Autopoietic Information Systems in Modern Organizations

Miroslav Bača[1], Markus Schatten[1], Dinko Deranja[2]

[1]Faculty of Organization and Informatics, Pavlinska 2, 42 000 Varaždin
[2]Security and Intelligence Agency, Av. grada Vukovara 33, 10 000 Zagreb, { miroslav.baca, markus.schatten }@foi.hr, dderanja@public.srce.hr

In this paper[1] we argue for the possibilities of applying the concept of autopoiesis to the information systems of modern organizations. Modern organizations in today's rapidly changing, turbulent and complex environment are virtual, open, heterarchic and autopoietic. The main question we try to address in this paper is how to support these organizations with an adequate information system. We show that it is possible to develop autopoietic information systems that should be able to respond to the challenges of modern organizations.

Keywords: autopoiesis, information system, organization

Avtopoetski informacijski sistemi v modernih organizacijah

V pričujočem prispevku se zavzemamo za možnost uporabe avtopoetičnega koncepta v informacijskih sistemih modernih organizacij. Moderne organizacije so v dandanašnjem hitro spreminjajočem, nemirnem in zapletenem okolju virtualne, odprte, heterarhične in avtopoetske. Najpomembnejše vprašanje, ki ga v tem prispevku skušamo obravnavati, je, kakšen naj bo primeren informacijski sistem za podporo teh organizacij. Pokazali smo, da je možno razviti avtopoetski informacijski sistem, ki naj bo sposoben odgovoriti na izzive modernih organizacij.

Ključne besede: avtopoetika, informacijski sistem, organizacija

1 Introduction

Modern organizations today are liable to frequent and fundamental changes coming not only from their environment, but also from their internal need for change. Every day we witness many organizational structures and forms that radically change the organizations' basic premises. In today's dynamic circumstances, organizations are virtual, networked, autopoietic and open (Žugaj and Schatten, 2005:1). The concept of organizational architecture might be a good metaphor for a holistic view of an organization. Organizational architecture states that the organization should be perceived in its entirety as an open, complex and chaotic system that influences and is influenced by its environment (Žugaj and Schatten, 2005:21).

The environment is the main factor that determines new trends in organization and, by implementing these trends, organizations influence the environment. In such a context we can define the main forces that drive organizations to change. According to Nadler (Nadler et al., 1992:1-3) these forces include technology, competition, oversupply, globalism, customer expectations, government participation, ownership and work force dynamics.

We can conclude that only organizations that can respond to these challenges will survive. In order to survive, organizations develop and create new organizational forms such as[2] (1) autonomous work teams, (2) high performance work systems, (3) strategic unions and alliances, (4) organizational satellites and spinouts, (5) networks, (6) self-organizing organizations, (7) fuzzy boundaries and (8) team work at the top of the organizational pyramid (Nadler et al., 1992:5-8).

The fundamental question is how to support these modern dynamic organizations with information technologies, or how to design, implement and maintain an adequate information system in these dynamic conditions.

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[2] It should be mentioned that these organizational forms are most common in services and information sector organizations. Examples of such organizations are consulting, software engineering, architecture, marketing, etc.

2   Modern Organizational Forms

Many new organizational concepts, structures, architecture and forms have been described in the literature of modern organization theory. The basic concepts on which we base our further elaboration are: (1) heterarchic or networked structures, (2) *ad hoc* structures, (3) a process and project approach, (4) organizational openness and (5) the concept of autopoiesis from organizational chaos theory (Schatten and Žugaj, 2005:217).

2.1   Heterarchies

The concept of a *heterarchic* organization (or network organization) is based on the following: an organization consists of organizational units (which in this context can be individuals, teams, departments, divisions and even entire organizations or groups of organizations by the fractal organization principle (Žugaj and Schatten, 2005:149-151)) that are mutually connected through information links (mostly based on modern information technology), are mutually independent, heterarchically organized (as opposed to hierarchy), and operate both internally and externally (with their environment) in most cases sharing some common goal (Žugaj and Schatten, 2005:106). The idea of a heterarchical organization comes from neuropsychological research into the human brain conducted by Warren McCulloch in 1945 (Reihlen and Rohde, 2004:3). He concluded that the human brain must have a heterarchical organization as opposed to the previously defined hierarchical models, and he described this organization as a neural network that is designed specifically for parallel information processing. If we apply such a concept to an organization, we get a structure where interrelationships are not strictly defined, but are activated or self regulated depending on the particular situation (Žugaj and Schatten, 2005:106).

