Annals on Economy, Law and Sociology, Volume 9, Number 4 Special/2026
Romania, October, 2026 ISSN ONLINE 2067-5704


# ON THE SYSTEM – A LOGICAL APPROACH

Emil DINGA [1]

[1] Centre for Financial and Monetary Research „Victor Slăvescu", Romanian Academy; Romanian House, Building West, Floor 5, Room 5715, Romania, ORCID 0000-0002-3750-3248; Academy of Romanian Scientists; emildinga2004@gmail.com (corresponding author)

ABSTRACT: The paper is aimed at providing an abstract view of the concept of the (generic) system. To this end, firstly, the sufficiency predicates that could logically define a system are identified and examined, with a special view on the concept of the system's finality (and its difference from the purpose). Based on the concept, a typology of the system is proposed, from a set of six criteria. Further, the system's functionality, on the one hand, and of system's behaviour, on the other hand, are analysed. As a consequence of the previous, an integrated logical model of the system's general working is established by combining the functionality and the behaviour. Next, the general topology of a generic system is introduced, based on the relationship between system, supra-system, and sub-system, respectively, including the concept of hub. The last issue examined refers to the (possible) co-evolution between functionality and behaviour of a generic system, by building up the logical model concerned.

KEYWORDS: system, logics, sufficiency predicates, hub, co-evolution, model.

DOI 10.56082/annalsarscieco.2026.4.49.

## 1. PREAMBLE

The concept of the system is a cognitive (gnoseological) concept, not an ontological one. În the world, either objective, subjective, or objectified, there are no systems as observational entities, that is, as causing sensations on our natural perceptions. Consequently, the system does not represent a phenomenon, in Kantian terminology but, of course, neither a noumenon—i.e., an unknowable substrate of the phenomenon. It results that it is a cognitive construct about the real world. But, have we to do here with a general? As known, the general does not exist as real (of any kind of the three realities), only the particulars have reality.

[1] However, the concept of the system is not of the general kind, because we cannot find its particulars, as real entities. Then, we must concede that the concept of a system could be called a generic particular. The distinction between the concrete particular (which is derivable from a general), and the generic particular is not derivable from a general but is constructed as a non-sensitive particular. More exactly, the concept of the system is an intellectual perception of reality, a *sui generis* way to organize reality, in a similar way in which the theory (in fact, any theory) organizes the reality for our intellectual perception. In other words, the system is an intellectual construction added to the world, from the subjectivity side

## 2. THE SUFFICIENCY PREDICATES OF A GENERIC SYSTEM

To get a general or universal definition of a system, we need to establish the sufficiency predicates that, once verified (joined) deliver, without ambiguities, the concept of system.

### 2.1 The list of sufficiency predicates

(i) ($S_S^1$) a *membrane*, of any type, capable to separate[2] between an entity and its environment;

Comment:

- there are three kinds of membranes: (a) *physical* membrane—e.g., an eggshell; (b) *institutional* membrane—e.g., a *normative* interdiction; (c) *cognitive* membrane—e.g., a definition;[3]
- the membrane can be either impermeable (e.g., in the case of isolated entities), quasi-permeable (e.g., in the case of closed entities), or permeable (e.g., in the case of open entities).[4] The permeability of membrane addresses the permission of trans-membrane transiting by the three categories of material flows: substance, energy, information (or, with a general and embedding term: entropy).

(ii) ($S_S^2$) an intra-membrane *set of elements* (individuals), so that they hold in common at least an attribute, of any kind;

Comment:

- the common (at least, one) attribute of the elements set constitutes the very reason of „entering into being" of the system in the case, either for practical or cognitive interest;[5]

- the sub-set of common attributes must be clearly declared when a system is brought in the (objectified) world, such declaration being a crucial element for the system identity;
- this way, any current entity (object, element, etc.), either known or unknown, or of the past, or of the future, that verifies the sub-set of the declared common attributes, enters, by ”right”, the system in the case.

(iii) ($S_S^3$) a *hierarchical* (vertical) intra-membrane *structure* of the set of elements, so that one (or more) elements is (are) of a leading nature, and the rest of the elements are of a driven nature;

Comment:

- this sufficiency predicate stipulates that a system is, structurally, non-homogenous, it contains two different (and, generally, opposed) sets of elements and, in fact (see the point 1.3) the system works exactly by interactions between the two sub-sets;
- the separation between the two sub-sets of intra-membrane elements is either automatic (by self-organizing) or deliberate (in the case of systems that are, essentially, artefacts);
- the own functioning of a system can modify the positions and roles of its elements, so the two sub-sets are not immutable, but they must exhibit some persistence, to provide the system with a certain stability and, in some cases, even predictability.

(iv) ($S_S^4$) an internal *principle of interaction*, which allows intra-membrane elements to develop relationships among themselves, as well as between them, on the one part, and the system's environment, on the other part;

Comment:

- the intra-membrane relationships among elements are called system's *functionality*, while the trans-membrane relationships between the elements, on the one part, and the system's environment, on the other part, are called system's *behaviour*;
- although the principle of interaction is internal (inside), it also ”governs” the trans-membrane interactions between the system and its environment;
- the principle of interaction must be considered as general and abstract as possible, so that it can be particularized in any way in real systems;

*Nota bene*: if the sufficiency predicate $S_S^4$ is not verified, we talk about a conglomerate, not of a system. More than that, if $S_S^4$ is violated, neither $S_S^3$ cannot work.

From a logical point of view, a system is ”caused” whenever the four sufficiency predicates are cumulatively verified. If a generic system is noted as $S$, then it can be written:

$$S \leftarrow [(S_S^1) \wedge (S_S^2) \wedge (S_S^3) \wedge (S_S^4)]$$

### 2.2. Other mentions

(a) the finality of a system

By finality of a system (or a process, etc.) can be understood two different issues: (i) the end state in the kinematic of that system; (ii) the role[6] of that system.

(i) any system changes either as the effect of its functionality or/and its behaviour, as the two concepts have been defined above. To change means to pass from one state to another one. From this perspective, there are systems with a time arrow, and systems without a time arrow. For the first case (systems with a time arrow), for example, from the entropic point of view, and inside the closed systems, the states go, irreversibly, to that state which has the maximum entropy. This state, with a maximum entropy, is the finality of the system in the case. For the second case (systems without a time arrow), there is a circularity of the states, so that, when a given state is reached, the system switches to a given state (let us call it as initial state). These kinds of systems have not a final state (that is, end state) only a circular path between an initial state and another state which triggers the return to the initial state. Of course, we can say that we have, however, a time arrow but it reverses cyclically its sense in an undefined perpetuation;

(ii) having a structure, a system generates a role (as a convergent set of functions). This role is, in fact, the very system's finality. *Nota bene*: of course, if the system is an artefact, the system's finality constitutes exactly the human being's purpose but the system, *per se*, cannot have a purpose, only a finality.[7]

It must be said that any system, no matter its nature and characteristics, has either a finality, either a purpose/goal. For example, a natural system has a finality, while an artefactual system has a purpose.[8]

An interesting issue is associated with the individual purposes that are embedded into a larger system.

