

## A Critical Review of Autopoietic Systems in Economic Discipline

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**Abstract:** Autopoiesis is a concept initially developed, forty years ago, by Humberto Maturana and Francisco Varela, to explain the behavior of biological systems and has enjoyed great popularity among international scientific community. The concept has been extended to the areas of the social sciences, including economics, law, political and other domains. The paper investigate the application of the autopoiesis social systems theory on the economic systems in a critical approach. The study delimits the theoretical framework of autopoietic systems and presents a critical review of the autopoietic social systems theory, based on the recent researches. We find that communication and organization are critical for the autopoietic systems and we consider that the main criteria that allow for the economies of the Baltic States to be considered as autopoietic systems can be available for any economy. We consider that the contribution of this paper will enable to start a debate about autopoietic theory applications in economic discipline and to serve as an introduction for future discoveries and better understanding of economy

**Keywords:** autopoiesis; autopoietic systems; autopoietic social systems theory

### 1. Introduction

Autopoiesis is a concept used for the first time in 1972, in the works of biologists Humberto Maturana and Francisco Varela. The term, that comes from *αυτό* (auto – self), and *ποίησις* (poiesis – creation, production or forming), was initial used for the phenomenon which they had identified as the definitive characteristic of “living systems”, (Whitaker, 2001), with the intention of providing a unifying concept for biology. The central idea of the concept is that the different elements of the system interact in such a way as to produce and re-produce the elements of the system. That is to say through its elements the system reproduces itself. (Seidl, 2004).

The Maturana and Varela’s autopoietic systems theory is both a general theory of life and a theory of cognition, the cognitive process not being determined by an objective, autonomous and external world. In context, the logic of cognition doesn’t involve an exchange of inputs and outputs between the observer and an external object of observation. (Lourenço, 2010).

Following the initial use in biology, the term “autopoiesis” gained conceptualization in other disciplines: sociology, organization theory, and the information sciences, economics. This conceptualization implies different views and in some cases incompatible. It was Nikolas Luhmann who extended the concept of autopoiesis to social domain, trying “to abstract from the originally biological concept of autopoiesis a general, trans-disciplinary concept of autopoiesis” (Seidl, 2004). The Luhmann’s autopoietic social systems theory, applied in economics, was the subject of many critics that are presented in the paper, together with our opinion.

### 2. Theoretical Framework of the Autopoietic Systems

The key concept of the third generations of systems theory, which consists of theories of self-production, “autopoiesis” is focused on system formation. An autopoietic system consists of a unity whose

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organization is defined by a particular network of production processes of elements, with three fundamental features (Takashi, 2010):

- elements as momentary event that have no duration; they disappear as soon as they are realized and, in this way, the system must continue to produce the elements in order to keep itself in existence;
- boundary of the system is determined circularly by the production of elements, being created a circular relation between the system and its elements;
- elements constitution based on the system, meaning that elements are elements only for the system that employs them as units and they are such only through this system.

In this context, we consider important to mention that each operation to constitute element has a double function of “production of system” and “preservation of structure”. According to Luhmann, (1995, quoted by Iba, 2010), “an autopoietic system reproduces both its reproduction and the conditions for its reproduction.”

In Maturana’s conception, “... 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). Few years later, in 1979, Varela find out that “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, through their interactions and transformations, continuously regenerate and realize the network of processes (relations) that produced them; and 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, adapted from Whitaker, 2001).

According to the recent research, academic thinking identified the features that delimit the autopoietic systems (Morkunas, Skvarciany & Titko, 2017):

- ability to create the elements of which are composed by themselves;
- self-organization, meaning that they can independently define the boundaries of the system and generate an internal system architecture; in the self-organization theory, the term autopoiesis means a result of a previous coherent transformation — the overarching reconstruction of a system in a self-organizing way;
- self-sufficient;
- at least for a short period of time they can become closed; this means that all actions that create or support autopoiesis are generated by the system itself.

In the Maturana and Varela’ view (1980):

- a unity is an entity which is “distinct from a background” or environment and they differentiate “composite unity”, which has processes of organization associated with its structure, and “simple unity”, with only physical properties, with which it is endowed by the operation of distinction;
- the organization of a particular kind of system consists of the “relations between components” that define the system’s typology;
- social system are third-order autopoietic systems wick arise as a result of structural coupling among second order;
- the linguistic domain which contain all linguistic behaviours within a typologyof systems;
- communicative behaviours are „coordinated behaviours mutually triggered among members of a social unity”.