A good example of this kind of organization is the fishnet organization, shown in figure 1. If we observe a fishing net on the coast, it seems completely nonhierarchical. But if we take one node and lift it up, we get a hierarchical structure. Lifting up further nodes and dropping the old ones, we can see the dynamic creation of new hierarchical structures and the destruction of old ones.

2.2   Ad-Hocracies

Ad-hoc suprastructures are concepts that are built on top of existing organizational structures and they emerge as a response to some problem or change in an organization's immediate environment (Žugaj and Schatten, 2005:119). *Ad hoc* organizations are characterized by adaptability, readiness, individual initiative, the desire for experimentation, creativity and outside growth and support (Baker and Branch, 2005:7). They usually disappear when the environment problem is solved. A Virtual organization[3] is a target-oriented suprastructure of geographically separated entities (organizational units) that are specialized for a predefined area of activity and are interconnected through space, time and organizational limitations – mostly using information, communication and network technology for efficient and flexible cooperation and exchange of knowledge. Figure 2. illustrates the concept of a virtual organization.

2.3   Process and Project Orientation

Process and project orientation puts an organization into a different perspective. They approach an organization as a system of processes (instead of departments and a hierarchy) and they analyze a series of ventures or projects instead of continuous business operations. In the process approach[4], grouping is performed by simultaneously applying all the principles that evolved from classical management theory,
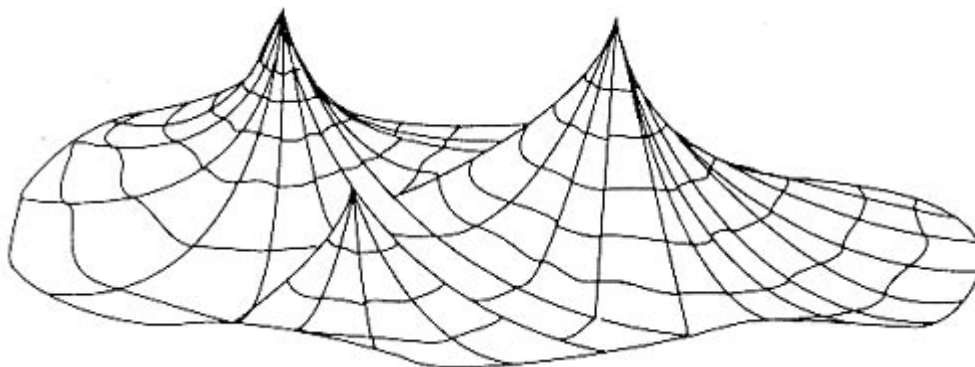

Figure 1. *The fishnet organization (Johansen and Swigart, 2004:on-line)*

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[3] The Virtual organization is one of the most widespread examples of the *ad hoc* organization in expert literature. Barnatt (2004) says that these organizations exist in cyberspace, that they develop proportionally with the development of information and communication technology and that they can be found within conventional organization structures. In cyberspace he understands the media in which electronic communication and computer programs exist, and he argues that the understanding of this term is essential to the understanding of the virtual organization.

