

A CRITICAL REVIEW OF AUTOPOIETIC THEORY AND ITS APPLICATIONS TO LIVING, SOCIAL, ORGANIZATIONAL AND INFORMATION SYSTEMS

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Autopoietic theory, a theory of complex, non-linear, autonomous and especially living systems, found its way from biology, through the social sciences to organization theory and information systems. It enjoys major attention from scientific audiences in lots of different disciplines. Still, there hasn't been enough effort to establish a common foundation for a new theory. There are often contradictions in the very essence of the theory which are outlined in this article. By using a more simplistic conceptualization of autopoiesis, we are trying to give guidelines for a new foundation in this area.

Keywords: autopoiesis, information, living systems, social systems, organizational systems, information systems

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INTRODUCTION

Autopoiesis, a pseudo Greek word that comes from *αυτό* (au-to – self), and *ποίησις* (poiesis – creation, production or forming), was firstly coined by the Chilean biologists Humberto Maturana and Francisco Varela in 1973 (Maturana & Varela, 1973) to label the type of phenomenon which they had identified as the definitive characteristic of living systems (Whitaker, 2001).

Using the metaphor of autopoiesis a whole social systems theory based on communication was later developed by Niklas Luhmann. He also introduced the concept of autopoiesis to

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formal organization theory, with supporting his reasoning on a special subset of communication: decisions which, according to him, are the essence of organization (Luhmann, 2003).

Since information systems are subsystems not only of organizations (Brumec, 1997), but also of social systems, the logical question whether information systems were autopoietic emerged as well (Bača et al., 2007; Maleković and Schatten, 2008).

These four conceptualizations of autopoiesis in biology, sociology, organization theory, and the information sciences are different and in some cases incompatible. There hasn't been enough effort to merge these perspectives in a new foundation that could yield a new theory. In the following we shall outline the contradictions and incompatibilities of the different conceptualizations, and provide guidelines towards a new foundation.

ORGANIZATION AND STRUCTURE

One needs to make a clear distinction of two basic concepts in autopoietic theory, since they are often used in the same context in order to avoid possible misunderstanding. First there is the concept of *organization* that is used three ways: (1) organization in the institutional sense – denoting a system of consciously coordinated peoples activities with a common goal (Žugaj et al., 2004, p. 5), (2) organization in Maturana's and Varela's sense – denoting the instrumental participation of components in the constitution of a unity (Maturana, 1975, p. 315) or basically a system of relations that build up a unity and (3) organization in Luhmann's sense – denoting a system of decisions (Luhmann 1998, p. 106). Luhmann defined organizations as "systems made up of decisions, and capable of completing the decisions that make them up, through the decisions that make them up." (Luhmann, 2003, p. 32).

As second, there is the concept of *structure* that is used in two different ways: (1) structure in the sense of (traditional) organizational structure – denoting a system of relations between organizational units and (2) structure in the sense of Maturana and Varela – denoting the medium upon which the organization (in Maturana's and Varela's sense) of a unity functions. To prevent possible confusion we shall use the terms organization and structure in their traditional (organization theory) senses if not stated otherwise.

DIFFERENT CONCEPTUALIZATIONS OF AUTOPOIESIS

Autopoiesis in Biology

As mentioned before, the concept of autopoiesis was firstly introduced by Maturana and Varela to characterize living systems, as opposed to any other system. The original idea was to develop a new perspective of perception and cognition by

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stating that cognition is a phenomenon of the living. Thus it was necessary to find out what characterizes living systems which led to the notion of autopoiesis that became the core of the new perspective (Whitaker, 2001).

Varela gave the following definition of autopoietic systems: "An autopoietic system is organized (defined as a unity) as a network of processes of production (transformation and destruction) of components that produces the components that:

1. through their interactions and transformations continuously regenerate and realize the network of processes (relations) that produced them; and

2. constitute it (the machine) as a concrete unity in the space in which they [the components] exist by specifying the topological domain of its realization as such a network." (Varela, 1979, p. 13; adapted from Whitaker, 2001).