We consider necessary to make some remarks:

it is a distinction between structure and organization: structure comprises set of components or elements that are exchangeable (which means that components change during time), and the mutual interactions between these components, while organization comprises the relations between these components and is stable over time;

the connection between an autopoietic system and its environment is usually denoted as structural coupling: “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);

“Autopoiesis or self-production can take place when there are distinct and autonomous individuals or agents interacting and communicating in a specific environment and according to specific behavioral rules of conduct and interaction”.

Autopoietic organization can be defined as a network of interactions and processes, involving at least:

- 1) Production (poiesis): the rules and regulations governing the entry of new components, such as emergence, input, birth, membership, acceptance.
- 2) Bonding (linkage): the rules governing associations, arrangements, manufactures, functions and positions of components during their tenure within the organization.
- 3) Degradation (replenishment): the rules and processes associated with the termination of membership, like death, separation, consumption, output and expulsion.

Autopoietic organization is an autonomous unity of a network of productions of components, which participate recursively in the same network of productions of components, which produced these components, and which realize such a network of productions as a unity in the space in which the components exist

An organization becomes autopoietic if all three types of constitutive processes are balanced or in harmony. Autopoietic social systems are networks characterized by inner coordination (or harmony) of individual action achieved through communication among temporary member-agents. The key words are coordination, communication and limited individual lifespan.” (Zeleny, 1997).

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 (Schatten & Baca, 2008).

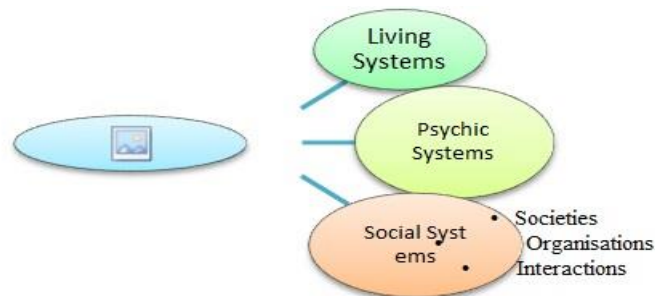
The unit of social autopoiesis is human actors permanently reproducing and/or transforming social structures. Society doesn't produce and reproduce humans biologically, but as social beings. What is permanently created in society is the fundamental quality of humans, heir sociality. Society reproduces and produces man as a social being, and man reproduces and produces society by socially coordinating human actions. Man is creator of, and created by, society; society and humans produce each other mutually (Fuchs & Hofkirchner, 2009).

### 3. The Autopoietic Social Systems Theory and Economics. Critical Approach

#### 3.1. The Challenges of the Autopoietic Social Systems Theory

Among the social scientists who have tried to apply the concept of autopoiesis to the social domain is Nikolas Luhmann. Unlike other sociologists, who have tried to transfer it directly, Luhmann has a new approach, trying to abstract from the originally biological concept of autopoiesis a general, trans-disciplinary concept of autopoiesis. (Seidl, 2004). According his view, “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)

Luhmann identifies, alongside the living systems that reproduce themselves on the basis of life, another two types of autopoietic systems: social systems, that reproduce themselves on the basis of communication and psychic systems that reproduce on the basis of consciousness or thoughts (fig. 1).



**Figure 1. Types of autopoietic systems**

Based on his view, Luhmann defines three types of social systems: interactional, organizational and societal which differ in the ways they constitute themselves and in how they select and form their boundaries (Schatten & Baca, 2008):

- 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;
- 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. 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.

The novelty of Luhmann's approach refers to two important aspects:

- the radicalization the temporal aspect of autopoiesis, considering the elements as momentary events without any duration. “Events are elements fixed as points in time. [...] They occur only once and only in the briefest period necessary for their appearance (the “specious present”)”. (Luhmann, 1995).
- deontologising the concept of element, considering that Elements are defined as elements merely through their integration into the system. Outside or independently of the system they have no status as elements; i.e. they are “not ontically pre-given” (Luhmann, 1995). In his work, he mentioned that “[W]e have deontologized the concept of element. Events [...] are not elements without substrate. But their

unity corresponds to no unity in the substrate; it is created in the system through their connectivity. Elements are constituted by the systems that are composed of them [...].” (Luhmann, 1995)

In this context, Luhmann defines 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), while structure denotes a system of relations between organizational units.

Fenton Robb (1989) shows the Mingers’ opinion about the main difficulties of the application of the autopoiesis theory to social organisations:

- the production of components which themselves constitute the system, humans cannot be seen as components of an autopoietic social system because it cannot be said that they are physically produced by the system;
- the creation by those components of a boundary defining the entity as a unity;
- the prohibition on extending the definition of autopoiesis beyond self-production to take account of specific structural properties which may be encountered in social systems.

