

# ON THE CO-EVOLUTIVE RELATIONSHIPS BETWEEN SOCIETAL ENTITY AND ITS ENVIRONMENT

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## **Abstract:**

*An autopoietic societal entity is always functioning in a strong relationship with its environment, although some degree of autonomy is required as well. The societal entity develops relationships with its environment based on a "game" within which the reaction norms of the two „players" are exchanged and mutually validated. Paper examines, from a logical and institutional perspective, the way in which the autopoietic entity evolution becomes, in fact, a co-evolution with its environment. To this end, some concepts are introduced, developed, and analysed as: reaction norm, norms compatibility (or fetality), tunnel of compatibility (or niches compatibility), fine adjusting of reaction norms (or co-web of co-evolution). Paper is preponderantly placed in the new perspective of the social system as autopoietic system introduced in social theory by sociologist Niklas Luhmann.*

**Keywords:** *autopoiesis, societal entity, co-evolution, reaction norm, niche.*

**JEL classification:** *A10, O10*

## **Introduction**

Concept initially used in the biological sciences by Ehrlich and Raven (1964), the term co-evolution refers to the evolution of interdependence and mutual adaptation relationships between different entities and their environments, while these environments evolve in relation to them. In essence, coevolution refers to the simultaneous evolution of entities and their environments, whether these entities be organisms or organizations (Baum & Singh, 1994)

Relatively recently, a vast literature has been dedicated to the co-evolution of both biology and organization, social systems, involving identifiable elements of a system of self-organization that is constantly changing through interaction and recombination "at the edge chaos" (Langton, C. (1992).

Porter (2006) summarizes as defining criteria: a) *the specificity*, the evolution of one entity is due to the other, the locus of coevolution being "the edge of chaos"; b) *reciprocity*, multiple organizational elements change permanently, often at different levels of analysis c) *simultaneity*, the change is mutual, in relation or in response to other elements in a complex adaptive system; d) *genetic fixing*, with structural forms or other permanent forms of replication, the fixation or permanence mechanism being identifiable; e) *boundary crossing*, in a multilevel, multitheory, multimethod approach; e) *organically derived*, adaptive and emergent, unplanned and unpredictable, derived from the edge of chaos.

In the relation with their environment, as cybernetics show us, no system can maintain itself by means of a point-for-point correlation with its environment; for any system, the environment is always more complex than the system itself and the reducing of the environmental complexity may be possible by means of selective system/environment relations or by perceiving its environment in a pre-formed way. (Vanderstraeten, 2005)

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## Description of the Problem

The relation between system and environment is a widely debated topic in systems theory, since the works of Ludwig von Bertalanffy (e.g. 1968). The developments in systems theory, especially those that are related to the autopoiesis 'paradigm' try to offer an answer for the great problems of the society in relation with its environment.

The concept of autopoiesis was introduced in the systems theory by Humberto Maturana and Francisco Varela (1972), to define the unity of a biological system in relation to its environment based on self-reference and self-reproduction: each organism has autonomy based on the of interactions between its own constitutive elements, without any direct reference to the environment, but due to structural coupling, they co-evolve.

The German sociologist Niklas Luhmann extended the concept of autopoiesis on the theory of social systems, which he claims "can contribute to the abstraction and refinement of the general theory of autopoietic systems". In the Luhmann's view, a system is defined by a distinction from its environment, which, together with selection restricts all observations and communications made by the system, as a way of reducing complexity. When a system comes into being as one entity, the difference between the system and environment is repeated within the system itself. In society, this yields functionally differentiated sub-systems each with their own autopoietic observation and communication processes (law, science, economy, politics, etc.) (Chettiparamb, 2019).

From the social theory perspective, defining the concept of autopoietic societal entity involves the conceptual clarification and logical definition of the concepts of system and poietic system, autopoietic system and societal entity identifying the distinctive characteristics and the predicates of sufficiency of each .

The system is conceived as an intellectual division based on reality) (objective, subjective, or subjectively objectified), whose existence is conditioned by: (a) a set of component elements discernible between them; (b) a membrane which separates the environmental components, c) a set of connections between the components (intra-membrane), which generates the system functionality, while the intra-membrane elements and the environment generate the system behavior. (Dinga & al, 2020).

