Organizing a Fishnet Structure

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Abstract. *The fishnet organization is a new organizational form which, among others, emerged in scientific literature in the field of organization theory in the past 20 years. Questions to ask here include: How to develop and maintain such a dynamic and heterarchic structure, described with the metaphor of a fisher's net, in a real organization? How to find knowledge and abilities which are fundamental in constructing such a structure? It seems obvious that without an adequate information system this task would be almost impossible. Thus we present organizational and information tools which are needed for the development and maintenance of this dynamic organization.*

Keywords. fishnet organization, information tools, organizational tools, PageRank, wiki, forum, semantic web, Web 2.0

1. Introduction

Modern organizations in the beginning of the 21st century often face a turbulent environment and thus need to change more frequently. We are witnesses to plenty new organizational structures and forms which fundamentally change the basic propositions of organizations. Dynamic organizations today are virtual, networked, autopoietic and open [23].

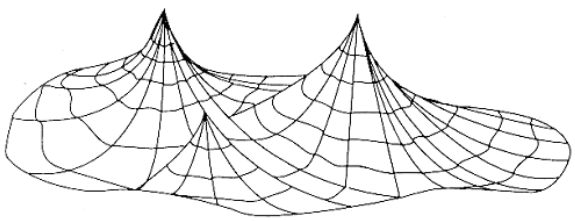

Figure 1. The fishnet organization

The idea of a network organization or heterarchy comes from Warren McCulloch's neuropsychological research on the human brain in 1945 [9]. He concluded, opposite to previous hierarchical models, that the human brain could have a heterarchical organization. He described this organization as a neural network which is specially equipped for parallel processing of information.

If we transfer such a concept to an organization, we find a structure which interrelationships are not strictly defined, but are activated and selfregulated depending on the actual situation.

The concept of the fishnet organization, invented by Johansen and Swigart [19] tries to combine the modern concept of heterarchy and the usual human habit of tendency to hierarchy and order.

A fisher's net if observed on some shore is fully non-hierarchical (thus the name heterarchy), but if we take one node and lift it up, as shown on figure 1., we can observe a dynamically created hierarchy, where the lifted node is on top. In this way we can lift and drop nodes at will, creating new, and destroying old hierarchies.

In analogy to this metaphor in a heterarchic organization, some nodes (organizational units, which in a broader context can be people, departments or even independent organizations, according to the principle of the fractal organization [23]) temporarily become some kind of manager or business coordinator.

Of course, this managerial role has to be assigned to a person which is most adequate for a given situation, or even more precise, which knowledge and experience are most valuable in solving some special type of problem which came from the environment of the organization. Here we can conclude, that the fishnet organization should be knowledge based.

A first question here is, how to find such a person for a given situation?

2. Information Tools

The information tools which we wish to point out here, and which we consider to be of use

when developing and maintaining a fishnet structure are mostly bound to modern network technologies. These technologies emerged through the rapid evolution of the Internet which interconnected the world in only a short period of time [24].

Network technologies like forums, wikis, blogs, video-blogs and similar systems, which are commonly called Web 2.0, are extremely popular among Internet users, but, as international communicology research showed [4], also become more and more popular in organizations that want to be in continuous contact with their customers.

At first there is the **forum**, a network application which allows it's users to communicate in a multimedia environment (usually through text, image and simple animated messages) and is organized through topics and subforums. A forum allows his users to create a heterarchical structure since every user is allowed to participate in any topic by replying to previous messages. The organization of the forum can be thought of like a tree structure where messages are nodes and arcs are the essential connection between message and it's reply.

Advantages of the forum are it's heterarchic structure, it's highly dynamic nature and adaptability. Disadvantages are the inability to make collective decisions and the eventual destructive communication of individuals. Against the inability of decision making, decision support tools can be used (e. g. polls, the implementation of an integral decision making process etc.) and destructive communication is solved through moderators which filter and guideline the communication.