### **3.2. Economics as Autopoietic System. Critical Approach**

In an attempt to identify the relationship between economics, law and politics from an autopoietic perspective, Teubner and Febbrajo (1992) shows us the Febbrajo’s outlook regarding the different meanings of autopoiesis, considered as the product of a logical development in social and juridical thinking. Febbrajo identified five theoretical models, whose main features of these models are presented in table 1 and encompass, in different measures, the concept of autopoiesis:

- the radial model – establishes, from a central point, connections between the various conceptual elements that enter its field of relevance, being a typical interpretation of social reality which starts from the identification of an element considered to be original as well as essential;
- the linear model – establishes connections between the various elements making it up, such that they can be set out in potentially endless chains;
- the triangular model – is characterized by a relationship between each of its constituent elements, limited by an apex and a base;
- the circular model - adopts a circular rather than a hierarchical structure, the distinction between higher and lower levels is relative; the model will be used in the context of theories of social regulation, where the object is to maintain certain functions which are considered necessary for the survival of the social institutions considered integrated, autonomous and well-delimited sets;
- the hypercyclic model - is characterized by a multiplicity of interconnected circular relationships and it may be represented as a meta-circuit that includes and stabilizes minor circuits whose criteria for functioning it determines; an example of the application of this model is the approach that uses the concept of autopoiesis.

**Table 1. The meanings of autopoiesis**

Mode I	Conceptual couple	Problem	Dimension	Approach	Method of connection
Radial	Centre/periphery	origin	spatial	emanationist	reference
Liner	Before/after	sequence	temporal	casual	production
triangular	Above/below	structure	social	formalist	organisation
circular	Inside/outside	Efficiency	systematic	functionalist	correction
hypercyclic	Compatible/incompatible	equilibrium	merasystemic	autopoietic	Self-observation

Source: Gunther Teubner and Alberto Febbrajo (*State, law and economy as autopoietic system, 1992*)

A recent study on the application of the autopoiesis concept in economics, (Morkunas, Skvarciany & Titko, 2017) identifies and evaluate the main factors that turn out on self-organization mechanisms of autopoietic economic structures:

- Big market entry barriers consisting in large scientific and/or economic resources which for individual business or small companies may be insurmountable;
- Risks related to production specialization, for companies, depending on the increasing degree of specialization, dependence on specific skills, which leads to caution among companies regarding formation of specific competencies or deepening specialization compared with the situation of a business group owned enterprises;
- The ability to more efficiently allocate resources, is referring to the efficiency of internal business group’s capital (loans to group’s companies), production (purchases from group companies), human resources (rotation of the best managers/specialists) markets and maneuvering them within the business group, due to the high coordination level from one (or several) center;
- The necessity of adapting to weak market regulatory institutions by reducing transaction costs, in the economies where market institutes are under development and a relatively high level of transaction costs is due to the low level of trust between the parties, frequent breaking of agreements or even disregard to property rights;
- Bargaining power in the development of relations with the state for state orders and/or favorable legislation is bigger for the large economic entities, companies become more attractive partners not only to other companies, but also to public authorities in its economic policy; indirect impact on inter-enterprise integration makes public institution’s policy, when influential politicians tend not to interact with many, but only with some of the strongest/most influential businessmen.

In an interesting research, Morkunas, Skvarciany & Titko (2017) identified the main criteria that allow for the economies of the Baltic States to be considered as autopoietic systems. Extrapolating, we consider that this criteria are available for any economy:

- creating the inner system, where new firms or business groups can emerge and new self-regulation mechanisms of a market can evolve (confederations, associations and etc.);
- determination of the systems’ architecture by their own market players, the emergence of some independent firms, and/or the changing of their the organizational structure by some business groups;

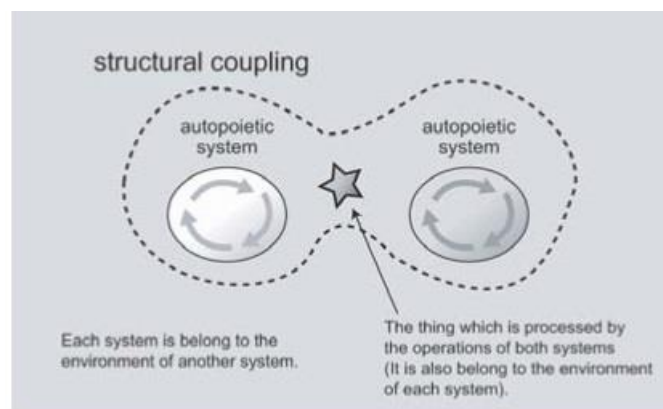
- mesoeconomical entities in the economy can be considered as self-sufficient, since they have the ability to maintain their short-term capability using own resources.