This division based on reality can be produced by identifying or introducing, as the case may be, membranes that separate the system from its environment. In our opinion, there are only three types of such membranes that can cut systems for the purpose of knowledge (or action, as the case may be): a) physical membranes (for example, the body of a car); b) institutional membranes (eg state borders); c) logical membranes (for example, defining the referent of a concept). Of course, in specific cases, several types of membranes can overlap (coincide). It is important to mention that the membrane of a system is not part of its structure, although, obviously, the formation of the membrane is a logical and chronological priority over the appearance of the structure. The membrane should be considered a constructive condition of a constructive type, while the structure should be considered a constitutive condition of an identifying type

Auto-poiesis is the process by which the structure of a system either resists external disturbances (robustness) or regains the state from which it was disturbed (inertia). The sufficient predicates of the autopoieticity are: (a) Autonomy of internal operations (operational closing, the system, has a membrane that differentiates it from the environment, and the internal operations which are operations inside the membrane; there are always external norms that emerge from a leading sub-system that embed themselves in the concerned autopoietic entity, which will tend to open that operational set). (b) roughly identical replicability of its phenotype, and (c) co-evolution with its environment, inside the "tunnel" of identity conservation (inter-actional opening). (Dinga & al , 2020)

The configuration of poietic and auto-poietic system and autopoietic societal entity are shown in The Journal Contemporary Economy / vol 5, Issue 1/2020. (pp 19-28) For the purpose of this work, we present them on brief:

A poietic system implies the definition of the concept of poieticity (based on which the concept of self-poieticity and, respectively, auto-poietic system will be defined) starting from its distinctive characteristics :

Poieticity is a property (either of a system, or of a process, or of a phenomenon) with the predicated by sufficiency:

(P1) structuring potential: this is a predicate of sufficiency that refers to the capacity of the entity concerned to create, modify, preserve, update etc. structures, either with reference to itself or to its environment.

(P2) integrative potential: this is a predicate of sufficiency that refers to the capacity (potential) of the entity concerned to capture influences from the environment (or even from within the entity itself), influences that integrate either in its structure or in its functionality.

The concept (property) of auto-poietics (AP) requires two additional predicates of sufficiency:

(AP1) self-reflexive capacity: refers to the capacity (potential) of an entity to observe, record (memorize) and evaluate its state of identity with itself.

(AP2) conservative capacity: refers to the capacity (potential) of an entity to generate actions - impulses - to deal with the impacts that have occurred from the perspective of maintaining the identity of that entity.

Auto-poieticity generates, once established, a series of new predicates of necessity, respectively:

(APN1) the benign accumulation of disturbances: it is a predicate that allows the storage (storage) of influences coming from the environment of the entity or from within it.

(APN2) the entropic dissipativity: is a predicate that allows (or requires) the entity (system) in question the ability to maintain or decrease its entropy.

This means the ability of the entity to extract nonentropy from the environment (including from other entities / systems with which it interacts) and to pour entropy into the environment (or into other entities / systems, as appropriate).

The property of sociality is given by a more primitive property, of community, by which we understand the property that the component elements of an entity to develop a limited number of functions that are common to all elements. The concept of community involves defining attributes: a) spatial coexistence; b) power hierarchy; c) non-void intersection of individual / group interests; d) non-void intersection of the resources usable / used by each individual / group. The sufficiency predicates of the set of connections between the components (intra-membranatic) may be with a "private" character or a "public" character, ie non-autonomous, inter-component connections, which involve all the components of the system.

As a consequence, the property of sociality is manifested in all cases of entities (systems) endowed with subjects (cultural or non-cultural) in which there are connections with "public" character, such as bees, ants, humans, some species of animals (lions, wolves).

As results, an entity (system) has social characteristic if the the set of connections between the components (intra-membranatic) is not void.

The concept of societality, as attribute of social, refers only to the set of the set of "public", ie non-autonomous, inter-component connections, which involve all the components of the system. The connections between the component elements of the system and the environment of that system generates what is called the behavior of the system, which is divided into two subsets: the subset of the "private" (autonomous) connections between the component elements of the system (entity) and the environment of that system (entities) and the subset . An entity (system) has societal characteristic if the subset of is not void.

Autopoietic societal entity (ESLAP): In order to obtain the logical formula of the autopoietic social entity we will add, in a conjunctive way, the sufficiency predicates of autopoeticity described.