A **wiki** system is also heterarchic in nature. Maybe the most popular implementation of a wiki system is Wikipedia (which uses the Wikimedia wiki system), the free on-line encyclopedia. The concept of a wiki system resides on the following principle: every user or visitor of a wiki service is able to change, to add new content and/or information and discuss about it. Wikipedia, as the most valuable example, was started in 2001 with the goal to create an on-line encyclopedia. 2007 it has over 1 635 000 articles and there are translations to about 250 world languages [21].

Another mechanism which is built-in to such systems is the possibility of interconnection of terms. Every term if mentioned in some article can be connected (hyperlinked) to other articles which elaborate it further. This mechanism gives users the possibility to find and understand unknown terms easier.

It could be said that the wiki system is an improvement of the forum of his own kind because communication is directed to achieve a purpose, in particular to create knowledge. Thus the advantages of wiki systems include, besides the advantages of the forum, goal attendance, direction of communication, and interconnection of terms which eases decision making. There is also an extension to traditional wiki systems, the so called semantic wikis that use concepts from the semantic web. In this way semantics or meaning is added to knowledge created on the system which eases search, integration and reasoning.

A disadvantage is the inability of making consistent decisions reflected through editor wars in which users continuously change the content of topics which they cannot agree on. This disadvantage can be solved through an implementation of an integral decision making process as discussed further.

Another drawback of such systems are malicious users which by intentionally adding incorrect information try to harm the system's consistency. Such and similar drawbacks can be solved through an implementation of an autopoietical filtering system as elaborated further.

An **autopoietical filtering system** is the idea of completely eliminating moderators from Web2.0 applications, and giving all users the same opportunities in filtering information. Every user can choose either to be a moderator her self or to use the moderation (filtering) of another user. Top lists of moderators are used to determine the most valuable moderators for specific topics. These moderators are most likely to be experts for a given topic and using their expertise they can eliminate incorrect and malicious information.

The **PageRank** algorithm was developed by the famous company Google, or more precise by Larry Page (from where the word play PageRank comes from) which, besides Sergey Brin was one of the founders of this company. They used this graph analysis algorithm, for the ranking of web pages on a web search engine. The algorithm uses not only the content of a web page but also the incoming and outgoing links. Incoming links are hyperlinks from other web pages pointing to the page under consideration, and outgoing links are hyperlinks to other pages to which the page

under consideration points to.

PageRank is iterative and starts with a random page following it's outgoing hyperlinks. It could be understood as a Markov process in which states are web pages, and transitions (which are all of equal probability) are the hyperlinks between them. The problem of pages which do not have any outgoing links, as well as the problem of loops is solved through a jump to a random page. To insure fairness (because of a huge base of possible pages), a transition to a random page is added to every page which has the probability q and is in most cases 0.15. The equitation which is used for rank calculation (which could be thought of like the probability that a random user will open this particular page) is shown under (1)

$$PageRank(p_i)=\frac{q}{N}+(1-q)\sum_{p_j\in M(p_i)}\frac{PageRank(p_j)}{L(p_j)} \qquad (1)$$

Where $p_1, p_2, \cdots p_N$ are pages under consideration, $M(p_i)$ is the set of pages pointing to p_i, $L(p_j)$ the number of hyperlinks which come from page p_j, and N the number of all pages [20]. It should be mentioned that even if this algorithm seems to be intensive and very dynamic the ranks of pages stabilize after some period of time, which allows for simpler processing.

This algorithm is also used in social network analysis. If we take that web pages are individuals (nodes) of a social network or group of people, and hyperlinks are votes of support among them, it is possible to calculate the rank of a particular person using this algorithm. In this way we can create flexible and dynamic hierarchies in a social network.

3. Information System

In order to use the described information tools we have to integrate them into an information system which will be able to support the fishnet structure.

The fishnet organization is dynamic and adaptable to situations, opportunities and influences from it's environment. Thus we need to establish a mechanism which will allow reaction. In this paper we will call such a reaction a project.

Every member of the organization should be able to start a new project as soon as he encounters an opportunity or situation in the environment which should be acted on. The result of a project is documentation which allows for implementation in a real world situation.