[4] Which is very important due to the business process reengineering and similar paradigms that enable business system management through business processes and their support through information technology.
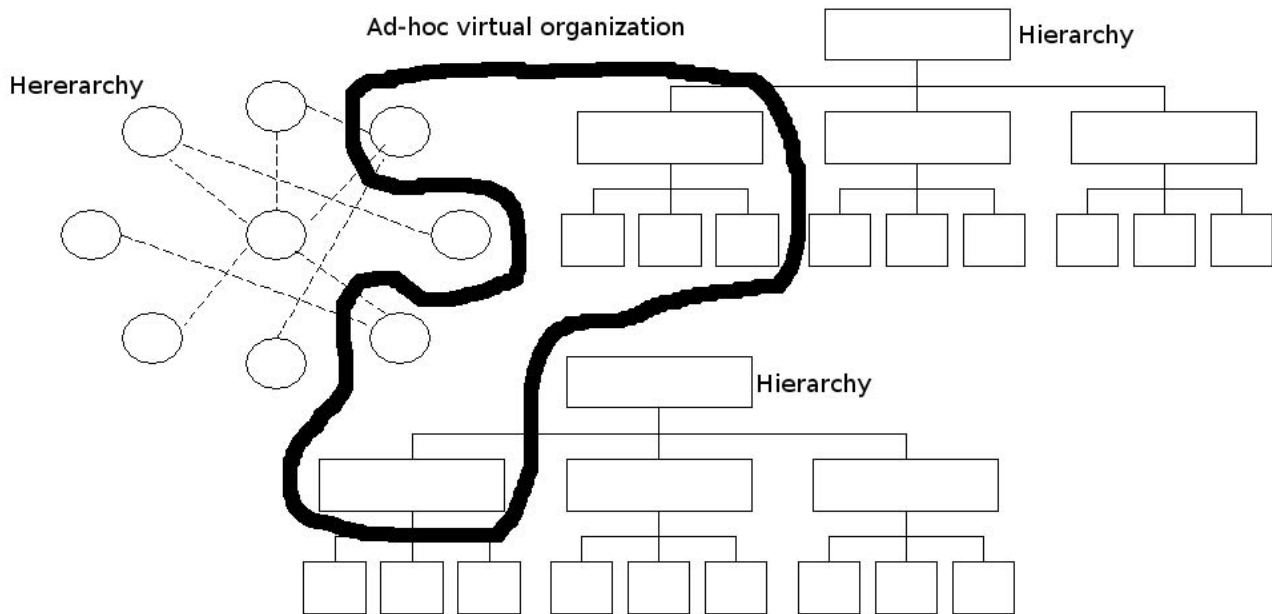
Figure 2. *The virtual organization (Barnat, 2004:on-line)*

meaning that work broken into segments by *scientific management* is being reintegrated (Buble, 2003:80). The project approach to organization subsumes task or project orientation and interdisciplinary team work. Projects are always time limited, so project organization is time limited from the beginning of the project until its conclusion (Dulčić et al., 1996:44).

At a first sight, it seems impossible to combine these two approaches together[5], but their mutual benefits (along with the elimination of their disadvantages) can be useful in the hypertext organization introduced by Ikujiro Nonaka (1995). This kind of organization consists of three layers – a business layer, which in essence is the performance of everyday bureaucratic tasks; a project team layer used for executing the multidisciplinary activities that increase an organization's total knowledge; and a knowledge based layer that is imaginary and where the knowledge accumulated by the previous two layers is once again categorized and put into new contexts (Žugaj and Schatten, 2005:165-168).

2.4 Openness

Modern organizations must permanently be in contact with their clients and are therefore forced to be more open. This behaviour makes the boundaries that separate the organization from its surroundings become fuzzy[6]. The most important factor apparently seems to be the

technology. When a client can "enter" the network and interact directly with the organizational tools and when the client becomes a part of the business process helping in the design of products and services, it will be hard to determine who is and who isn't a member of an organization. The development of mechanisms for managing such unclear boundaries would allow organizations increased positive interaction with its surroundings. One of these mechanisms is the open organization concept[7], a result of using the open source concept in organizations (Nadler et al., 1992:1-3).

2.5 Autopoiesis

The word autopoiesis comes from the old Greek words *autos,* which stands for self, and *potein,* meaning create. In context of autopoietic systems it can be said that the system itself is a product of an autopoietic system (Žugaj, 1996:59). The term autopoiesis was first introduced by Humberto R. Maturana who published an article in 1980: *Autopoiesis* and Cognition: The Realization of the Living[8] and presented the basic ideas of autopoietic theory in cognitive biology in collaboration with his student and associate Francisco J. Varela (Whitaker, 2001:on-line).