What happens with those individual purposes as a result of that embedding? My answer is the following:

- if the individual purposes, autonomously chosen, are embedded in an impersonal way (as, for example, the invisible hand's action in the economic field based on free market), the result of such embedding is a finality, not a purpose;
- if the individual purposes, autonomously chosen, are embedded in a „personal" way (as, for example, by voting based on some procedure), then a new purpose comes into existence, and it can be, alternatively:
  - one of the "old" individual purposes, to which all the other individuals adhere by "vote";
  - a different, new purpose that is compatible, at a higher level, with all "old" individual autonomous purposes.[9]

(b) *causa sui* vs. causa *ab alio*

The systems are, generally, of three categories: (i) natural systems—$NS$; (ii) artefactual symbolic systems—$ASS$; (iii) artefactual logical systems ($ALS$).

(i) the *natural* systems ($NS$) arise by their own forces, by the internal spontaneous principle of self-organizing, or, as often said, by *causa sui*. Those internal forces are, in fact, the natural laws, and they act necessarily.[10] Also, all integration/dis-integration processes of natural systems as well as their entire "evolution" are under the necessity of the natural laws.[11]

(ii) the *artefactual symbolic* systems ($ASS$) arise based on external inter-subjective forces, induced by human beings (usually by society as a whole), in a deliberative (even programmatic or strategic) way—*causa ab alio*. The external forces are the social laws and they act quasi-necessarily. By quasi-necessary predicate I understand:

- there is a law (social law) instituted also artefactually, usually called positive law;[12]
- there is a pressure to apply the positive law (usually as a sanction introduced into the norm, for evading the law application in the case);
- despite the pressure to apply the positive law, some individuals (at the limit, even the society as a whole) could ignore it, by intermediation of their free will;
- the syncope in regularly applying the positive law explains the quasi-necessity in their action. The quasi-necessity (or quasi-necessary character) of applying the positive (societal) laws can be called also a *social necessity*,[13] by contrast with the natural necessity;

(iii) the *artefactual logical* systems ($ALS$) arise based on external subjective idiosyncratic forces, belonging to human individuals, either deliberatively or spontaneously. Although we have here also a *causa ab alio*, this time it is an individual cause, not a social one.[14]

## 3. SYSTEMS' TYPOLOGY

Starting from the point 1.2.2 (b), I shall try now to picture a general view of the systems typology. First of all, of course, we need to choose the criteria to conduct to the typologies searched.

### 3.1. Criteria for systems' typology

I consider six criteria which can provide typologies of systems, in a general and abstract way: (i) criterion of membrane ($C_M$); (ii) criterion of components/individuals ($C_I$); (iii) criterion of cause ($C_C$); (iv) criterion of principle of interaction ($C_F$); (v) criterion of internal structure ($C_S$); (vi) criterion of impact ($C_O$), either spontaneous or deliberate.

(i) the criterion of membrane ($C_M$)

The membrane of a system is the first thing that arises in the phenomenology of system birth. As shown above, there are three categories of membrane: (a) *physical* or material/substantial; (b) *institutional* or normative; (c) *cognitive* or logic.

(ii) the criterion of components/individuals ($C_I$)

The components of a system are „observable" based on the interest associated to that system. This means that different components are observed depending on the different interests of observers. However, from a general perspective, those components/individuals can be: (a) *physical* individuals—e.g., things as objects; (b) *symbolical* individuals—e.g., signs;[15] (c) *informational* individuals—e.g., time series; (d) *cognitive* individuals—e.g., knowledge/cognizance; (e) *ethical* individuals—e.g., social interactions rules; (f) *æsthetical* individuals—e.g., sound or colour harmonies.

(iii) the criterion of cause ($C_C$)

As sketched above, there are two generic causes in generating systems: (a) *causa sui*—an internal, autonomous, own cause; (b) *causa ab alio*—an external cause. *Causa sui* acts in the „worlds" that are not endowed with humans who have purposes and develop teleological actions.

(iv) the criterion of principle of interaction ($C_F$)

The principle of interaction addresses the way in which two or more entities make exchanges among them. These exchanges, in an abstract terminology, are simply, pairs of action-reaction or, after the case, only actions without reactions.[16] Obviously, the type of interactions, both between the system's components and between these components and the system's environment, depends on the particular system in the case. However, from a general perspective, it can be examined as an abstract typology of how the principle of interaction works. In this context, I think there are the following categories of principles of interaction: (a) actions *without* reactions; (b) actions *followed by* reactions. In reality, it is possible that a reaction happens only after cumulative actions reach a ceiling threshold, so to have a lagged reaction, not a lack of reaction.

(v) the criterion of internal structure ($C_S$)

By definition, any system is a hierarchical one, namely it contains a leading component and a driven component. This is a general, definitory structure of a generic system. Based on the internal structure, we can „calculate" the *degree of centralizing* of the leading component, so getting a typology of systems from this perspective.

(vi) the criterion of impact ($C_O$)

The impact of a system cannot address other than the manifestation of its role, either on other systems with which it interacts or on its environment. Consequently, identifying the categories of impact is logically equivalent with identifying the categories of possible impact of a generic system. I think the categories of roles could be the following: (a) structural; (b) operational; (c) cognitive; (d) axiological.

### 3.2. The classes of systems—general and abstract view

(a) According to the criterion $C_M$

The classes of systems generated by the type of membrane involved are:

(a1) physical/material systems—$S_M^P$;

(a2) institutional/normative systems—$S_M^N$;

(a3) cognitive/logical systems—$S_M^L$.

(b) According to the criterion $C_I$

The classes of systems generated by the type of components/individuals involved are:

(b1) physical/objectual systems—$S_I^P$;

(b2) symbolical/semiotic systems—$S_I^S$;

(b3) informational systems—$S_I^I$;

(b4) cognitive systems—$S_I^C$;

(b5) ethical systems—$S_I^E$;

(b6) aesthetical systems—$S_I^A$.

(c) According to the criterion $C_C$

The classes of systems generated by the type of cause involved are:

(c1) natural systems[17]—$S_C^N$;

(c2) social symbolical systems—$S_C^S$;

(c3) social logical systems—$S_C^L$.

(d) According to the criterion $C_F$

The classes of systems generated by the type of functioning involved are:

(d1) hiper-active systems (equivalently: hypo-reactive systems)—the actions massively dominate the reactions;

(d2) hiper-reactive systems (equivalently: hypo-active systems)—the reactions massively dominate the actions;

(d3) balanced systems—the actions and reactions come, generally, in regulated pairs.

