-East Europe – BFC SEE)

According to the data of this year published in the WEF's report on information technology, Croatia is ranked 51st of total 144 states by ICT competitiveness. We, therefore, strongly believe that strengthening dialogue and cooperation between representatives of the economy and public government as well as science and education is the key condition for achieving stronger development in Croatia's ICT industry, and a basis for attracting new investors.
Implementation of the second phase of Business Friendly Certification South-East Europe program (BFC SEE), initiated in 2011 by the German Society for International Cooperation Association (GIZ) and Serbia's National Alliance for Local Economic Development (NALED), started at the beginning of 2014. In Croatia, BFC SEE project is managed by the Center for the Local Economic Development at the Faculty of Economics Rijeka [1].

BFC SEE is the first regional project that stimulates development of cities and municipalities, strengthening international economic relationships within the region and contributing to creating of recognizable business quality standards at national, regional and world levels. City/Municipality Certification provides a systematically conceived tool to establish evaluation criteria and procedures that a local unit has to fulfill in order to be recognized for a favorable business environment thereby realizing goals of increased investment, revenues and economic growth at local level [1].

Carefully conceived software solutions simplify the city certification process. Criteria of Business Friendly Certification can be seen as a reminder of what a city or municipality needs to develop as its own capacity and which operative segments of city or municipal organizations need to be functional. This process is expected to serve to increase competitiveness with respect to the cities and municipalities in the region inside and outside the country borders helping them compete with competitors that started reforms during the transition process much earlier.

Criteria of Business Friendly Certification can be seen as a reminder of what a city or municipality needs to develop as its own capacity and which operative segments of local organizations need to be functional. This process is expected to serve to increase competitiveness with respect to the local units in the region inside and outside the country borders helping them compete with competitors that started reforms during the transition process much earlier.

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5. Cloud Computing Models and Levels

5.1. Cloud Computing Models

The major architectural models of cloud computingservice are known as SPI; Software as a Service, Platform as a Service and Infrastructure as a Service. Cloud computing providers offer their services according to several fundamental models [2]:

5.1.1. Softwareas s Service(SaaS)–The capability provided to the user is to use the provider's applications running on a cloud infrastructure. End users access cloud-based applications from different devices via a web browser. Saas is a technology platform that enables users to access applications via Internet and rent services as necessary, instead of actually purchasing and installing them on their own home or office computers. Companies can rent textual, table, calendar or other software according to what is needed thereby avoiding cost of software purchasing, installing, upgrading and maintenance. The end user is not concerned with the additional costs related to service provider licencing or software license, and service providers have low costs comparing to traditional database systems. Google Apps and Zoho Office are examples of SaaS.

5.1.2. Platform as a Service (PaaS)is a variation of SaaS structure that provides an end user with a development environment as a service. PaaS provides a software platform on which users can build their own applications and host them on the PaaS provider's infrastructure. Developers create applications on the provider's platform over the Internet. End users do not have complete freedom in designing and deploying applications. Users cannot check out cloud structure or network, storage systems, operation systems or providers, but do have control over applications. Sometimes, users can control environmental configuration. Some of PaaS examples are: Saleforce.com, Force.com, Cogheadand Google App Engine.

5.1.3. Infrastructure as a Service (IaaS) – IaaS is defined as computer infrastructure, such as virtualization, being delivered as a service. Instead of having to purchase software, servers, storage area or network equipment, users can buy these as a fully outsourced service. Iaas users are responsible for managing applications, operation systems, data, storage, networks, and other basic computing resources, while vendors still manage cloud infrastructure. The end user can also have a limited control over chosen network components.

5.1.4. Business Process as a Service (BpaaS)is a top-level part of the service-level architecture for cloud platform.BpaaS describes integration of technology, people, process and analysis enabling development and use of virtual inter-organizational applications, which link and integrate business activities and processes between cities and local communities.

5.2. Development Levels of Electronic Business

According to the Strategy for the development of electronic business in the Republic of Croatia for the period from 2009 until 2012, we can systematize five levels of informatization [6]:
1 – Information
Only information on service such as procedure description, books of rules etc. is available on the Internet.
2 – One-way interaction
You canprint and saveelectronic forms to your computer.