Maturana stated that "... autopoietic systems operate as homeostatic systems that have their own organization as the critical fundamental variable that they actively maintain constant." (Maturana, 1975, p. 318). Thus the concept of autopoiesis involves organizational preservation and componential (re-)production (Whitaker, 2001).

It is important to state here that the initial theory was developed for micro organisms which is why the definition of autopoiesis has to be extended in order to adhere to more complex living systems like primates, humans, social systems as well as organizations and information systems.

Luhmann's Perspective on Autopoiesis

One of the first attempts of applying autopoiesis to social systems was conducted by the German sociologist Niklas Luhmann. According to him, social systems are meaning processing systems and this fact distinguishes them from other types of systems such as biological ones (Mingers, 2003, p. 104). "A social system comes into being whenever an autopoietic connection of communications occurs and distinguishes itself against an environment by restricting the appropriate communications. Accordingly, social systems are not comprised of persons and actions but of communications." (Luhmann 1989, p. 145). Social systems are networks of communication that produce further communication and only communication (Mingers, 2003, pp. 104-105) which is maybe the most radical viewpoint of Luhmann's theory leaving out everything else that common social theory subsumes.

Social systems according to Luhmann are self-referential. "The system continuously refers to itself by distinguishing itself from the environment." (Luhmann, 1983, p 992). This self-referentiality is used by social systems to maintain the distinction between system and its environment.

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Luhmann argues that there are three types of social systems: interactional, organizational and societal which differ mostly in terms of the ways they constitute themselves, and in terms of how they select and form their boundaries. *Interactional systems* are comprised of communication between a set of people, by making a distinction between people one talks with (system), and people one talks about (environment). Common examples of such systems include meetings, happenings, concerts, demonstrations, chat rooms etc. *Societal systems* do not rely only on communication taking place, but also on previous (stored) communication in form of culture, social expectations, law, ethics etc. Therefore, towns, countries, villages and communities would all be examples of such systems. *Organizational systems* are special since they are formed of a special type of communication – decisions. In terms of Luhmann's theory, organizational decisions produce new decisions and only decisions. Companies, syndicates as well as teams would be examples of such systems.

As pointed out by Zeleny (1995, p. 179) there have been successful attempts to define all biological systems as autopoietic, whereas there was less success to prove that all autopoietic systems are living ones. To go even further Zeleny claims that "(...) all biological (autopoietic) systems are social systems. They consist of production, linkage, and disintegration of related components and component-producing processes. An organism or a cell is, therefore, a social system." (Zeleny, 1995, pp. 179-202).

Autopoiesis in Information Systems

If analyzing information systems as subsystems of social or organizational systems, one could define autopoiesis in information systems as a set of relations between communicative events that reproduce new communicative events based on previous (stored) communication. The organization of this system (in Maturana's and Varela's sense) is comprised of the relations between communicative events described through their semantics (meaning). The structure of the system (in Maturana's and Varela's sense) is comprised of the means that are used to produce communication described through syntax (Maleković and Schatten, 2008).

Another, more descriptive definition states that "Autopoiesis in the context of information systems denotes the ability of an information system to continuously adapt to the needs of its current users and also to keep all the characteristics that make it unique and recognizable as an information system" (Bača et al., 2007), and further that an information system can be considered autopoietic if it "continuously adapt[s]

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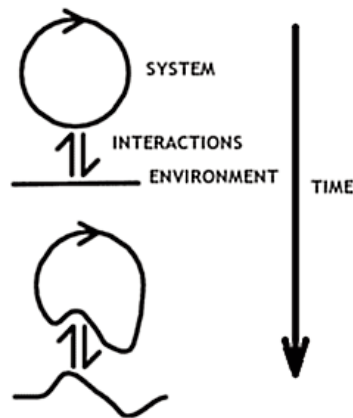
to its users and the surroundings in which it operates, by collecting, storing, keeping, processing and disseminating information important for the organization and society, in order to make it accessible to everyone who wants to use it." (Bača et al., 2007). Thus, every information system is more or less autopoietic.