(e) According to the criterion $C_S$

The classes of systems generated by the type of internal structure involved are:

(e1) mono-command systems: the systems with one-level of command, namely a single very strong leading component (with „global jurisdiction") vs. the rest— driven components;

(e2) oligo-command systems: the systems with a small number of levels of hierarchized leading components (with „local jurisdiction", except the higher positioned leading component (*primus inter pares*), each of them with „allocated" driven components. *Nota bene*: we have here a system of systems;

(e3) networked systems: big leading components, each of them with locally allocated driven components, so that the leading components are not anymore hierarchized among them, but are horizontally positioned. *Nota bene*: we have here a network of systems;

(e4) network: this is an exceptional case in which there is no leading component, and the „driven" components are mutually positioned horizontally. This is a case of system degeneration (or of the degenerated form of a system) toward network.

(f) According to the criterion $C_O$

The classes of systems generated by the type of impact involved are:

(f1) normative systems: introduces, into the societal system, new norms (rules) of behaviour or functioning, after the case, so completing the normative framework of the society;

(f2) functional systems: introduces, into the societal system, new actors (operators) regarding the societal interactions (e.g., new institutions, new organizations, etc.)

(f3) cognitive systems: introduces, into the societal system, new institutional agents aimed at producing/improving knowledge, of any type (scientific, philosophical, metaphysical/theological, artistical, etc.);

(f4) axiological systems: introduces, into the societal system, new values and new evaluators in the axiological field, including ethics, aesthetics, social capital, etc.

## 4. SYSTEMS'S FUNCTIONALITY

The functionality of a system is understood as the set of real/actual[18] relationships among the components of that system. The functionality implies only intra-membrane interactions. As shown before, a system contains at least a component of the leading type (*Nota bene*: depending on the degree of centralism/centralization of the system, things can be a little bit different but the separation between a leading component and the driven components is always present).

From the leading component (LC) of the system orders/commands go to the driven components, while from the driven component (DC) reports about the accomplishing the orders/commands received go to the leading component. During functionality, inside the LC actions/reactions can happen among the sub-components of LC, and inside the DC actions/reactions can happen among the sub-components of DC, of all three sorts of interactions: informational, substantial, energetical.

Figure 1 synoptically presents the stylized functionality of a generic system.

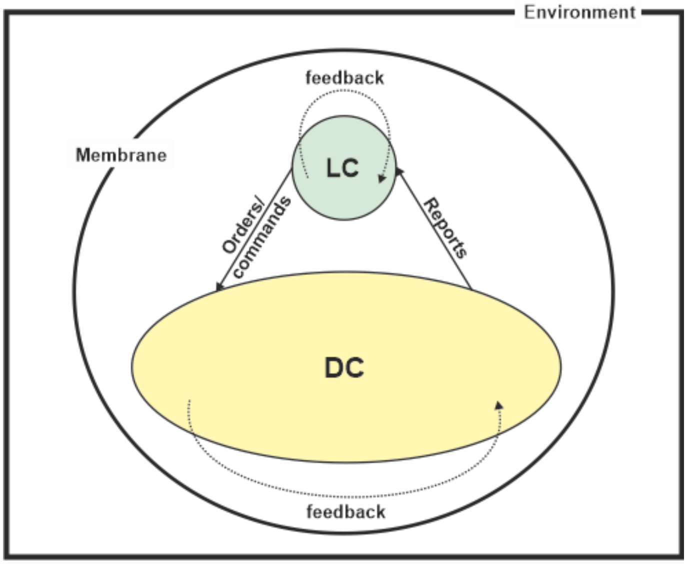


**Figure 1. The functionality of a generic system**

*Source*: author.

<u>Discussion</u>

- LC transmits to DC orders/commands to accomplish certain tasks, in a logic that characterize the system in the case, especially its finality;
- DC executes the orders/commands and, after accomplishing them, informs LC by intermediation of dedicated reports. These reports can contain, of course, the problems encountered during accomplishing the orders/commands so requiring their fixing for the next cycles of interactions;
- inside LC, feedbacks fix its working, based on either internal conditions or reports coming from DC;
- similarly, inside DC, feedbacks fix its working, based on either internal conditions or orders/commands coming from LC.

*Nota bene*: the orders/commands cannot be considered feedbacks coming from LC to DC, as the reports cannot be considered feedbacks coming from DC to LC. The reason is the following: a feedback means a reaction (i.e., a response to an action) coming from the output/outcome of a given system to the input of the same system. As LC and DC are different sub-systems in the given system, we cannot have feedbacks between LC and DC. Of course, at the level of the system the things are different: the orders/commands, respectively the reports can be considered as feedbacks, since they work inside the given system.

## 5. SYSTEMS' BEHAVIOUR

The behaviour of a system is understood as the set of real/actual relationships between the components of that system, on the one part, and the system's environment, on the other part. So, the behaviour implies only trans-membrane interactions, of any type: substantial, informational, energetical.

*Nota bene*: from a logical (and conceptual) point of view, the behaviour can be put under the aegis of entropic exchange between a given system and its environment (which, of course, contains, in turn, other…systems). At the adequate point, I shall resume and analytically develop this crucial idea.

Figure 2 shows the abstract model of a generic system's behaviour.

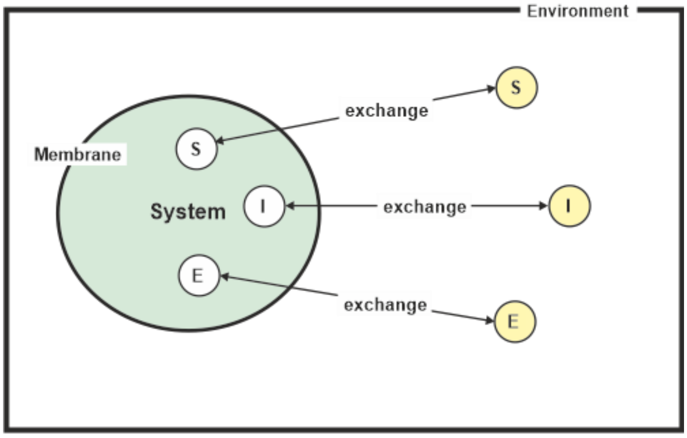


**Figure 2. The behaviour of a generic system**

*Source*: author.

<u>Discussion</u>

- any other system, of any nature, except for the given one, constitutes the environment of that given system;
- consequently, the behaviour (i.e., the inter-actions that imply membrane crossing) will take place between the intra-membrane components of the given (fixed) system and the extra-membrane systems (in fact, the intra-membrane components of the extra-membrane systems);
- in Figure 1.2. has represented the three standard classes of interactions (substantial, informational, and energetical); in fact, a system can develop interactions of one, two, or all three types of trans-membrane interactions;
- in a (conceptual) integrated way, the generic exchange between a given system and its environment is of entropic type. To the entropic issue, I will arrive in future chapters of the book, but here I want to say that the entropy mark of a system (respectively of its environment) is associated—perhaps, in a bijective correspondence—with the concept of order, whatever that means.