3 – Two-way communication

Interactively completing a form.Creating an application that requires authentication. After the end user has completed the form, service is initiated.

4 – Transaction

Whole service is available on the Internet including completing forms, authentication, payment and delivery of confirmations, orders or other forms of complete service via Internet.

5 – Targeted, automated proactive service

This service is completely adjusted to individual users. It is automated and proactive. This means that the end user receives electronic form (that contains all information on the user, which have already been stored in public administration information systems) and timely warning notice to submit data or initiate electronic service.

6.3. Combining Cloud Computing Models and Development Levels of ElectronicBusiness

- One-way interaction

One-way interaction describes local government web pages, on-line news and various simple on-line forms and questionnaires.

- Two-way communication

Internet forum such as Google Group is an example of cloud computing as a service categorized into a group of two-way communications. Such service can significantly improve communication with the local and regional government bodies, local branches of state government bodies or generally within a community.

Creative communication with citizens is a practical example of how to use Internet forum. For instance, when an individual or a group of people in a community need to communicate or cooperate with each other, using Internet forum and web applications can be a good way to activate citizens via electronic communication and stimulate their creative thinking. Through a process of sending and receiving creative information a local community can react better and provide new business opportunities and ways of resolving local problems. Local authorities can in this way become good managers who actually care of the community interests instead of just being bureaucratic masters filling the budget hole. Use of applications and cloud computing as a service in communication between the local government and users may enable more citizens to participate in different discussions, share their opinions about community and offer new solutions for individual problems [7].

- Transaction Service

Transaction service describes services and forms dealing with the public services and procedures provided by state eAdministration.

- Automated,Proactive and Interactive Service

An example of automated, proactive and interactive service is common work on a project and project management. Local and regional government bodies work on various projects. Most of them work on at least one large project that consists of several smaller parts where each one depends on completion of previous tasks. Following up all individual tasks, spending funds, project flow and dynamics can be valuable information not only for citizens but also economic entities. Cloud computing tools can be used for managing and controlling projects and project documentation. Every member of a project team can work individually on his or her part of the report. After all individual parts of the report have been completed, project manager and other interested parties can review the entire report or its parts [7], [5].

Project dynamics can often influence business decisions made at local community level. Project follow-up and reporting project dynamics can be simplified by use of web applications

for project management. Members of a project team can open the application from anywhere and access individual databases. Authorized persons can add or update project tasks, mark completed ones, add and disclose information on payment etc. As the project management application is accommodated on a cloud, every member of the team sees the same Gantt chart and the same task list. Data contained in the database are immediately updated as soon as any member of the team enters a change. Many project management applications have also additional functions such as web-based database sharing, bill boards, timeline and cost control etc. thereby allowing an insight into the project by elected rep

6. SWOT Analysis ofCloud Computing Development and Implementation in Local Government

A simplified SWOT (Strength, Weaknesses, Opportunities, Threats) analysis of development and implementation of cloud computing in local government can be systematized as strengths, weaknesses, opportunities and threats. SWOT analysis is shown in scheme 1.

Scheme 1. SWOT Analysis of Cloud Computing Development and Implementation in Local
Government