CRUCIAL CONCEPTS

As one can see from these various aspects, there are a few crucial concepts that one should have in mind before any discussion about autopoiesis. First, there is a distinction between structure and organization (in Maturana's and Varela's sense). While structure is something that is visible (observable) from the outside, organization is unobservable and resides inside the system. Structure comprises a set of components or elements that are exchangeable (which means that components change during time), and the mutual interactions between these components. Organization comprises the relations between these components and is stable over time. That means that structure does change but organization remains stable even if the components that make up the structure change due to interactions of the system with its environment.

This connection between an autopoietic system and its environment is usually denoted as structural coupling (depicted in Figure 1). "The result of structural coupling is an autonomous and strictly bounded system, that has nevertheless been shaped extensively by its interactions with its environment over time, just as the environment has been shaped by its interactions with the system." (Quick, 2003).

⇒ FIGURE 1
Structural coupling
(Quick, 2003)



The mechanics of the process of autopoiesis as described by Maturana and Varela are kept strictly within the bounds of an autopoietic system. Thus autopoietic systems are closed in terms of operational and organizational closure (Quick, 2003).

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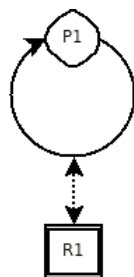
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In order to preserve this principle of closure, Luhmann has used his radical metaphor that social systems consist exclusively of communication. While in living systems structure is comprised of biological processes, in social systems structure is, according to Luhmann, comprised of communication. Organization (in Maturana's and Varela's sense) is then comprised of the particular relations between certain communicative events.

Another important concept is the reproduction of components. While one can easily depict this process in living systems (e.g. living beings feed themselves with food from their environment that eventually after certain processes becomes an integral part of the living being facilitating thereby the regeneration of the process) in social systems this reproduction is less obvious. If we follow Luhmann, then communicative events are reproduced by previous communicative events, or in the case of organizations (in Luhmann's sense) decisions reproduce new decisions. Under decision Luhmann understands the event (action) when a decision was made.

To picture autopoiesis at the most basic level we could introduce an imaginary autopoietic system consisting of only one process and only one component. The process uses the component's resources to produce new resources which in turn enable the recreation of the process. Thus the process' recursive relation with itself represents the organization and the component represents the structure of the system. Note that this recursive relation is strictly inside the system which yields its organizational and operational closure. This most basic autopoietic system is depicted in Figure 2 whereby P1 represents the process and R1 the component. The resources in the component could but do not have to be from the environment.

➔ FIGURE 2
The basic autopoietic system



RELATIONS BETWEEN SOCIAL, ORGANIZATIONAL AND INFORMATION SYSTEMS

In order to develop our critique of common autopoietic theory, we need to clarify our standpoint when talking about social systems and their mutual relationships. We advocate the position that social systems are subsystems of society (the global social system), organizations are subsystems of social sy-

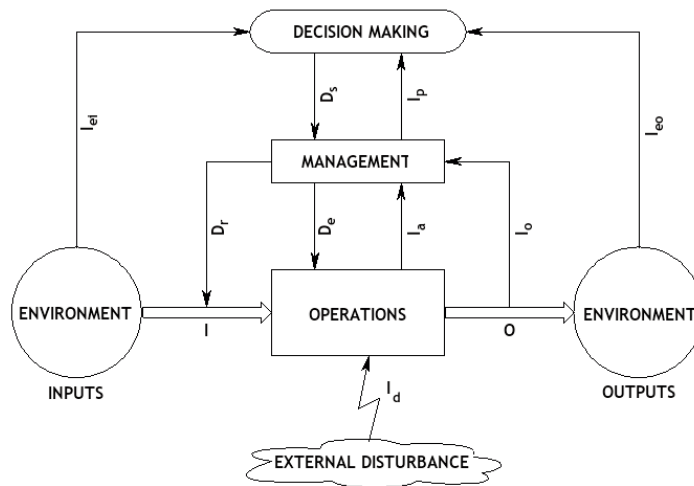
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stems, and information systems are subsystems of organizations in the sense of general system theory.