## 6. SYSTEMS' GENERAL WORKING

The whole activity of a generic system is a permanent and continue mix between functionality and behaviour. In fact, the functionality causes behaviour, and, in turn, behaviour causes functionality. Figure 1.3. suggests the interactions between functionality and behaviour.

Figure 3 suggests the interactions between functionality and behaviour.

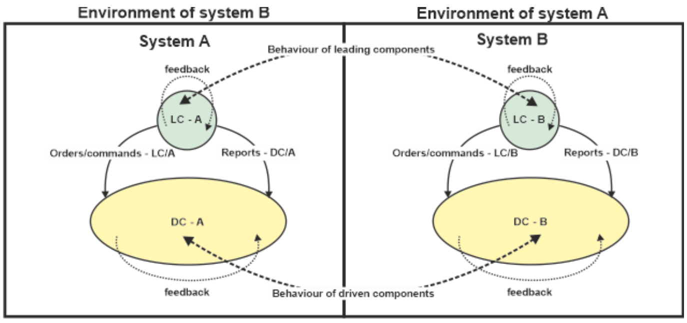


**Figure 3. Interactions between functionality and behaviour in a generic system**

*Source*: author.

<u>Discussion</u>

- from the behaviour point of view, cannot exist (direct) relationships between LC-A and DC-B, respectively between LC-B and DC-A: the two systems are internally hierarchical, not between them. Of course, we can have the case in which a system is a sub-system of another system—in this case, the LC of the supra-system can transmit orders/commands to the DC of the sub-system, and the DC of the sub-system can report to the LC of the supra-system (see more at the point 1.7);
- so, there are behavioural relationships (i.e., trans-membrane relationships) either between LC-A and LC-B, or between DC-A and DC-B;
- as said before, system A constitutes (works as) the environment for system B, and vice-versa, system B constitutes (works as) the environment for system A;
- being about two systems, i.e., two hierarchical entities, all the relationship between DCs must

be either ordered or allowed (approved) by the corresponding LCs.

## 7. A SYSTEMS' TYPOLOGY

From the point of view of topology we can discuss regarding the entire space inside which some systems are considered. More precise, the topology addresses the way in which a set of systems „covers" a given space of interest, for example, a national one. The core concepts in the system's topology are those of supra-system and sub-system. In such a context, I shall examine the following topological aspects of the concept of system: (a) how emerge supra-systems, systems, and sub-systems; (b) how coexist supra-systems, systems, and sub-systems; (c) are there fractal properties or propensities in system's topology? (d) what about kinematics/dynamics of the system's topology?

### 7.1. Emerging of system, supra-system, and subsystem

*7.1.1. System emerging*

We saw above that a system is an entity inside which, in one way or another, a component gains the power (or attribute) of command, so becoming a leading component. The quality of leading component can be of very different nature. Shortly, I discuss below a generic (possible) typology of the system's components.

(i) preliminaries

The leading components in a system[19] can arise either spontaneously (by the so-called invisible hand[20]) or deliberatively (by the so-called visible hand )—this categorization will be resumed at point (ii). At any rate, it seems that, somewhat, one component inside a membrane can accumulate more connections (arches in a graph) with the other components, at a moment. Such a component becomes, *eo ipso*, a hub, that is a node that is (or seems) more attractive than others for new connections. In such a way, a self-catalysing mechanism is initiated, through which the contingent fact of more connections into a node than in others, becomes, this time, necessarily, a leading node. In the problem of the hub into a network—*Nota bene*: before a node becomes a hub, the components inside a membrane constitute a network—we shall discuss below the following issues: (1) the conditionalities based on which an ordinary node is liable to become a hub; (2) the chances for a node that has just become a hub to maintain its state of hub; (3) the possibility that more hubs to exist inside a given membrane.

(ii) conditionalities to become a hub

A node can become a hub in two distinct situations: (a) it is designed, from the beginning—by Nature or by the human subject, after the case—, with a special capacity to attract connections from the other nodes. Such a pre-disposition towards the state of the hub is specific, for example, for the symbolic systems (artefacts) inside the human society, based on teleology; (b) it is altogether identical with any other node inside a given membrane. In fact, only the case (b) is interesting to be examined, what I do next.

We shall say from starting that, in case (b)—which is specific outside the human networks, namely to Nature, either living or not-living—, the different number of connections for a node is absolutely a random phenomenon. As said before, such a phenomenon is of contingent nature, not of a necessary one. For some reason, at a moment, for a node, there are more connections than for other nodes. In such a state of affairs, something like a "connecting gravitation" appears at that node and, namely, the more connections to/from it are, the stronger „connecting attraction" will manifest, so the more connections will come to and leave from related to that node. A self-catalysing process acts, so, after a while, shorter or longer, the node in the case becomes a dominant one over the other nodes from the point of view of the connections intermediated. Finally, that node becomes a hub inside the membrane. Somewhat, the hub will lead, in one way or another (depending on the exact nature of the components inside the membrane) the most important and relevant connections (arches). We say, in such a situation, that one node has become a leading node (component), while all the other nodes (components) inside the membrane have become driven nodes (components). From a logical point of view, as said before, we have a system.

(iii) irreversibility of an existing hub

We said above that, once, by a random chance, a node acquires (earns) more connections than other nodes, the "connecting gravitation" will escalade and the process will continue. Two problems can be posed here: (iii.1) how long will continue the action of the "connecting gravitation"; (iii.2) which is the mechanism of "connecting" functioning; (iii.3) in which conditions, the node in the case can lose its position as leading node; (iii.4) what about more (competing) hubs; (iii.5) how do the functions of the hub differentiate.