They noticed that organisms have the ability to adapt to their environment, while being able to keep their own identity within that environment. That dual capability is

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[5] The process based approach is oriented to everyday operations, while the project based approach is oriented to certain ventures which generally are not repeatable and are time limited.

[6] Architectonic elements such as strategic unions and alliances, organization satellites and networks only accent this unclearness even more.

[7] According to Žugaj and Schatten (2005:921-922), an open organization is an „organization that is in constant interaction with its customers, which attentively listens and respect their opinions, an organization without strict hierarchical relations in which the members network together in order to achieve their common goal. It is a fully project and process oriented, transparent and autopoietic organization.".

[8] Which is actually a combination of two earlier works published in 1970 and 1973.

called autopoiesis. In cybernetics, autopoiesis is a special case of homeostasis in which the critical constant system variable is the organization itself.

Niklas Luhmann, a German sociologist whose work is fundamental to social system theory, found autopoiesis in social systems. The main basis of his theory is communication, since social systems are systems of communication. Every system is determined by the border between the system and its environment. This border is complex (chaotic) in nature in the case of social systems. Therefore, the internals of the system is an area of reduced complexity. Communication inside the system is performed by choosing only limited quantities of information outside of the system, and the process of choosing this information is called "reduction of complexity". The criterion on which information is chosen from the surroundings is called a sense (germ. *Sinn*). Every social system has its distinctive identity, which is reproduced constantly in its communication and depends on what is considered to be of sense or to be senseless. If a system is unable to reproduce its identity, it looses its sense and disappears back into the environment. Luhmann used the word autopoiesis to define this process of the reproduction of filtered elements from a complex environment (Wikipedia, 2005:on-line).

Since organizations are a special type of social system it was expected that the concept of an autopoietic organization would also emerge (Bakken and Hernes et al., 2003). Autopoiesis in an organization can be explained metaphorically as the fact that organizations survive as independent entities, although the people inside them are changing due to constant employee fluctuation.

3 What is an Autopoietic Information System?

After defining autopoiesis in biological, social and organizational systems, we now try to define it in the context of information systems. To be able to define an autopoietic information system we need to answer a few other questions, such as: what should an autopoietic information system for modern organizations look like? Is it possible that such systems already exist? And if they don't exist, is it possible to utilize some familiar concepts taken from the existing information systems to create such a system?

Autopoietical information systems must support heterarchical relations and, if possible, enable the establishment of a fishnet organization to express the necessary potentials of an individual at the right time. Such systems must be able to support an ad hoc or virtual organization, which means that it has to be adaptable and must allow quick changes. They must enable the process and project approach to organization management and should be open to the customers, who can constantly interact

with the organization. The system must be autopoietic, but the question is what does it mean when we say that an information system is autopoietic?

To answer this question, we must set up the following definition: *Autopoiesis in the context information systems denotes the ability of an information system to continuously adapt to the needs of its current users and also to preserve all the characteristics that make it unique and recognizable as an information system*. Using this definition we can further define an autopoietic information system as: *a system that continuously adapts to its users and the surroundings it operates in by collecting, storing, keeping, processing and disseminating the information important for the organization and for society, in order to make it accessible to everyone who wants to use it.*

According to these definitions, we could state that all information systems are autopoietic to a greater or lesser degree[9]. But are today's information systems able to satisfy the needs of modern organizations? The information systems implemented in today's organizations are mostly inflexible because they represent a data snapshot of reality at a given moment and they hardly adjust at all to dynamic circumstances. We can conclude that there is no such information system today that would be able to solve the problems of modern organizations.

Are there concepts that would enable the construction of such a system and, if they exist, what are they? The definition of autopoiesis in the context of information systems reminds us of the open source paradigm. Information systems that are developed in an open source manner become more and more adjusted to its users needs. The need to network and the necessity of being adaptable reminds us of modern WEB 2.0 technologies, which we shall address now.