Every project should have it's project manager and a project team which creates and collects knowledge about the opportunities from the environment and thus creates project documentation. The manager or project leader should be an individual which is most adequate for the given project, e. g. which has the most knowledge and experience on this particular field. Project team members should communicate and exchange data, information, ideas and experiences with each other.

A project could be supported by information tools described earlier in the following manner. Every project has it's own forum on which the communication about the project takes place. It also gets a semantic wiki system which should be used for the creation of knowledge and project documentation. Every member of the organization which enters the project team should be able to communicate through the forum with the other project team members and to accumulate knowledge on the semantic wiki system.

Every team member is a candidate for the project leader. Thus every team member gives and accepts support votes to and from the other members respectively. A PageRank algorithm is used to calculate team member's ranks from the given votes, and the individual with the highest rank is promoted to the project leader. Since PageRank is a dynamic algorithm, if the vote structure changes over time, also the project leader could change. In this way a dynamic hierarchy is created inside of every project.

Now, since we constructed a tool for the creation of dynamic hierarchies we need to multiply it, in order to have multiple parallel hierarchies as it is the case in the fishnet organization. Thus, the information system becomes an information interface which offers every member of the organization the possibility to start a new project with the tools described earlier. Projects should be mutually connected through a unique semantic wiki system which in a way represents the organizational knowledge base.

In this way we designed an information system which will allow the development and maintenance of a fishnet organization and in parallel create structured knowledge.

4. Organizational Tools

In this context we will consider organizational tools to be rules and procedures which allow and organize everyday work. The following rules and procedures have to be developed in order to maintain the described organization:

- every member of the organization should be able to start a new project as soon as he encounters an opportunity in the environment which he considers to be possibly valuable to the organization;
- every member of the organization should be able to join any project for which he considers to be able to contribute with his knowledge and experience;
- every project member should be able to create documentation, accumulate knowledge and add meaning (semantics) for the integration of organizational knowledge;
- every project member should be able to give and detract votes to and from other project members respectively, with regard to their ability and knowledge on the field of a particular project;
- the highest ranked project member becomes the project leader or project manager and thus claims rights to make time critical decisions, e. g. decisions which should be made in a short period of time;
- time uncritical decisions are made through a collective integral decision making process, a process which consists of preparation, making, implementation and controlling of decisions [17].

Such defined organizational tools, which we also could call business rules, allow for the creation of a fishnet organizational structure with special emphasis on knowledge and experience of the project leader. They also define the need for adding semantics to particular parts of project documentation which allows creation of an organizational knowledge base.

5. Implementation

For the purpose of implementation of the described information system, we developed a full documentation and implementation guidelines. Figure 2. shows a use case diagram, which is part of the documentation. The documentation consists of a series of diagrams which were developed using a customized framework for the strategic planning of information systems [2].

Our project is in the phase of final implementation. We decided to use Zope [22] as a platform on which the information system should be implemented. The project is fully Open Source under a GPL licence and available at [15].

In addition to the described concepts which are bound to the creation and maintenance of a fishnet structure other concepts from communicology (mind mapping, idea writing, Delphi method etc.), organization theory (virtual and open organization, balanced scorecard etc.), decision theory (integral decision making process, multicriteria decision making methods etc.), information systems (autopoietic filtering, development, and moderation, Open Source, knowledge bases etc.) and deterministic chaos theory (autopoiesis, attractors etc.) are used but constrained with place we decided to present a particular view of the system.