## Methodology and Data

Based on the definition mode of the autopoietic societal entity, we propose as classification criteria: (C1) resistance to disturbances: the criterion refers to ESLAP's ability to preserve its identity under the pressure of internal disturbances (generated by its own operation) or external ones (coming from the environment, including from other systems);

(C2) membrane penetrability: the criterion refers to the ability of the ESLAP membrane to oppose the passage of disturbances from the environment (including other systems) inside it. This implies, of course, certain selection properties that the membrane possesses, properties induced by ESLAP design;

(C3) the way of treat with disturbances: the criterion refers to the procedure adopted by ESLAP for the treatment of disturbances (either internal or external), either in order to preserve its identity or, in some cases, in order to accept pre-established forms of change);

(C4) evolutionary direction: the criterion refers to the general (or specific, as the case may be) trend, usually in the medium or long term, of the changes that an ESLAP manifests (or accepts, as the case may be);

Based on these proposed criteria we will establish the ESLAP classes:

resistance to disturbance, according to whom the following classes can be established (fig 1.):

(C1/PI) strongly inertial ESLAP: shows a strong resistance to changes that can be induced by disturbances (either internal or external, after they have managed to penetrate the membrane)

(C1/SI) weakly inertial ESLAP: shows a relatively weak resistance to changes that can be induced by disturbances (either internal or external, after they have managed to penetrate the membrane). This means that the effects of disturbances can occur even without the critical threshold of the previous ESLAP class being reached;

(C1/NI) non-inertial ESLAP: does not show any resistance to the changes that the disturbances (either internal or external, after they have managed to penetrate the membrane) generate by their pressure.

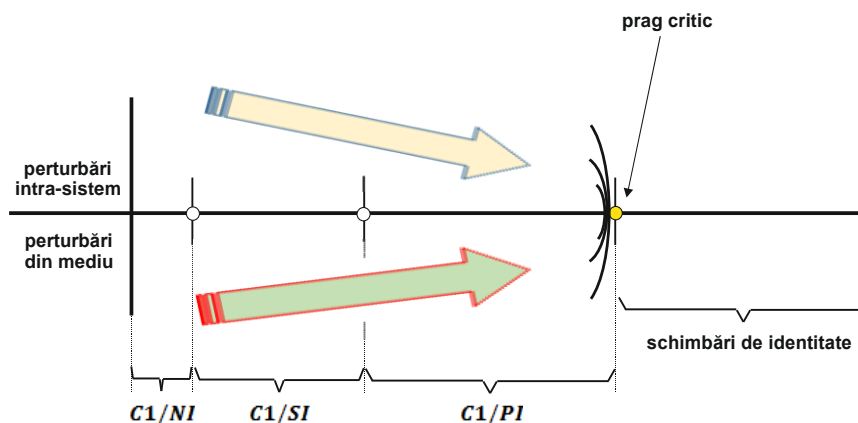


Figure 1. ESLAP classes based on criterion C1

Source: graphic construction of the author, based on his own research

#### b) membrane penetrability (figure 2)

Based on these proposed criteria we will establish the ESLAP classes:

autonomous ESLAP: shows a very high opacity in terms of the passage of external disturbances through the ESLAP membrane. These ESLAPs are quasi-impenetrable and one of the fundamental consequences of this property of strong impenetrability is the strong asymmetry between the internal and external complicity of the ESLAP in question - the degree of internal complicity is much higher than the degree of external complicity semi-autonomous ESLAP: shows a medium opacity in terms of the passage of external disturbances through the ESLAP membrane. These ESLAPs are relatively penetrable, and one of the fundamental consequences of this property of relative penetrability is the symmetry between the internal and external complication of the ESLAP in question - the degree of internal complicity is approximately equal to the degree of external complicity.

Dependent ESLAP: shows a very low opacity in terms of the passage of external disturbances through the ESLAP membrane. These ESLAPs are almost transparent in terms of penetrability,

and one of the fundamental consequences of this strong penetrability property is the strong asymmetry between the internal and external complicity of the ESLAP in question - the degree of internal complicity is much lower than the degree of external complicity.