3.1 Open Source Paradigm

The approach to building information systems and applications based on open source is used by many very successful systems[10] such as Apache, Perl, Wikipedia, Mozilla and Linux, to give the most popular examples. The concept of an open source project[11] functions in the following way: a programmer (or team of them) starts an information system or an application development project. All the source code they produce, the application and the documentation is publicly accessible, usually via the Internet. Users play an important role in the system development process. They test it, check it, make suggestions, report bugs, criticize the functionality, etc. If the application or information system is widely used, it becomes more and more aligned with the customers' needs and its environment, which by our definition means that the information system or application is developed autopoietically.

A question to ask here is how it is possible to achieve

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[9] The degree of autopoiesis manifests in degree of adaptability of the system to its users and environment.

[10] Many successful systems, probably much more than open source systems, were developed in a closed source environment using traditional software engineering methodology.

[11] Not to be mistaken with classical (commercial) application development, where a development company in addition to the application sells the customer the source-code of the application.

any results at all in such an apparently chaotic development? In some cases even excellent results? One of the fundamental problems with the classical software development models is the so called Brooks law, which states that "the complexity of the execution and communication in a project has a square growth in relation to the number of executors, while the work achieved only has a linear growth". In other words, with N executors on a project, there are:

$$\frac{N \cdot (N - 1)}{2} \qquad (1)$$

communication lines between them, which would make the communication in a project with thousands of executors (as is the case with open source projects) almost impossible. But Brook's law is implicitly based on the premise that the communication structure between the executors is a full graph (everyone communicates with everyone), which isn't the case with open source projects (Raymond, 2005: on-line). Autopoietic information systems for modern organizations could be developed taking advantage of the open source paradigm. In this manner they could be constantly adapting to the requests and needs of its users and its environment.

3.2 Modern Network Technologies

Modern network technologies are the consequence of the fast growth of the Internet, the world's biggest network. The Internet became very popular among organizations wanting continuous communication with their clients. It is necessary to describe the most important network technologies in order to understand them better.

A *forum* is a network application that allows its users multimedia communication (most often through text, images and simple animations) and is organized into subjects and subforums. A forum is organized hierarchically so that every user can participate in the communication process by answering previous messages. The communication process of this system can be thought of as a general tree structure in which the nodes are messages and the arcs are the essential connections between message and answer.

The concept of a *wiki* system operates in the following way: every user or visitor to a wiki service on the Web can edit the articles and information encountered there, add new articles and/or information and discuss the existing ones. An additional mechanism that is built into such systems is the possibility to interconnect terms used in the articles. In other words, every term that is mentioned in one article of the system can be connected with other articles that elaborate on it further. This mechanism facilitates finding and explaining unknown terms to its users. A disadvantage of such a system though, is the lack of a mechanism for consistent decision making. In other words, such systems are often affected by the so called editor wars, where users start fighting each others by constantly changing some disputable content in an article.

Peer-to-Peer (P2P) is a group of networking protocols that, instead of the usual client-server model, allow each participant to be both client and server simultaneously. The concept is based on mutuality as every user shares certain content placed at the disposal of other users who also gives him the right to access their shared content. P2P protocols are not used for interpersonal communication, but for the exchange of electronic data. Their advantages are the stability of the system and the fast and dynamic dispersion of electronic data. Disadvantages might be the lack of organization of the content and the inability to determine the trustworthiness of certain electronic data.

Web services are modern networking technologies that enable the usage of remote procedures or services as if they were local. They allow the development of distributed networking applications without the need to contain all the parts of it on a single computer or server. *Extensible markup language* (XML) is a data description language. It is very simple and intuitive and it is often used in conjunction with web services for the interchange of data between local application and the service. *Business to business* (B2B) communication is a modern communication concept between different organizations, distinguishing it from the *Business to Customer* (B2C) communication model used by the organizations to communicate with their customers. B2B often relies on concepts such as web services and XML for the interchange of data.

3.3 Additional Concepts

These concepts are not enough by far to address all the needs of dynamic organizations, and therefore it is important to examine other concepts for improving system efficiency and adaptability.

An *Open Source Project Management System* (OSPMS) is a system that enables the management of open source projects. It consists of different communication channels used by the developers or open source application users to communicate with the project leader, or in most cases, with the programmer himself. It also contains a *Concurrent Version System (CVS)* used to manage concurrent versions of the open source project.