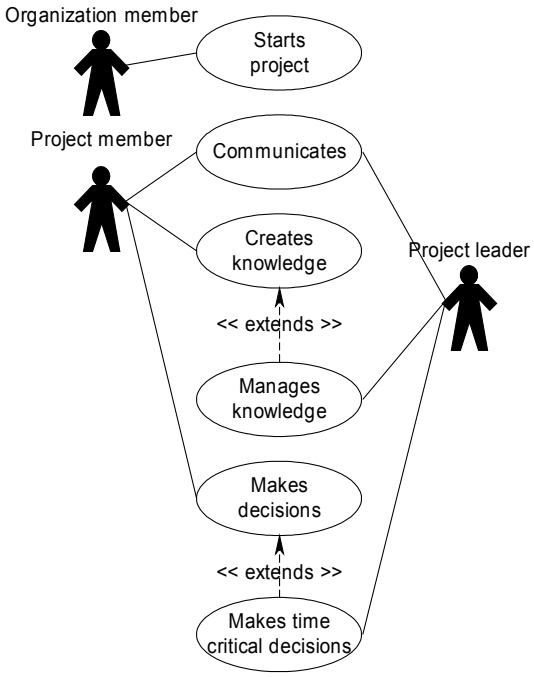

Figure 2. Use Case Diagram

We hope that we will be able to prove our system and ideas in real world environments in near future.

6. Related Work

Up to our knowledge there has been no attempt in creating an information system to support a fishnet organization. Still there are

similar projects which should be mentioned here.

At first OpenSource project management systems like SourceForge [18], RubyForge [13], and JasperForge [3] provide project management facilities to any OpenSource developer. SourceForge developed by VA Software, the leader of such systems at present time, hosts over 100 000 projects and has more than 1 000 000 registered users. The system is also provided for corporal use to IT companies with significant success.

OpenSource project management systems (especially in IT companies) differ from the proposed system since they were developed exclusively for the purposes of IT project management. Also they do not provide additional adaptibility and flexibility since a developer can only join a project if the project leader (which is a static role) allows him to join. It can be concluded that such systems allow the creation of multiple static (as opposed to dynamic) hierarchies.

Projects like OpenOrganizations [7], DDD [11] (Dynamic Distributed Democracy), and SD2 [16] (Structural Deep Democracy) should also be mentioned. The OpenOrganizations projects tries to apply concepts encounterd in OpenSource project management to usual organizations. Guidelines for transparent and consistent decision making are proposed. The SD2 and the DDD projects (in a context of political organizations) aim to use PageRank and other social network algoritms for decision making. All mentioned projects lack knowledge management facilities since their primary purpose is decision making and organizational structure building.

Semantic wiki systems like Ike Wiki [14] or Platypus Wiki [8] are extraordinary tools for collaborative knowledge creation and sharing. Still, since it isn't their primary purpose, they do not provide project management and decision making facilities.

The METORA [5] system, which is maybe the most similar to the proposed one, provides knowledge and expertise management and sharing facilities to organizations and allows for community building and interconnection with the environment of the organization. The system still lacks the possibilities of fishnet structure creation, e. g. the adaptability and flexibility provided through dynamic hierarchies.

7. Discussion

From the previously described cases we can conclude that there are partial solutions to the described problem. The amazing success of OpenSource project management systems (especially in the case of IT companies) gives us the idea to apply this concept in a broader context of dynamic organizations.

There are also experimental results of applying ranking algoritms to social networks for decision making like in [10] and [12]. The analogy is simple since organizations are special cases of social systems.

Semantic web technologies are shown to be efficient in knowledge management [1]. Especially wiki systems allow for fast and dynamic creation of content.

From this reasoning we can conclude that by integrating modern Web2.0 technologies, which were proven to be succesful, modern semantic web technologies (also proven to be succesful), and developed methods from the field social networks we can expect the faciliation of a fishnet structure through such a developed information system.

Extensive testing in real world circumstances must be conducted in order to proove our reasoning.

8. Conclusion and Future Research

In this paper we described information and organizational tools which can be used to develop and maintain a fishnet organization.

We also tried to show that modern network technologies like the forum, wiki systems, semantic web and the PageRank algorithm, when used in a particular way e. g. integrated into an information system, support the organization of such a dynamic and adaptable structure.

Adequate organizational tools, as we argued, allow the creation of structured knowledge, which can later be used in knowledge management and which ease new projects' development.

Such a system, if made available through network technologies like Virtual Private Networks, allows distributed organization and work on organizational projects. It also allows for greater dynamics of the organization as well as faster reaction to situations from the organizations environment. Thus it provides an organization with flexibility and adaptability. Such a system can be used in any organization

where is need and/or will for a heterarchic structure.