(iii.1) persistence of the "connecting gravitation"

In the case of "connecting gravitation" initiation, this state is continuously and permanently fed with new connections that gravitate toward the implied node. A *sui generis* positive feedback acts, so the more connections there are at a given moment, the stronger gravitation that works. Consequently, we have an indefinite increase in the number of connections leaving from and ending in the node in the case. The process can cease in the following possible alternatives:

- the connections available inside the network are exhausted—this possibility is always present in particular networks, with a specific ”*raison d'être*” which at a given moment, is no anymore of interest;
- other nodes begins, parallelly, to manifest some attraction (”connecting gravitation”) for new connections or, in some cases, even for old ones, so stealing them from the node in the case. *Nota bene*: it is immediately clear that we have, here, a competition between nodes for attracting the connections, and this competition can shape the network into an evolutionist process *sui generis*;
- the node in this case exhausts its capacity to attract and handle new connections. In my opinion, this alternative has a greater probability of entering into reality. Consequently, it is of scientific interest to examine the ceiling thresholds of the potential nodes to attract the connections in a network. At point (b) below, I provide some considerations in this matter, including a floor threshold, i.e., the (relative) number of the possible connections that can „decree” a node as a hub;

(iii.2) the ”connecting gravitation” mechanism

The (possible) connections in a network are very particular, that is, are specialized to that network's nature and finality (*Nota bene*: the finality becomes a purpose in the networks composed by humans, i.e., by living entities capable of representation, which implies the consciousness). This peculiarity of the network generates exactly the force with which a new connection will choose the same node that already acquired a connection, so this process cannot receive a theoretical (abstract) explanation but an empirical one. In my opinion, the mechanism of the ”connecting gravitation” can be describes as follows:

- be the number of nodes in a network, $N$. Let us presuppose, at a given moment, that the node $N_1$ exhibits $C_1$ number of connections, from and to the other $(N-1)$ nodes, and we have the following state of affairs: $C_1 > C_i$, where $C_i$ is the total connections from and to the node $i$, with $i = 2, \dots, N$;
- be the number of connections $\bar{C}$, above which the network will ”observe” the agglutination of the connections in node $N_1$ (of course, $\bar{C}$ is unique for a given network and depends on the nature and finality of that network);
- when $C_1 > \bar{C}$, the state of $N_1$ becomes observable within the network and, so, $N_1$ is ”acknowledged” as the dominant hub in that network (*Nota bene*: we talk about a dominant hub since other nodes can be, of course, hubs too, but with $C_i < \bar{C}$, for $i = 2, \dots, N$; such a situation will be examined at point (3) below;
- so, once the condition $(C_1 > \bar{C}) \wedge (C_i < \bar{C})$—which is the sufficient condition for hub emerging—is verified, then, the network in the case becomes a system;
- it is required, however, to find/propose/describe the very way in which one node ($N_1$) manages to become a hub. I provide in this matter the following considerations:
  - in a network, according to how this concept has been defined above, each component (especially, nodes) is equal among them under any criterion, so there are no privileged nodes, as well as there are no vertical hierarchies;
  - an initial agglutination of connections to a node is a random phenomenon, and, consequently, it is completely unpredictable (*Nota bene*: do not forget that, by now, that is, in the state of the network, the nodes are, somewhat, indiscernible among them);
  - however, that initial agglutination of connections creates what we have called ”connecting gravitation”. The ”connecting gravitation” acts as follows:
    - any new connection depends on the ability (handleability) of the nodes that are targeted by a potential connection. The node’s handleability is (non-linearly) directly proportional to the number of connections in place;
    - so, the more connections are in place related to a given node, the greater the node’s installed handleability, and an escalating process is triggered this way until the sufficient condition for the hub emerging ($C_1 > \bar{C}$) is verified;[21]

- the process of agglutination is fed by imitation/contagion, no matter if the nodes are conscious ones or not.[22]

(iii.3) reversibility in the statute of the hub

Principled, a hub seems to be capable of maintaining its position in an indefinite temporality. However, a random failure of the node-hub or (this time, in the human systems, i.e., in systems containing humans, artefacts, and non-anthropic entities) a deliberative renouncing to that position, are cases in which the node-hub ceases to be and function as such. In this context, the hub state could be lost and the node involved comes back to its ordinary statute: of a simple node. We can talk, so, about the reversibility in the statute of the hub. Although such reversibility is possible, I think that it can appear, regularly, in the long term. Alongside the two cases mentioned, a third one could be taken into consideration: the case in which a node earns its position of hub as a result of a kind of energy (or, after the case, neg-entropy) and, if or when that energy/neg-entropy is consumed, the node in the case ceases to be and function as a hub. This last case is rare enough but, at least in the human systems, it can be met more often. The last (but not the least!) case in which we can meet the reversibility of a node-hub is generated by the… competition among the nodes for the position of the hub (*Nota bene*: in fact, alongside the dominant hub, which, usually, is unique in a system, we can have, in that system, many other hubs also, but with a number of connections considerably lower than for the dominant hub, so we are discussing here the dominant hub only).[23]

To be mentioned that, in the human society, the replacing of a leading node with another, or even abolition of any such dominance (e.g., in the case of monopoly arisen in the economic field) is a deliberative decision.

(iii.4) more (competitors) hubs

In any network, in different degrees (speed, intensity, etc.), depending on the nature of that network, among the nodes unfolds a competition to get the potential connections, either inside the network or between network and its environment. More than that, inside the network, namely, among the nodes, as well as between network and the environment, happens evolutionary processes, so that the mentioned competition takes place in the general framework of evolutionary dynamics of the network and its environment. The competition among nodes has as its goal, in the most general case, the survival of the implied nodes. The survival of a node depends on the number of connections it attracts, maintains, and, perhaps, multiplies. Metaphorically, the connections constitute the feed of nodes or, more generally, their energy (*Nota bene*: of course, the universal term for this is that of the neg-entropy), since, below a critical number of such connections—this critical number is a quantitative threshold with an empirical, non-theoretical nature—, the node in the case could disappear because its uselessness. So, even in the most abstract approach, the competition is focused on survival in the most proper sense of the term. The competition for connections is very similar to the economic competition among economic actors for resources or for markets. As in the economic (more general, in the social) case, in an abstract network, fortunately, one node can attract, at a given moment, more connections that, as explained above, will generate ”connecting gravitation” and, this way, „monopolies” could form, in an endless escalating based on positive feedback.

(iii.4.1) criteria

A question can be put: there are criteria based on which the competition among the nodes unfolds? And, if yes, which are they, and how are they working? Next, I provide some considerations in this matter.

- the most important criterion is the *quantitative* one; this criterion can act, without discrimination for any node in the network and, above a ceiling threshold of the number of connections, it will „decree” the involved node as a hub (more exactly, that node will become observable as a hub inside the network, by the other nodes, and, this way, it will enter the self-catalysing process);
- another criterion could of be a *qualitative* nature; it is talking about some specialisation of the nodes inside the network. Here is the time to introduce a new and very interesting concept in network analysis (the concept, as we know, has been used for decades in Biology, more exactly, in the ecologically balanced bio-diversified systems): the concept of *keystone node* or, shorter, $KSN$ (by paraphrasing that of keystone species in Biology):
  - a $KSN$ is a node without which the network either blocks itself or change dramatically its role, functionality, and behaviour—the impact of lacking the $KSN$ is similar to the dramatically change of the biodiversity in an ecological system when a keystone species disappears;

– identifying the $KSN$, like in the case of keystone species, is possible in a counter-factual way, either in a natural experiment or an artificial one;

– consequently, in a network where a $KSN$ exists or is in the process of forming as such, it is able to gain more connections rapidly compared with the other nodes in competition, so, in a short time, it becomes a hub, and dominates the network functionality and behaviour;

– of course, not any node that has become a hub is, *eo ipso*, a $KSN$ in that network, but the converse—i.e., any $KSN$ is a hub in a given network—seems to be true.