Since the first two statements about social systems and organizations are obvious, the last statement needs further explanation. Brumec developed a genetic as opposed to descriptive definitions of information systems as follows: "An information system is a subsystem of the organizational system, whose task is to link processes on the operational, management and decision-making level. Its goal is improving performance efficiency, supporting good quality management and increasing decision-making reliability." (Brumec, 1997). An information system comprises information and decision flows between these organizational processes as depicted in Figure 3.

➡ FIGURE 3
 Brumec's genetic
 definition of
 information systems

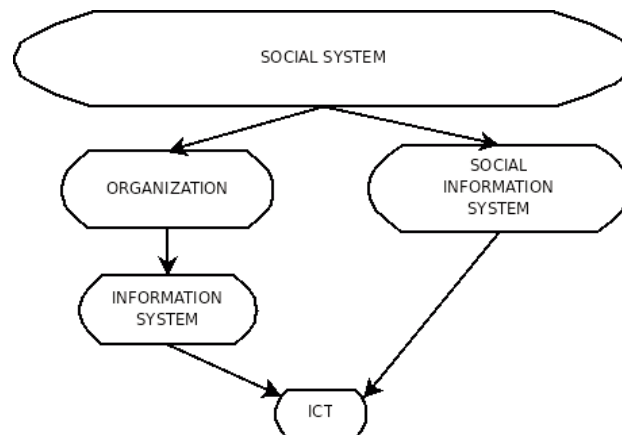


The consequence of such a definition is that an information system cannot exist by itself. It is always a subsystem of some real organizational system, and thus each organizational system has its unique and distinctive information system. An information system can, but doesn't have to be supported by information and communication technologies (ICT).

More recently due to the development of the Internet and especially so called Web 2.0 applications one was able to observe systems supporting information flows inside social systems. We could easily call this kind of systems social information systems since they comprise the same elements as information systems defined by Brumec, except that they are subsystems of a larger class of systems than organizations. They are subsystems of social systems comprising of their information flow and used to facilitate social functions and decision making.

➔ FIGURE 4
Relations between
social, organizational
and information
systems

Thus we can conclude with the following set of relations (depicted in Figure 4): organizations as well as social information systems are subsystems of social systems. Information systems (in Brumec's sense) are subsystems of organizations. Information systems as well as social information systems can, but do not have to be supported by ICT.



QUESTIONS AND CONTRADICTIONS

In terms of Maturana and Varela, autopoiesis consists basically of two parts: (1) preservation of organization, and (2) regeneration of structure. While the latter seems to be obvious, the former raises questions outlined in some critiques of the theory. We shall try to depict these questions using some simple examples.

First, let us observe a living being that naturally changes due to metamorphosis for a most impressive example. "A caterpillar organization auto-organizes to a larger caterpillar organization or pupa organization, and pupa organization in a butterfly organization." (Valenzuela, 2007). If we follow Maturana's and Varela's reasoning in this case we would have three distinct autopoietic systems: a caterpillar system, a pupa system and a butterfly system, since processes in these systems are in different relations even if we are talking about one and the same entity. We can extend this example to any living beings, since living beings are born, evolve, eventually reproduce themselves, age and die.

Now let us observe a living being that changes drastically due to environmental influences. For example, a cat loses its tail due to an accident. The system isn't able to maintain its organization (when following Maturana and Varela) since a part of the structure (particularly components that were part of the cat's tail with accompanied resources) have disappeared.