Future research in this field includes the final implementation of such an autopoietic information system and it's testing in real world situations.

9. References

[1] Blumauer A, Pellegrini T. Semantic Web Fibel, Leitfaden un Einstiegspunkte fur die Praxis, Semantic Web School, Vienna, 2006.

[2] Brumec J, Vrcek N. Strategic Planning of Information Systems (SPIS) — a Survey of Methodology, Journal of Computing and Information Technology - CIT 10, 2002, 3, p. 241–247.

[3] JasperForge.org. Open Source Development Portal, http://www.jasperforge.org [03/20 /2007]

[4] Jurin E. Blogosfera u novoj komunikacijskoj areni, manager.hr Poslovni Svijet 1025(XVII) [01/11/2006.] p. 22.

[5] Metora.de. METORA – Quelle des Wissens, http://www.metora.de [03/20 /2007]

[6] Nadler DA, Gerstein MS, Shaw BR. et. al. Organizational Arhitecture. Designs for Changing Organizations. Jossey-Bass 2004.

[7] Open-Organizations.org. The Open Organizations Project, http://www.open-organizations.org [03/20 /2007]

[8] PlatypusWiki. The Semantic Wiki Wiki Web, http://platypuswiki.sourceforge.net/ [03/20 /2007]

[9] Reihlen M, Rohde A. Das heterarchische Unternehmen: ein flexibiles Organisationsmodell im wissensbasierten Wettbewerb. Beitrag fur die Zetschift Lernende Organisation, http://www.uni-koeln.de/wiso-fak/planung/veroeff/reihzfo02.pdf [02/03/ 2004]

[10] Rodriguez M. Social Decision Making with Multi-Relational Networks and Grammar-Based Particle Swarms, 2007 Hawaii International Conference on Systems Science (HICSS), Track: Collaboration Technology - Social Cognition and Knowledge Creation Using Collaborative Technology, Waikoloa, Hawaii, LA-UR-06-2139, January 2007.

[11] Rodriguez M, Steinbock D. Dynamically Distributed Democracy, http://en.wikipedia.org/wiki/Dynamically_Distributed_Democracy [03/20 /2007]

[12] Rodriguez M, Steinbock D. Societal-Scale Decision Making Using Social Networks, North American Association for Computational Social and Organizational Science Conference Proceedings, 2004.

[13] RubyForge.org. Home for Open Source Ruby Projects, http://rubyforge.org [03/20 /2007]

[14] Salzburg Research. Ike Wiki, http://ikewiki.salzburgresearch.at/ [03/20 /2007]

[15] Schatten M. TAOPIS, http://sourceforge.net/projects/taopis [02/10/2007]

[16] SD-2. Structural Deep Democracy, http://groups.yahoo.com/group/sd-2 [03/20 /2007]

[17] Sikavica P. (et al.) Poslovno odlucivanje, II izmj. i dop. izdanje, Informator, Zagreb, 1999.

[18] SourceForge.net. Collaborative Developement Environment, http://www.sf.net [03/20 /2007]

[19] Swigart R, Johansen R. Upsizing The Individual In The Downsized Corporation Managing In The Wake Of Reengineering, Globalization, And Overwhelming Technological Change. Basic Books 1995.

[20] Wikipedia contributors. PageRank. Wikipedia. The Free Encyclopedia. February 14, 2007, 17:18 UTC. http://en.wikipedia.org/w/index.php?title=PageRank&oldid=108111261. [02/15/2007]

[21] Wikipedia. http://www.wikipedia.org [02/10 /2007]

[22] Zope.org. The Web Site for the Zope Community, http://www.zope.org [10/10 /2005]

[23] Zugaj M, Schatten M. Arhitektura suvremenih organizacija. Tonimir Varazdinske Toplice 2005. p. 1.

[24] Zugaj M, Schatten M. Nekoliko rijeci o otvorenoj organizaciji (A Few Words about Open Organization). 5th International Conference on Production Engineering. RIM 2005. Bihac Bosna i Hercegovina, 14th – 17th September 2005. p. 917. - 922.