(iii.4.2) classes

Based on the two criteria, we can, abstractly, identify four classes of nodes able to become hubs in a generic network, as follows:

- ($N_O^H$) ordinary node that becomes a hub by the simple accumulation of connections based on the ”connecting gravitation”;

*Nota bene*: it seems to be probable that a node of type $N_O^H$ be more propensive to lose its quality of hub, in a strong competition, especially if, parallelly, in that network, arises the second type of hub—in other words, the first type of hub has a larger propensity to reversibility.

- ($N_O^{KSN}$) ordinary node that becomes a $KSN$ by accumulating the connections based on the ”connecting gravitation”;
- ($N_{KSN}^H$) keystone node that becomes a hub by accumulating the connections based on the ”connecting gravitation”. The previous attribute of being a $KSN$, will lead with necessity to the position of hub, so, logically, the attribute of $KSN$ is a sufficiency predicate for becoming a hub.

Comment: we can put the question if it is possible, in a generic network, to arise more than one $KSN$. My answer is negative, based on the following (abstract) considerations:

- the concept of $KSN$ has, as a necessary crucial attribute, that of its indispensability (or, of lack of alternative) in initiating, maintaining, and perhaps, evolving the network in question. Such a crucial role and place is difficult to be thought as sharable between two (or, more!) nodes in a given network;
- logically, by sharing of the sufficiency predicates (and, as a consequence, of the necessary ones) between two $KSNs$ would lack content of the very concept in question, because either little of each attribute of $KSNs$ will be dissipated to more of them (with the risk of falling under the threshold of correct functionality of them) or some such attributes will remain at a $KSN$ and others will go to an another, with the same result of compromising the proper functionality expected from both.

From the above, a clarification is required: after all, what are the sufficiency predicates of a node to make it a $KSN$? I believe that the following sufficiency predicates in the case must be verified simultaneously to „give birth” to a $KSN$:

(a) ($KSN_1$) *accumulating*, in a sustainable way, of the largest number of connections inter-nodes—as stated above, this constitutes the quantitative sufficiency predicate. *Nota bene*: it is common for all the three classes of nodes mentioned at point (iii.4.2); probably, a bottom threshold should be established but, as said before, this issue is not a theoretical one;

(b) ($KSN_2$) *owning* the control connections at the network level—by control connections, we understand those connections that are without alternatives, that is, those which if changed (including by deleting) would dramatically change the nature, structure, functionality, and behaviour of the network, even until to its extinction. Of course, the „definition” of the control connections is vague enough, since the control connections are very different from one network to another, so it cannot be provided a more analytical definition, at least in this point of discussion—*Nota bene*: based on the general determination of this sufficiency predicate, I shall develop the required details when discussing the social system (Chapter 2), respectively the societal system (Chapter 3).

(iii.5) how do the functions of the hub differentiate?

As shown, the dominant component in a system is called (and have functions accordingly) leading component. Such a statute implies that from the leading components depart connections of orders/commands type, and from the rest of the system’s components (driven components) come to the leading one reports regarding the accomplishment of the orders/commands. But, we have seen that, till now, the connections are not differentiate, they are homogenous, so that, among the nodes of the system there are only quantitative difference (number of connections), not qualitative ones. Next, I propose a mechanism/process that could explain the transforming of the quantity into quality, regarding the connections, thus separating between leading components and driven ones in a given network:

- in the initial steps, the connections among nodes are randomly and approximatively equally distributed;
- after a while, it is possible that a node earns, incidentally, more connections compared with the other nodes and thus triggers a self-catalytical process to attract more and more connections based on the connecting gravitation arising; so the node in the case becomes a hub in that network (i.e., verifies the sufficiency predicate $KSN_1$);
- although in the previous step, only a quantitative difference (more connections) appears between the randomly privileged node and the rest of the nodes, something qualitative is triggered as follows::
  - the privileged node, as having more connections, probably with the most nodes, can „know"[24] better than the other nodes, the types of connections among the nodes, and, this way, design and deliver connections that use that knowing;
  - in time, the privileged node could take control of the connections it sends and receives from the other nodes, so its sent connections gain more and more the character of orders/commands for the tasks the other nodes achieve or should achieve, based on the mentioned knowing;
  - somewhat, at a moment, the privileged node earns prerogatives of a leading node, by holding the control connections (the sufficiency predicate $KSN_2$).

Comment:

Of course, not any leading node is a keystone node ($KSN$) but, in the expected competition among the nodes to become leading nodes, one of them—namely that node which performs the best knowing on the connections to adjudicate the control connections in the network, will become a $KSN$.

*7.1.2. Supra-system emerging*

While the mechanism through which, in a given network, one of the nodes becomes a leading one, this way generating a system, is an internal phenomenon of that network, the issue of supra-system emerging concerns two or more systems already formed, i.e., having leading nodes and, correspondingly, driven nodes. Next, I shall examine this last issue.

(i) what means a supra-system

As the name suggests, a supra-system is a system that dominates another one, but what precisely does that? I think the answer should be composed of the following considerations:

- a supra-system is a system that structurally comprises another one. This means that the membrane of the supra-system incorporates another system, as the concept of system was described above;
- in fact, the supra-system contains a system as a component. Let us examine more detailed this strange „animal":
  - being a system, the supra-system has, of course, a leading component and some driven components;
  - as among the components of the supra-system is the system in question, this one could be either the leading component or one of the driven components of that supra-system;

So, a supra-system is defined only structurally (in fact, quantitatively) as that system that contains, as a component another system. The system contained by a supra-system is called sub-system. It is obvious that the quality of supra-system or sub-system depends on the interest of analysis, for example, on the degree of analyticity desired (at the point (iv) more comments on this issue will be provided).

(ii) how supra-systems establish them?

The „force" that generates supra-systems is the function—when a function of a system incorporates, in one way or another, the function/s of other systems, the first can become a supra-system by structurally integrating the second one. So, the supra-systeming process, so to speak, is function-based, which means that a system can be supra-system for different systems (which, *eo ipso*, are sub-systems) from the perspective of different functions—consequently, a system can be a sub-system for many supra-systems, each position is based on a given function of that system. Of course, the same can be said about the supra-system—a supra-system can incorporate many different sub-systems, depending on the functions of interest for it. This multi-belonging is part of the real texture—no matter it is of Nature or the society. From this supra-systeming process a conclusion can be withdrawn: it is the function that creates the structure, not inversely, as Darwinism claims. So, at least in this context of discussion, we must accept that a Lamarckian inter-actions take place—we shall resume later this issue in the economy of the book.