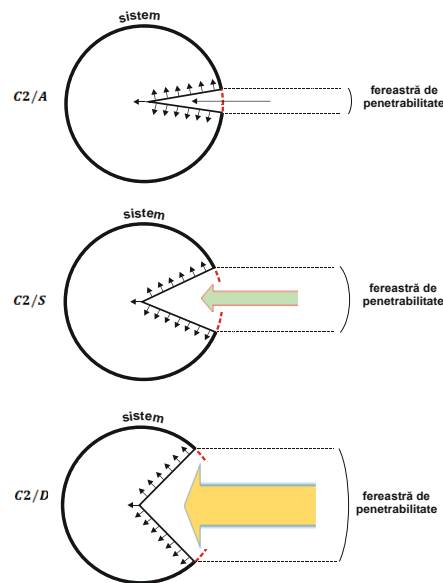


Figure 2. ESLAP classes based on criterion C2

Source: graphic construction of the author, based on his own research

#### The way of treat with disturbances

In order to examine the ESLAP classification related to this criterion, it is necessary to discuss the main structural and functional “devices” with which a system is “equipped” in its relations with disturbances.

In our view, the following such devices must be define:

*M-type device* (memory) that preserves the image of the structural "being" of the system in question. Indeed, the restoration of the structural configuration modified by a disturbance (internal or external) can only be done by referring to an "image" of this configuration prior to the time of the disturbance. Likewise, in order to preserve the structure under the "siege" of a disturbance, a benchmark is needed to be maintained. The memory in question, which can be held either inside or outside the system in question (as is often the case with social systems) can be of different natures:

- genetics (eg: in case of wounds of the organisms, the organisms in question recover the state prior to the moment of the injury based on the genetic code that will realize the synthesis of the proteins necessary for the recovery of the organism);
- cultural (eg: the case of normative changes at the level of society that need to be restored / reintroduced because they have proven to be beneficial); cultural memory includes both a memetic type reference (based on memes) and a semantic type reference (based on memes). Mema represents a replicator of cultural origin, of informal and non-imperative type of behaviors, and sema represents a replicator of cultural origin, of formal and imperative type of behaviors. The meme is random, while the meme is deliberative

*APE type device* (anticipation / prevention / avoidance) of disturbances (either internal or external). This device can, of course, be natural or cultural, depending on the system in question. The APE device operates before the disturbance occurs, so it is an ex ante device

*NRD type device* (neutralization / reduction / dissipation) of disturbances in front of which the APE device did not give results. The NAD device works after the disturbance has acted on the system, so it is an ex post device

*F-type device* (fructification) of the disturbances in front of which the NRD device did not give results. Device F is also an ex post device, but of last resort and even having a connotation of...

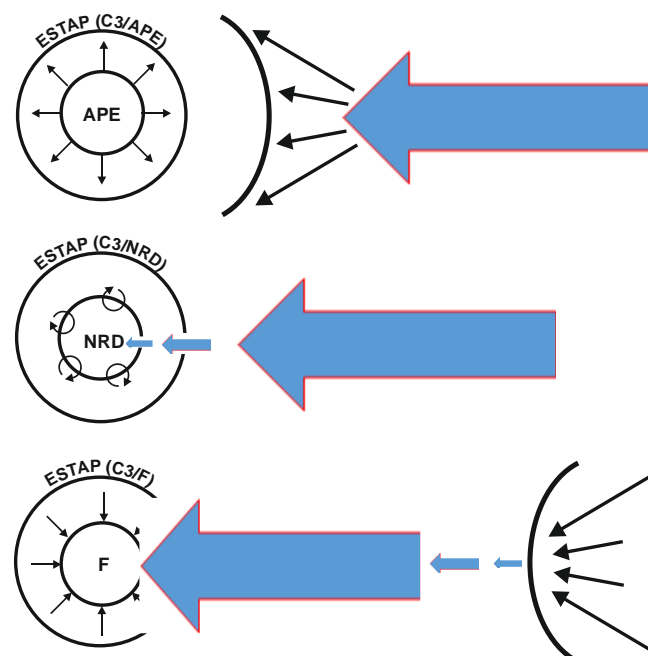
purpose.

Based on these considerations, we can now identify the ESLAP classes according to criterion C3.(fig 3):

(C3 / APE) evasive ESLAP: characterizes those ESLAP in which the APE-type device predominates and is manifested by the tendency to avoid disturbances - either by anticipating them and, therefore, taking measures to avoid their impact, or by preventing those which occur but were not anticipated, either by avoiding those that can neither anticipate nor prevent, the last reaction being ad hoc in nature;

(C3 / NRD) palliative ESLAP : characterizes those ESLAP in which the NRD type device predominates and is manifested by the tendency to actively treat the disturbances - either by neutralizing them by counteracting measures, or by reducing them by repair measures, or by dissipating them, by reorientation measures;

(C3 / F) antifragile ESLAP : characterizes those ESLAP in which the type F device predominates and is manifested by the tendency not to avoid disturbances and even to "look for" them, if not deliberately cause, in order to obtain advantages of any kind from bearing the disturbances in question.