Mind mapping is another modern communication technique. It is used across many different areas including personal, family, educational and business situations for making notes, modified brainstorming technique, composing reports, repetition and generally explaining complex concepts (Wikipedia, 2006:on-line). This technique can surely find its place in an autopoietic information system for modern organizations because of its versatility and adaptability to human comprehension behaviour.

Idea writing and Delphi are creative group-based problem solving techniques. The brainstorming technique, where participants generate a great number of ideas through intensive discussion, is far more familiar, but brainstorming assumes that all participants are physically in the same room so that they can discuss. In a network environment this is not the case. Of course, it is possible that they can communicate on-line using real time chat applications, but the idea writing technique variant is considered more appropriate to implement. Idea writing is used to solve problems that require great creativity and a large number of solution variants for solving them. Delphi applies to problems it is hard to find a consensus for and when a small number of special solution variants are required.

One important consideration when modelling information systems – perhaps the most important one – is quality and effective decision making support. Decision making is the process of creating and evaluating solution variants of a problem as well as the process of choosing among these variants. In essence, decision making is a process that can last a longer or a shorter period of time and results in a decision made. This definition implies that the decision making process consists of two phases: (1) the decision preparation phase and (2) the decision making phase.

The integral decision making process (in a wider context) includes two more phases: (3) the decision implementation phase and (4) the implementation control phase (Sikavica et al., 1999). By passing through the phases of the integral decision making process, the decision-maker uses certain methods and procedures that ease the final decision making and allow him supervision and control of decision implementation. In the preparation phase, the decision-maker informs himself about the problem and the decision goals, possible solution variants are generated and their evaluation is performed. The preparation phase thus consists of five sub phases:

- Problem identification
- Definition of tasks and goals
- Snapshot and analysis of the current situation (information gathering)
- Generation of solution variants
- Evaluation solution variants.

In a decision making phase, one of the previously proposed variants is being chosen. The decision implementation phase is a phase where the previously chosen decision is being implemented. In the implementation control phase, the implementation of the decision is checked and monitored. This phase can include monitoring the decision results, monitoring the correctness of the decision implementation, etc.

The integral decision making process shows extremely good characteristics for being supported by modern information technologies. Modern expert systems, decision support systems and management information systems often do not implement all the phases of this process. Similar modern groupware tools are not focused on the decision making process. Therefore the idea of implementing this process into an autopoietic information system for modern organizations emerged.

3.3.1 An Autopoietic System for Continuous Development

The idea of an autopoietic system for continuous development is very simple and it fits the open source paradigm development framework. Since the system being developed using an open source paradigm is constantly under improvement, several methods and techniques have evolved to support the upgrade and change of such a system. It is possible to modernize that concept by directly integrating the subsystem of upgrade and change into the information system. It is necessary to ensure that the development of the system can be performed in parallel with the operation of the system that includes a decision

support mechanism. Therefore, the decision to upgrade or perform a global change should be performed by an automatic procedure that starts the adequate method of the information system that is being changed or upgraded.

3.3.2 Autopoietic Filtering System

In order to make the system more heterarchic, we propose the following concept. Every user can be an information moderator instead of specific, selected individuals. That way, everyone can make his own view of the information that is published on the system. Moreover, we are adding the possibility that everyone who wants to can acquire the view or filter of another user. In this way, a list of best moderators is created autopoietically.

3.3.3 PageRank/InPrestige

Structural Deep Democracy (or SD-2) is an elaborate (SD-2, 2006:on-line) application of PageRank/InPrestige algorithms in social systems. The PageRank algorithms family serves for web crawler page ranging, which is one of the reasons behind the enormous success of the Google company. PageRanking, besides only taking web page content, also takes into account the number of ingoing and outgoing hyperlinks to and from the page.