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The organization would be preserved if the components could be regenerated, but nature tells us that cats do not regenerate their tails once losing them. Relations between processes that were performed in the cat's tail are gone. But, part of the organization is still maintained, as well as autopoiesis since the cat is still a living being.

Another interesting observation would be the one of a vine tree. It is well known that one can cut a twig of a wine tree, put it into soil, and under certain circumstances the twig will root and become a tree of its own. In terms of Maturana and Varela the organization of the initial wine tree was split into two distinct parts and both of them became a system of their own. But which of them is the original one, if any? We can extend this example to any reproducing species, and ask the famous question when does life and consequently when does autopoiesis occur?

All these questions raise contradictions probably due to the fact that the initial conceptualization of autopoiesis was developed for microorganisms where such questions couldn't be raised and the inconsistencies disappear. The situation is similar to fractal geometry where a simple rule can yield unpredictable outputs on higher and higher levels. Since one cell organisms behave in a special way, this does not mean that multiple cell organisms will behave in exactly the same way. Due to synergy and possible redundancy of biological processes, it is likely that one needs to extend the initial definition.

On the other hand, Luhmann's theory of social systems has its own pitfalls. Even the original authors of the biological perspective, Maturana and Varela, have reservations about Luhmann's theory of autopoiesis. In a discussion Maturana once stated that:

"Just imagine for a moment a social system that is, in actual fact, functioning autopoietically. (...) This would entail that every single process taking place within this system would necessarily be subservient to the maintenance of the autopoiesis of the whole. Consequently, the individuals (...) would vanish. They would have to subordinate themselves to the maintenance of autopoiesis. Their faith is of no further relevance. (...) This kind of negation of the individual is among the characteristics of totalitarian systems." (Maturana and Poerksen, 2007, p. 72).

In fact, Luhmann neglects the individuals, describing social systems as systems of communication and only communication in order to describe autopoiesis in terms of communicative events reproducing communicative events. As Maturana points out "[a]utopoiesis as a biological phenomenon involves a network of molecules that produces molecules (...)"

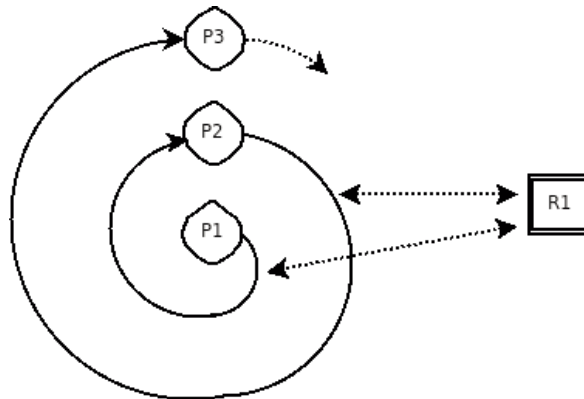
and molecules do not need any external help on performing this process, whereas in social systems humans who are actually communicating are excluded from the system (Maturana and Poerksen, 2007, pp. 70-71).

TOWARDS A NEW FOUNDATION

The described examples allow us to seriously consider that organization (in Maturana's and Varela's sense) has to change during time. Even if they describe autopoietic systems as processes they do not seem to include basic system dynamics like evolving, aging or metamorphosis. So we consider that organization can change but in a natural (evolutive) way, only if certain preconditions are fulfilled. Organization evolves, matures, eventually reproduces itself, ages and dies.

From this point of view we can depict the most basic (evolving) autopoietic system as shown in Figure 5, whereby P1, P2, P3, ... , Pn are instances of the same process performed in different time frames, whilst R1 is a single component holding the resources needed for the processes to perform. The component will change during time, as well as the organization comprised of the relations between process' instances by evolving in a natural manner.

➔ FIGURE 5
The basic (evolving)
autopoietic system



The example of a cat tells us that not the whole organization has to be maintained for a system to maintain autopoiesis. So we introduce the notion of a core part of organization – the *system's identity*. A system will remain autopoietic if its identity remains.