**Figure 3. The ESAP classes based on criterion C3**

*Source: graphic construction of the author, based on his own research*

## Results

An autopoietic societal entity is both supported and disturbed by its environment. It forms its own structures in reaction to irritation from the environment in order to continue the autopoietic process, or it simply ceases to exist. (Vanderstraeten, 2005)

The autopoietic societal entity does not have direct inputs or outputs in the traditional sense; it constitutes a web of interdependent (and in fact for the most part non-linearly coupled) molecular processes that maintain autopoietic organisation, so, the external environment with which it interacts does not inform, instruct or otherwise define directly the internal dynamics, instead it indirectly perturbs the dynamics of the system. (Briscoe & Dini, 2010)

Letelier et al. (2003) suppose that autopoietic systems do not simply behave or react passively in the environment that is provided. He considers that an important aspect of autopoiesis generally is its mechanism of structural coupling, by which the autopoietic entities and its environment

determine, in a mutual way, change in the autopoietic system structure which contains these spatio-temporal correlations, on the form of complementary changes in interacting entities. That forms are called congruences, as a consequence of structural coupling. A congruence between the system and its medium can be selected or stabilised, so the medium gradually becomes the system and, for external observers unaware of the buildup of the relationship, the organism appears to become adapted to some characteristics of the medium, the autopoietic entities do not only adapt to the defined ecological niche, the standard notion of evolution by adaptation, but also partly create their environment through the systematic production of congruences (Briscoe & Dini, 2010).

The modern society works on the pattern of the functional differentiation, according to which the environment is perceived through different "lenses", such as political, legal, economic, educational or scientific lens, becoming impossible to anticipate and control their impact on the environment, which disturbs the internal dynamics and sensitivity of function of this sub-systems. In a functionally differentiated society, the change of one system can have social effects for the other. .( Vanderstraeten, 2005).

In the modern sense, society is a free and democratic social entity, a system organized as a leading sub-system and an executive sub-system, so, it is a system of systems; the relationship between the two sub-systems of a system is one of input-output type: the orders/commands from the the leading sub-system to executive sub-system are outputs for the leading sub-system and inputs for the executive sub-system, while the reports made by the executive sub-system for the leading sub-system are outputs for the executive sub-system and inputs for the leading sub-system. (Dinga&al, 2020)

In the modern society, norms are a necessary outcome of the social contract; they are stipulated into normative acts with the role of building sufficient social channels of interactions so that synergy can arise and replicate indefinitely. The fetality of norms means that the features of norms will be consistent, given a pre-existing normative background. In a certain sense, the fetality condition is a filter for the internal order of society analogous with the concept of "normal science " (Dinga&al , 2020)

The reaction norm is a concept helping to explain the observation that individuals of the same genotype will produce different phenotypes if they experience different environmental conditions (R. Woltereck, 1912).

The reaction norm is the result of a complex environmental cue response system, which buffers the functioning of the organism against environmental and genetic perturbations. The consequence of such a regulatory system is that environmental influences can play an important part in shaping the phenotype.

A reaction norm perspective on phenotypic traits unifies two concepts which have often been treated as opposing mechanisms: phenotype diversification due to environmental variation (plasticity) and the limitation of phenotypic variation by mechanisms that buffer development against genetic and environmental variation (canalization).

Both plasticity and canalization have been considered as adaptive traits evolved as a consequence of environmental variation. It is the reaction norm itself that one should consider as the evolved trait its adaptive value is. (Voelkl &Wurbel, 2019).

If the external norms are fetal for the entity concerned, then they will be internalized, and their external origin will be "forgotten" and fully replaced with an internal one. This, however, does not mean that a leading sub-system will arise inside the entity concerned, but simply that those norms acquire "citizenship" to the entity (Dinga&al , 2020).

## Conclusions

In conclusion, we believe that by using this new theoretical approche it is possible to develop new concepts that are helpfull in describing the co-evolutive relationship between societal entity and its enviroment.

## Future Directions

The directions of the future research is aiming to develop the described approach to further explore the relationship between societal entity and its environment with the scope of building a 4D imagine of the ESLAP regarding the structure and dynamic from spatial, temporal, institutional and teleological perspective.

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