(iii) a typology of the supra-systems

The supra-systems can be classified based on the following criteria: (a) the number of horizontal sub-systems contained; (b) the number of levels (layers) of sub-systems contained.

(a) the number of horizontal sub-systems contained

According to this criterion, the supra-systems can be richly populated or poorly populated, insomuch as they contain more or fewer sub-systems horizontally arranged. By horizontally arranged sub-systems we understand those sub-systems that are contained by the supra-system in question based only on the functions needed by that supra-system, namely, those sub-systems which are not integrated among them in pairs supra-system—sub-system.

(b) the number of levels (layers) of sub-systems contained

According to this criterion, there are supra-systems mono-layered or supra-systems multi-layered. The supra-system mono-layered are those supra-systems that contain horizontally arranged sub-systems only, while the supra-systems multi-layered are those supra-systems that contain more supra-systems among their components. Of course, from methodological point of view, it is important to know the number of layers in a supra-system, since the both functionality and behaviour of the „last" supra-system (i.e., the supra-system at the highest layer) is sensibly depending on the number of layers. In this context, I could consider that the degree of complicatedness[25] of a supra-system is directly proportional with the number of such structural layers. Of course, the topology of a supra-system is of a great importance, so a research dedicated to such a topic would be, in turn, very interesting and useful, both theoretically and methodologically. In fact, any generic system can be given a (numerical) mark signifying the number of layers under which it is functioning, since we can have supra-systems of supra-systems. Such a mark is relevant from the point of view of information circulation among layers (see more on this matter at point (iv)).

(iv) the relativity among system, supra-system, sub-system

As introduced above, the concepts of system, supra-system, and sub-system are positioned to one other in a relative way. A supra-system is as such related to a system only if the interest of research or practice indicates such a relationship. Another interest will establish other relationship from this perspective. Moreover, a supra-system related to a sub-system is, in turn, a sub-system related to a supra-system. Consequently, the problem of the ontology of systems, supra-systems, and sub-systems arises here, and I provide some considerations in the matter:

- for a system to be a supra-system for another system (that becomes, so, a sub-system), the leading component of the supra-system must exert leading actions for the sub-system. So integrating a system as a sub-system implies for that sub-system to „recognize" that the leading component of the integrator system is, also, a leading component of itself, which implies to receive order/commands from the supra-system and send to the last reports regarding the accomplishment of orders/commands;
- in fact, the circulation of information in a supra-system follows a multilevel route:
  - the orders/commands from the supra-system's leading component are transmitted to the sub-system's leading component;
  - the sub-system's leading component transmits the orders/commands received from the supra-system's leading components to the sub-system's driven components, perhaps with particularizations needed;
  - the driven components of the sub-system transmit the reports to the sub-system's leading component;
  - the sub-system's leading component transmit the reports to the supra-system's leading component.
- consequently, the new arrangement between supra-system and sub-system has an ontological character, no matter from what perspective the new supra-system is subject of observation.

*Nota bene*: some questions can be put here:

(1) can the sub-system's leading component transmit orders/commands, either those received from the supra-system's leading component or its own, to the other components of the supra-system?
   - answer: negative—the mentioned possibility would mean that in a system there is more

leading components, a situation excluded by definition

(2) can exist more than one sub-systems within a supra-system?

- answer: affirmative—with the condition that all sub-systems to be horizontally arranged among them

(3) is there an internal physiology of appearing/disappearing of sub-systems within a generic supra-system?

- answer: affirmative—alongside the integration of a sub-system by a supra-system, any supra-system can develop its own internal structure based on sub-systems—examples: the federative states, the deconcentrated/decentralized institutions.

The transmission of orders/commands and of reports in a supra-system is a little bit different from an „ordinary" system, as Figure 1.4. suggests, with notations: $OC/x$ order/command from system $x$, $R/x$: report from system $x$, $IE/xy$: information exchange between components $x$ and $y$.

Discussion

- first of all, it must be mentioned that the sub-system B is not anymore placed in the supra-system A's environment, so we are not anymore in the situation described in Figure 1.3;
- between the supra-system's leading component and its driven components, the relationships unfold normally, as shown before;
- instead, from the supra-system's leading component, the orders/commands do not go to the sub-system's driven components but to the sub-system's leading component only;
- from the sub-system's leading component the orders/commands go to the sub-system's driven components;
- the same, from the sub-system's driven components the reports go to the sub-system's leading component, not the supra-system's leading components;
- similarly, the sub-system's leading component cannot transmit orders/commands to supra-system's driven components;
- however, between supra-system's driven components and sub-system's driven components can unfold mutual exchange of information.

*Nota bene*: a question arises here: can or is it a good idea for the sub-systems to adjust the orders/commands received from the supra-system's leading component before retransmitting them to their own driven components? My answer is as follows:

– the supra-system's orders/commands must be preserved in what constitutes their finality (or purposes if it is about the social case), not mandatorily in their expression;

– so, the sub-system should combine the supra-system's objectives with its own ones, so the orders/commands it transmit to own driven components synergistically combine the two finalities (or purposes) —form a logical point of view, the sub-system should operate a conjunction between the two finalities.

The interactions within a generic supra-system are shown in Figure 4.

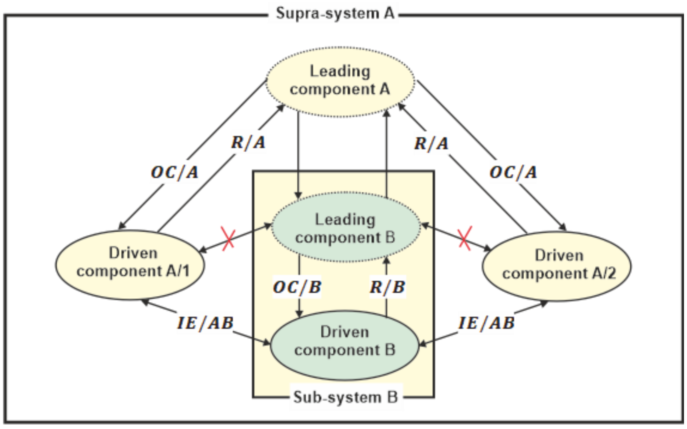


**Figure 4. Interactions within a generic supra-system**

*Source*: author.

*7.1.3. Stability of the supra-system*

Generally, the stability means maintaining, for a (pre-accepted) while the crucial or definitory parameter mark, usually, numerical expressed, of a system (or network, after the case), inside a variation tunnel. The mechanism of providing stability is the negative feedback. Consequently, the basic conditions to ensure the stability in a supra-system are the following:

- mutual negative feedbacks between the leading component of the supra-system and the leading components of the sub-systems; this is a stability adjustment of first order;
- mutual negative feedbacks between the leading components and the corresponding driven components within each sub-systems;

- mutual negative feedbacks between the leading component of the supra-system and its environment.