An issue that has to be addressed here, is how to determine the identity of an autopoietic system? What makes some parts of a system's organization special to be included in the vital part that has to be maintained in order for the autopoietic system to survive?

Since organization represents a system of recursive processes, the systems identity must provide the necessary rela-

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tional paths that will preserve self-reproduction. On the other hand, these relational paths need to be provided with the necessary resources. Due to the absence of such resources and/or paths, the system will eventually stop maintaining autopoiesis since the system is unable to restart its processes. Thus the system's identity consists of the relations between processes that are on the main paths that preserve the reproduction of components – relations that form the cycle of recursive processes. If such a chain of processes is cut off, and if there are no alternative relational paths, the system will, as soon as all impasse paths are taken, cease to exist as an autopoietic system.

The notion of identity enables us also to explain the example of the wine twig and reproduction of living beings. In the former only a part of the organization (that isn't included in what makes the identity of the system) was split off and has produced another separate entity which due to the availability of necessary resources, has produced an identity of its own. The original tree has retained its identity and thus has maintained autopoiesis. In the latter case a living being will create a new part of its own organization that will eventually yield a separate new entity as a new living being which will have its own identity. This process is usually denoted by reproduction.

As argued previously in terms of Luhmann, social systems are sense processing systems of communication and are autopoietic in terms of reproducing communication. In the sense of Maturana and Varela structure would be comprised of communicative events that are reproduced. Organization would be the system of relations between these communicative events. In the original sense of Maturana and Varela, this organization had to be preserved. But, relations between communicative events change due to the evolution of social systems, and especially through the evolution of language. Thus, organization, as we reasoned previously, evolves and changes in a natural way.

If we take the global social system (society) as an example, we could ask the question if this system still existed after catastrophes like the tsunami or the civil war in Rwanda? Even if a great deal of stored communication in all these victims' minds disappeared, the system still remained since its identity survived.

As it was stated earlier, another questionable statement is that social systems are systems of communication and only of communication. Especially societal and organizational systems, but in a way interactional systems as well, rely on stored communication. The question is where this communication is stored and can we conceptualize autopoiesis of these systems in a-

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another way that would yield a better understanding of social systems.

To answer this question, let us take the very simple example of a flock. We could say that relationships between the processes conducted by the animals in the flock comprise an organization that emerges through communication and perception. These relationships set up certain roles during time inside the flock (like the alpha male). We could furthermore define a structure to be comprised of the animals (components) of the flock as well as their characteristics in the perception of the others. It is important to state here that the components of the structure are not any animals but animals accepted by the other animals, that in turn accepted to be part of the flock. Thus structure changes during time, but the organization remains, and this simple system of a flock could be considered as an autopoietic system.

If we take this example into a social systems' perspective we can conceptualize social systems as systems comprising of accepted individuals, that for themselves accepted to be part of the social system. These accepted individuals are reproduced (their acceptance, their social roles, expected attitudes and manners, their beliefs but not the individuals themselves) and thus comprise the components of the social system that build up the structure. The organization (in Maturana's and Varela's sense) is comprised of the relations between the accepted individuals that are built up through social processes of communication. Organization remains constant but evolves in a natural manner. This reasoning introduces individuals as a new idea into Luhmann's social system perspective that we missed in some extent. These individuals are exchanged during time and reproduced (not physically but socially).

Having the previous reasoning in mind, we could define the following classes of autopoietic systems: (1) *biological (living) systems* – autopoietic systems in the sense of Maturana and Varela with the addition of organization's identity and dynamics, (2) *social groups of biological systems* (flocks, swarms etc.) – systems that are comprised of relationships between living beings whereby during time roles evolve which are attractors that lead future development of the system, (3) *social systems* – special cases of social groups where biological systems are mostly humans, (4) *information systems* – subsystems of social systems that deal only with information and communication inside them. Social systems can further be divided into: (a) *interactional*, (b) *societal*, (c) *organizational* having corresponding information systems.