According to Luhmann (1988), quoted by Miyuko Naruse and Takashi Iba, the theory of economic system is one of the functional system of society, and an economic system is realized by the nexus of payments. The key terms of the economic system are element, three-part selection of operation, actor, code, and communication media:

- element of economic system is view as a kind of communication, named “payment”;
- three- part selection of: (1) information, for which it is a lot of diversified sources, (2) utterance, being many ways of expressing the information; it is done by reffering to the system which the communication belong to, and (3) understanding, reffering to the understanding the information which is uttered. Luhmann interpret the communication as an emergent phenomenon, the three selections occurring together at the same time;
- result, which change the difference between acceptance and rejection;
- code is payment or non-payment, each system using their codes with whom it distinguish if the communication is belong to their system ot not.

Symbolically generalized media is currency, which motivate the people for participating in communication, and bring the successful results of accepting the meaning of communication.

In the autopoietic system theory, the relationship between the functions of system can be described through the concept of “structural coupling”. Economic system are structurally coupled with political system by the media of “tax” and “national budget”, and with law system by the media of “contracts” and “property right”. (fig. 2 )



**Figure 2. Structural Coupling of Autopoietic Systems**

Source: Miyuko Naruse and Takashi Iba, “Ecosystem as an autopoietic system”

In the recent years, a series of scientific papers analyzed the causes that led to the ignorance and/or criticism of Luhmann 's theory, whose application in organization studies is still limited, though it was applied on philosophy, sociology, theology, law, political sciences and others fields. In their work, Baralou, Wolf & Meissner (2012) identified three rations that can explain, in their views, the lack of interest from scholars for Luhmann's theory:

- in contrast to other approaches (Weick, Giddens, for exemple), Luhmann failed to identify and make use of sources of support in the scientific community. Besides, he only published in German language



and he was so much involved in structuring and crafting his researches, that the awareness and time for a wider dissemination were missing;

- the application of Luhmann's system theory was viewed with skepticism by the scholars, managers, students and politicians, because of the depersonalization of systems, individuals being 'reduced' from a holistic person to a social address for communication; his theory revolves around the concept of omnipresence and self-generation of communication, assuming that one can only create communications out of other communications and only communications can lead to new bases for making of novel communications (Van Assche & Verschraegen, 2008). Beyerle shows that Luhmann doesn't show how communications are produced. (Christian Fuchs, Wolfgang Holzkirchner. In Luhmann's view, social systems reproduce themselves based upon self-referential operations, i.e. by affiliating communications to communications (Luhmann, 1995);
- the difficulty to empirically explore theoretical concepts, such as reflexivity and recursiveness; without empirical applications, his theory remains at the level of pure abstraction which reduces its potential value; some of scholars (Mathus, 2005) suggests that his theory has little to offer for the theorization of broader sociopolitical consequence, while the others (Hernes & Bakken, 2003) suggests that concepts such as reflexivity and recursiveness, pose obvious methodological complications, and Luhmann didn't really offer any solution to applying recursive theory in empirical research.

In spite of the some studies (John Mingers, Fento Robbm e.g.) who sustain that not all social systems, institutions and organizations are autopoietic, the scientific research so far, allows us to affirm that autopoiesis is essential for the survival of the organization and the quality and speed of the communication is directly linked to the quality of decision-making process that is essential for the ability to maintain the autopoiesis processes. Therefore, the autopoiesis characteristics are directly linked to communication.

#### **4. Conclusions**

We restrain to elaborate, as Luhmann, that communication is the unit of autopoietic organization, but we find that communication and organization are critical for the autopoietic systems. Even more, we now can consider fundamental the idea (expose by Luhmann and detailed by Milan Zeleny) that in a autopoietic organization, communication must be preserve, secure and enhanced as it is the base for coordination and decision-making.

We think that the organization preserves its identity but also can change structure following its interactions with environment by communication among units and making decisions that are implemented. A system that is organized for autopoiesis will survive even if the units do not know or are not aware of the whole organization. We are supporting the idea that an autopoietic organization has to preserve the processes that allows future generations of units to have the same (or greater) number of choices for their decisions.

We believe that we can still define as autopoietic the organization that makes a decision to limit their choices while making a decision only for the current generation of units. But the decision that limits the options of the future generation of units cannot be assign to an autopoietic organization.

We can now contemplate the idea of a social autopoietic organization that has the human as a unit and acts as agent in a organization with a structural coupling with its social environment. Humans create society and society influence humans.

As studies shows, personal decisions are greatly influenced by society and the rules of society are influenced by personal decisions. Thus, the main product of a social organization is society.





The knowledge, in form of the rules, organization construct, decision patterns are preserved as long as a majority of the organization remembers, act and communicate them. The failing of communicating to units of current of future generations will result in a degradation of organization and finally, its disappearance.

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