Ingoing hyperlinks are hyperlinks from other pages that link to the current page. Outgoing hyperlinks are hyperlink destinations that the current page points to. PageRanking is iterative and starts from a randomly selected page by following its hyperlinks. It can be seen as a Markov process in which states are pages and transitions (all equally possible) are the hyperlinks between pages. If the system encounters a page that has no hyperlinks, or if a loop occurs it is solved by randomly choosing another page again and starting over. In order to preserve fairness, because of the large number of web pages and long calculation times, a transition to a randomly chosen page is added to all pages with a probability of q, which is equal to 0.15 in most cases. The formula for calculating the rank, which is the probability of a random user opening that specific page, is shown below (2)

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

(2)

where p_1, p_2, ..., p_N are pages under consideration, $M(p_i)$ is the collection of pages that points to p_i, $L(p_j)$ is the number of hyperlinks that are coming from page p_j, and N is the total number of pages (Wikipedia, 2006:on-line). It should be noted that although the algorithm looks very dynamic with frequent changes, page ranks stabilize after a certain period of time, allowing simpler processing.

If we assume that every page is an individual in some social system and every link is a vote that an individual gives to another individual we get the InPrestige algorithm for social networks, a concept on which SD-2 is based. If we transfer a modified SD-2 concept into an organization, we get a flexible mechanism to support the fishnet

organizational structure, because rank based data can be a good indicator of the capability of a node in certain area.

4   System Model

The autopoietic information system model contains these concepts. It has to be an open type system in order to support open organizations that impose a web-based interface. As a starting point, the information system framework should be an Open Source Project Management System (OSPMS). That way we are setting up an organizational procedure or rule by which every member of the organization can start their own project. Moreover, from the OSPMS we can take version management systems and systems for alerting interested parties about project results. Using this formation we are stimulating the heterarchical structure of the organization members.

If a network structure of project participants is formed on every project in a way where the PageRank or SD-2 concepts between project members are implemented, we get a fishnet structure or specific decision structure. That means that, as the number of projects grows, we shall be able to identify the most competent individuals for certain project types. SD-2 recommends that, in smaller groups (of up to ten members), three members should get the right to make decisions by voting, and five members for larger groups.

A wiki system can provide the ability for everyone to participate in the creation and elaboration of content, advanced content publishing capabilities bound to every single project, as well as the term interconnection system. Mind mapping can also find effective usage as a creative presentation method. Moreover, every single project can have its own discussion forum.

In order to introduce a certain order into potential disorder, we establish the autopoietic filtering system with a modification allowing the use of SD-2 instead of ranking lists. We do this by forming a permanent project in which guidelines are autopoietically developed for moderating and moderators themselves are creating a moderators hierarchy using the PageRank algorithm.

To a system organized like this, we can add the integral decision making process implementation. We set up an organizational procedure where every decision should pass all the phases of the integral decision making process. It is necessary to implement appropriate presentation methods and, if necessary, multimedia content for the information gathering sub phase. It is necessary to implement creative problem solving techniques such as idea writing and Delphi for the sub phase generating solution variants . It is also necessary to establish a procedure where everyone involved in a project can participate in generating ideas, if they wish to. In the phase evaluating solution variants, it is necessary to implement one or more multicriterial decision making methods (such as a decision tree, Electre or Promethee), which should be accompanied by the ability for each project member to make and publish their own evaluation.

In an initial OSPMS it is necessary to build in an autopoietical system for further development and administration. We do this by establishing two more additional projects in which we perform (1) the administration of the current system and (2) further development based on the open code principles. By doing that, a system becomes adaptable and able to handle fast changes.

Our system still misses integration features, which we accomplish by setting up web services for B2B communication. To make the integration features truly autopoietic, we suggest using a modified P2P protocol for sharing the data warehouse that emerges over time in an autopoietical information system.

We can state that an information system organized like that would be heterarchical and it would support the fishnet structure. Moreover, since it has a web based interface, it enables the establishment of *ad hoc* and virtual organization. The system also enables the hypertext organization concept through which it represents the project team layer and knowledge based layer implementation. The remaining layer requires a traditional information system to support a bureaucratized business operation in an organization. In the end, we can say that this system would be extremely autopoietic, unlike existing information systems.