Thus, information systems would be interactional-, societal- and organizational- social systems in the sense of Luhmann since they deal exclusively with communication. Since

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social systems from our perspective are systems of accepted individuals, we can state according to the genetic definition of information systems that their subsystems dealing with information are their respective information systems.

Interactional information systems are systems that emerge and do not depend virtually on previously stored communication but on current interactions between communicative events. Interactional eventually yield societal information systems when attractors of meaning emerge that are reproduced through stored communication. A special case of societal information systems are organizational information systems that primarily consist of decisions that set up the possible future states of the system.

CONCLUSION AND GUIDELINES

Even if there has been a lot of scientific research and publishing in the field of autopoietic theory, it seems that the theory still lacks a common foundation that should make it possible to overcome inconsistencies and incompatibilities and allow for the creation of a new interdisciplinary framework. It is important to outline here that the main aim of a new foundation in autopoietic theory should be to provide a common framework in understanding complex, non-linear and especially living systems. Such a framework should make it possible to put research as well as results from different disciplines into new perspectives. If it is possible to establish such a foundation, results from biology, sociology, organization theory, and information systems could be combined and yield better understanding of the complex systems these disciplines face. The foundation should also provide a common grounding for the development of methods for observing, analyzing and improvement of autopoietic systems.

It seems clear that such a new foundation should include insights from all mentioned disciplines and it is quite likely that more disciplines will be added in the future. Herein we discussed some contradictions and incompatibilities that should be solved.

The new foundation should bring a clear definition of crucial concepts: (1) reproduction of structure (components), (2) preservation of organizational (system's) identity, (3) structural coupling, (4) system's life cycle and dynamics (birth, evolving, reproduction, aging, death), (5) distinction between structure and organization, as well as (6) operational and organizational closure. These definitions should be applicable to any type of autopoietic system: living systems, social groups of living systems, social systems, organizational systems, interactional systems as well as their corresponding information systems.

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REFERENCES

- Bača, M., Schatten, M., Deranja, D. (2007), Autopoietic Information Systems in Modern Organizations, *Organizacija. Journal of Management, Informatics and Human Resources*, 40 (3): 157-165.
- Brumec, J. (1997), A contribution to IS general taxonomy. *Zbornik radova Fakulteta organizacije i informatike Varaždin*, 21 (1): 1-14.
- Luhmann, N. (1983), Insistence on Systems Theory: Perspectives from Germany – An Essay. *Social Forces*, 61 (4): 987-998.
- Luhmann, N. (1989), Law as a social system. *Northwestern University Law Review*, 83: 136-150.
- Luhmann, N. (1998), *Observations on modernity*, Stanford: Stanford University Press.
- Luhmann N. (2003), Organization. In: Bakken, T. and Hernes, T. (eds.), *Autopoietic Organization Theory Drawing on Niklas Luhmann's Social Systems Perspective* (pp. 31-52), Abstract, Liber, Copenhagen Business School Press, Oslo.
- Maleković, M., Schatten, M. (2008), Leadership in Team Based Knowledge Management – An Autopoietic Information System's Perspective, In: Aurer, B., Bača, M. (eds.), *19th Central European Conference on Information and Intelligent Systems – Conference Proceedings* (pp. 53-56), Faculty of Organization and Informatics, Varaždin.
- Maturana, H. (1975), The organization of the living: A theory of the living organization. *International Journal of Man-Machine Studies*, 7: 313-332.
- Maturana, H., Varela, F. (1973), Autopoiesis: the organization of the living, a 1973 paper reprinted in: *Autopoiesis and Cognition* (Maturana and Varela, 1980), 63-134.
- Maturana, H., Varela, F. (1980), Autopoiesis and Cognition: The Realization of the Living. In: Cohen, R. S. and Wartofsky, M. W. (eds.), *Boston Studies in the Philosophy of Science*, 42, Dordrecht, D. Reidel Publishing Co.
- Maturana, H. R., Poerksen, B. (2007), Autopoiesis and Social Theory: A Conversation. *Journal of Sociocybernetics*, 5 (1/2): 68-73.
- Mingers, J. (2003), Observing organizations: An evaluation of Luhmann's organization theory. In: Bakken, T. and Hernes, T. (eds.), *Autopoietic Organization Theory Drawing on Niklas Luhmann's Social Systems*