Strength:
🖥 Optimal use of cloud computing services as necessary
🖥 Maintaining software centrally on a cloud infrastructure
🖥 Service accessibility (available wherever you have Internet access)
🖥 Providing high-speed Internet connection (ADSL)
🖥 Affinity and capabilities of human resources for abstract and imaginative   thinking in developing and implementing cloud computing services
🖥 Several university scientific educational units in electrical engineering, computing and economics generating top experts
🖥 Developed cooperation with top foreign IT companies in the process of informatization
🖥 Development of ICT technology at an EU average
🖥 High ranking of Croatia in terms of ICT investment (according to the World Bank's data Croatia is ranked first among transition countries by ICT investment.
Weaknesses:
🖥   Insufficient number of good managers and IT experts required to build a well conceived and systematic strategy on cloud computing, particularly from the point of view of a coordinated approach to business infromatization in Croatian companies aimed at developing and implementing cloud computing
🖥 Safety problems related to confidential data made available to service providers
🖥 Bigger need for integration
🖥 Lack of companies providing server management
🖥 Difficulties in establishing responsibility for loss of data
🖥 Legal issues related to various laws dealing with hardware for data storage
🖥 Lack of strategy on cloud computing development and implementation
🖥 Low annual production of ICT experts
🖥 Low participation of local IT firms in cloud computing development
🖥 Supremacy of leading foreign IT companies
Opportunities:
🖥   Growing and synergy integration of hardware and software resources and human resources in Croatian IT firms modelled on successful IT companies and corporations from developed countries
🖥 Incentive for development of new and innovative business models operating together with technological innovations
🖥   Increased computing possibilities at lower cost, faster communication and more efficient use of computing capacity
🖥 Possible economic benefit in tandem with synergy achievement of added value at lower cost of development and use of computing system
🖥   Standardized cloud computing services enabling fulfillment of specific user (city) needs can be an attractive way of converting capital cost into business cost through faster availability and measurement of effectiveness of IT infrastructure and superstructure in the cloud

Scheme 1. (continued)

Opportunities:
▫ Creating a powerful ICT sector competitive and capable of entering into partnership with developed foreign IT companies in the cloud computing service development and implementation
▫ Stimulating integration of small-sized and mid-sized firms by reducing obstacles for entering the market (i.e. by decreasing IT infrastructure costs)
▫ Positive orientation and EU openness for investing in Croatia, particularly in ICT sector
▫ Insufficiently developed regions of Middle and East Europe with increased needs for ICT technology creating export opportunities

Threats:
▫ Non-understanding of the significance of ICT technology on the account of general lack of knowledge
▫ Increased requirements and needs for supervision over information of individual users and approach to such information and their protection by data storage provider
▫ Risks for users especially in terms of delicate data
▫ Use of outsourced cloud computing services increases risks related to citizen data and public service duties and tasks
▫ Responsibility for safety of information belonging to each individual user passes from user to provider
▫ Foreign IT companies have control over IT development
▫ Insufficient digital literacy of decision makers and focus on old technology due to social issues
▫ Lack of support for starting new business. Use of outsourced computing services increases risks related to citizen data and public service duties and tasks

7. Conclusion

Cloud computing provides a flexible, scalableaccess to hardware and software resources where end users do not need to know in advance their exact needs, but can ask for and use resources as necessary and at request. This allows for creating infrastructure conditions, which enable employees, organizations and subsystems of local government to focus on strategic factors of development of smart cities such as communication, cooperation and innovativeness.

Systematization and integration of cloud computing models and levels can help the cities in defining ways, approach and dynamics of inclusion into cloud computing systems, and contribute to the development and visualization of the informatization of local government activities and processes. A simplified SWOT analysis of cloud computing development and implementation in local government allowed us to systemize strength, weaknesses, opportunities and threats. SWOT analysis can serve in defining guidelines and building a methodological frame for quality, successful and proactive inclusion of the cities and local communities into cloud computing systems.

The biggest advantage of cloud computing is use according to need. Instead of having to purchase their own equipment, users pay for cloud services enabling vendors to rent and allocate resources to individual users according to need and priority.

The most important disadvantages are accessibility and safety. Users are expected to run business that is depending on services accommodated in somebody else's infrastructure. In case of inaccessibility due to difficulties, the end user might suffer huge losses. Other than that, confidential data must be kept secure in the cloud. Service providers are expected, therefore, to establish relationships with clients that are based on trust and ensure data protection and privacy.

There may be a number of indistinctness when defining clouds. The biggest one is what is meant by a cloud. In general, the cloud is defined based on its infrastructure size. In large infrastructures, exploitation and effective allocation of resources is very important for successful business. From user's view one feels that there are unlimited computing resources used as necessary. This is obtained by virtualization methods and smart allocation of resources.

Cloud computing has become one of the key factors influencing the concept of the smart city, which will enable building of systems of integrated and whole cities and an aligned development and functioning of local government activities and processes such as administration, energy, transportation, environment protection, health, education and culture.

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