5   Partial Solutions

As mentioned earlier, there is no such system that incorporates all the concepts described in this paper. However, there exist some systems that can be considered partial solutions. Open Source Project Management Systems like *Source Forge* (SF, 2007:on-line), *Ruby Forge* (RF, 2007 : on-line), *LibreSource* (LS, 2007 : on-line), etc. offer their users a lot of functionality such as wiki systems, forums, mailing lists, concurrent version and other systems. Still such systems are specially designed for open source application development projects and not oriented towards organizations. Also they lack decision making capabilities, which make them almost useless for modern organizations.

Modern semantic wiki systems add semantics (meaning) to the traditional wiki systems. They have the capability of better organized knowledge on a wiki-like system but they still lack project management and decision making functionality.

A partial implementation on which the authors are working, but which is still a work in progress, can be found at (TAOPIS, 2007 : on-line). The aim of this project is to create a system similar to the one described, but this is far from completion.

6   Conclusion

In this paper we pointed out that modern organizations need a new kind of information system, a system that will support virtual, heterarchic, open and autopoietic organizations. We argued that such a system, which would fit the needs of dynamic organizations, has not yet been developed.

We also showed that the term autopoiesis, besides operating in biologic, social and organizational contexts, can also be considered in the context of information

systems. We propose that an information system is autopoietic if it continuously adapts to the needs of its users and its environment. If an information system is autopoietic enough (since, as we argued, every information system is autopoietic to a greater or lesser degree) it will be able to support modern organizations.

We analyzed modern information technologies (concentrating especially on network technologies) in order to identify concepts that make an information system more autopoietical than the others. Open source was identified as a concept that allows information systems to be developed autopoietically. Forums, wiki systems, Web services, project management systems and the PageRank algorithm implemented in an organizational context allow users to communicate and work in a heterarchical, open and virtual environment. Modern organizational and communicological concepts, such as the integral decision making process, idea writing, the delphi method and mind mapping allow creativity and decision making in a turbulent and distributed environment.

We proposed a model of an autopoietic information system that takes advantage of the technologies analyzed to support modern organizations. Our future research will be oriented towards the implementation of such a system in order to test our premises.

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Miroslav Bača received his MSc degree in Information Science in 1999. and his PhD degree in 2003, both issued by the University of Zagreb, Varaždin Faculty of Organization and Informatics. His fields of interests include biometrics, security systems and computer crime. He is currently an assistant professor at the University of Zagreb, Faculty of Organization and Informatics. He has completed several courses in the areas of computer system management, database searching and e-learning. He is currently a member of the program and organizing committee of the POWA International Conference, and organizing committee chairman and program committee member of the international conference on Information and intelligent systems (IIS). He has published two books: Police and Security and Introduction to Computer Security (in Croatian). He is author over 30 scientific and professional papers.

Markus Schatten studied at the Faculty of Organization and Informatics in Varaždin. He was awarded the dean's degree for extraordinary intercession and effort. He received his bachelor's degree in Information Systems issued by the University of Zagreb, Faculty of Organization and Informatics in 2005. In the same year he published a book about the architectures of modern organizations in collaboration with prof. dr. sc. Miroslav Žugaj (in Croatian). His fields of interest include organization, system and chaos theory, knowledge-based systems and biometrics. He is currently a research and teaching assistant at the University of Zagreb, Faculty of Organization and Informatics.

Dinko Deranja left for Varaždin in 1991, where he attended the Faculty of Organization and Informatics, where he graduated in 1996 and entered postgraduate study of Information sciences in 1998, finishing in 2003 with a title of information science. He is currently working on getting a PhD degree at the same faculty. After study and service in the army, he worked for four months as a system administrator at Obiteljski radio in Zagreb. After that, in 1998, he got a job at the Ministry of the interior of the Republic of Croatia as information system architect, and in 2003 he joined the Security and intelligence agency. He researched performance management problems in the government sector and its organizational units and the implementation of information technologies for that purpose. The results of the research were published in his master thesis. On his last job, information security related problems became the focus of his further research, resulting in several papers published in the Mipro and IIS conference proceedings, as well as several lectures held at other business security related conferences.