DRUŠ. ISTRAŽ. ZAGREB
GOD. 19 (2010),
BR. 4-5 (108-109),
STR. 837-852

SCHATTEN, M., BAČA, M.:
A CRITICAL REVIEW...

Perspective (pp. 103-122), Abstract, Liber, Copenhagen Business School Press, Oslo.

Quick, T. (2003), *Autopoiesis*, <http://www.cs.ucl.ac.uk/staff/t.quick/autopoiesis.html> (1. 4. 2008)

Valenzuela, C. Y. (2007), Dentro de la selección (Within selection). *Revista Chilena de Historia Natural*, 80 (1): 109-116.

Varela, F. (1979), *Principles of Biological Autonomy*, New York: Elsevier, North Holland.

Whitaker, R. (2001), *Tutorial 2: Concepts and Constructs, The Observer Web*, <http://www.enolagaia.com/Tutorial2.html> (20. 3. 2008)

Zeleny, M. (1995), Ecosocieties: Societal Aspects of Biological Self-Production. *Soziale Systeme*, 1 (2): 179-202.

Žugaj, M., Šehanović, J., Cingula, M. (2004), *Organizacija (Organization)*, Second Edition, TIVA & Faculty of Organization and Informatics, Varaždin.

Kritički osvrt na teoriju o samostvaranju i njezine primjene na žive, društvene, organizacijske i informacijske sustave

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Teorija autopoiesisa ili samostvaranja, teorija o složenim, nelinearnim, autonomnim i prije svega živim sustavima, našla je svoj put iz biologije preko društvenih znanosti k organizacijskoj teoriji i informacijskim sustavima. Ovo je područje od velikog interesa za znanstvenu javnost te se obrađuje i iskorištava u relativno velikom broju disciplina. Ipak, čini se da još nisu učinjeni dovoljni naponi kako bi se uspostavili temelji za novu teoriju. Često se može naići na kontradikcije u samim njezinim temeljima, kao što se pokušava pokazati u ovom članku. Koristeći se jednostavnijom konceptualizacijom autopoietične teorije, pokušavamo dati smjernice prema uspostavljanju novoga temelja.

Ključne riječi: autopoiesis, živi sustavi, društveni sustavi, organizacijski sustavi, informacijski sustavi

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A CRITICAL REVIEW...

Kritische Betrachtung der Theorie der Selbsterschaffung und ihrer Anwendung auf lebende, gesellschaftliche, Organisations- und Informationssysteme

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Die Theorie der Autopoiesis ist die Theorie der Selbsterschaffung von komplexen, nicht-linearen, autonomen und vor allem lebenden Systemen, die aus der Biologie stammt und über die Gesellschaftswissenschaften Eingang in die Organisationstheorie und Informationssysteme gefunden hat. Dieser Bereich ist von großem Interesse für die wissenschaftliche Öffentlichkeit und wird daher für eine relativ große Anzahl anderer Disziplinen fruchtbar gemacht. Dennoch fehlt es offensichtlich immer noch an den notwendigen Anstrengungen, um die Grundlagen dieser neuen Theorie zu festigen. Wie die Verfasser des Artikels zeigen, ist die Grundlagendiskussion häufig widersprüchlich. Ausgehend von einer einfacheren Konzeptualisierung der autopoietischen Theorie versuchen sie daher Richtlinien für eine neue Grundlegung vorzugeben.

Schlüsselbegriffe: Autopoiesis, lebende Systeme, gesellschaftliche Systeme, Organisationssysteme, Informatiksysteme