Of course, the instability is not always something undesirable—for example, the system's growth, and, especially, the system's development[26]—presupposes some destabilization, perhaps a temporary dominance of the positive feedback. What is important to mention here is that the positive feedback interlude must be administered by the… same negative feedback. Principled, the stability in a supra-system case is a dynamical texture, on many layers, of the stability in the case of a single system but, of course, we have here more than a simple quantitative multiplication of stability mechanism.

*7.1.4. Fractality in the system's topology*

Fractality (Peters, 1994; Dinga, 2025) is understood, generally, as a property of an entity (system, network, process, phenomenon, etc.) to manifest self-similarities either as structure, or functioning, either in space (as form) or in time (as processualism). The presence of fractality has some usefulness as the following:

- some degree of *predictability* of that entity: indeed, if an entity exhibits fractality, of any kind, since the fractal process is structural, so has a necessary character, it becomes a predictor for the state or position of the entity in question in a presumed time horizon;
- some *automatism* of that entity regarding different impulses arrived within: the fractal structure and functioning of such an entity ensures, to some a degree, a knowable pattern of dissipating of impulses received, either from interior or exterior, probably with certain multiplying/dividing effects among the different scales of the entity in the case.

It is to be mentioned that, in the societal system (see Chapter 3), the fractality is one of the most spread and significant way in which that supra-system functions. As we shall see, the autopoiesis works, in an important measure, through the intermediation of fractality, both in time and space.

## 8. REPLICATION OF A GENERIC SYSTEM

Defining the replication of a generic system is difficult enough. Firstly, we need a time horizon inside which the replication can be identified. At the end of the time horizon, what can we say about the system in question? Is it the same as before? What means, more exactly, „the same"? Then what is the concept itself of replication and what is the mechanism that provides such a replication? In what follows, I try to formulate my position on this matter.

Regarding the time horizon inside which the replication of a system should be examined, I think that it is an empirical (not theoretical) issue, depending on the nature of the system on which the exam is focused. Most systems (either natural or artefactual) have their own period of „reproduction", and that period should be considered. On the other hand, in the special case of artefactual systems deliberative systems, such a period can be set from the beginning, i.e., with the designing of that system. Moreover, the interest in research or practice could, also, impose particular periods of „reproduction".

The question of the sameness is of a more extensive, both ontological and epistemological, matter. I shall say the following:

- *firstly*, we must ask what means, more exactly, the replication of a system?

answer: the replication of a generic system means preserving its identity

- *secondly*, the question must be posed: in what consists the identity of a system?

answer: the identity of a system resides in its structure, that provides both the functionality and the behaviour of the given system

- *thirdly*, we must clarify the issue: the structure addresses the substantial, the formal, or both for a generic system?

answer: the structure refers to the formal personality of a system—for example, a material system in the objective reality has, as its replication, a system of equations that preserve a formal isomorphism with the real structured modelled. Consequently, the substantial identity of a system can be different from its previous version, with the condition of preserving the formal structure. So, the replicated version of a system can have a very small (or no) sameness with the previous one from the substantial point of view

- *fourthly*, how the replication of a system occurs?

answer: to observe a system replication a period of such a replication must be defined. So, the replication (or non-replication) will be observed at the end of that period or, equivalently, with the frequency of that period. In this context, a replication must be considered if the system is the same in a period with the system in the immediately previous period—*Nota bene*: as said before, the sameness is established by the sameness of the formal structure of that system.

## 9. SYSTEM'S NAVIGATION

By system's navigation is understood the ways (principles, mechanisms, devices, potentialities) by whose intermediation a generic system goes between its states and, especially, maintains its path/chreod.

In my previous book, entitled ”*The Economics of Social Justice and Societal Evolution—An Epistemological Approach*” (Dinga, 2026), some considerations on the feedback and feedforward in causally describing the systems' dynamics were provided, but, this time, a more comprehensive approach to such a (generic) dynamics will be performed.

### 9.1. Additionally of finality

Any dynamic system has a finality. The finality is the end-state that a system will necessarily reach, within a given time horizon. When we say ”necessarily”, we understand, of course, the two kinds of necessity: (a) natural necessity—that necessity against which cannot exist opposition; (b) social necessity—to which there is opposition based on free will.[27] In the first case, we talk about necessary finality, which is driven by laws, and in the second case, we talk about contingent finality, which is driven by desirability. The desirability is a kind of ”law”, but a subjective one. As being subjective, why is it, however, called ”law”? Of course, here we have rather a metaphor, but with strong affinities with the standard law, as follows:

- the desirability is a propension to a finality, emerging both from belief (theoretical rationality) and interest (practical rationality);
- consequently, at subjective level (i.e., at the individual level), desirability is, somewhat, a ”local law”;
- obviously, such a ”local law” is not immutable, as in the case of ”non-local law”
- so, theoretically, is hazardous to talk about a too crisp/radical distinction between objective law (the law of Nature) and subjective law (the law of human individual), since, from the *modus operandi* point of view, and even from the effective impact, the two categories of law are equivalent;
- of course, according to the vision of the three possible worlds (Popper's worlds), can exist also a third category of law, namely, the objectified law. An objectified law represents that law that emerges from the intersection (i.e., commonly agreed) of the subjective laws of the individuals or, better said, of the subjective desirabilities of the individuals;[28]
- in the societal life, any legislation, i.e., normative (either codified or not) grid of behaviour, is a sui generis mix/combination of three categories of laws, objective, subjective, and objectified;
- of course, depending on the context, the weights of the three categories of laws in the aggregate law (i.e., effective law) are different both in space and time.

Let us call this aggregate law: societally incident law—$SIL$. The $SIL$ has three layers: (a) a hard layer, the hard-core of $SIL$, represented by the natural laws involved, denoted $H_{SIL}$ (b) an intermediate layer, represented by the objectified laws, denoted $M_{SIL}$; (c) a peripheric layer, represented by the subjective laws (free will), denoted $F_{SIL}$. If a linear relationship between the SIL and the categories of laws is presumed, then:

$$\widetilde{SIL} = \widetilde{H}_{SIL} + \widetilde{M}_{SIL} + \widetilde{F}_{SIL}$$

where $\widetilde{SIL} = 1$, and $\tilde{x}$ means the relative expression of $x$.

Figure 5 suggests an image of the topology of $SIL$.

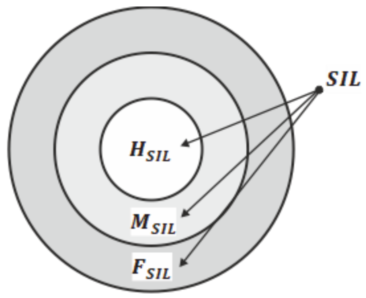


**Figure 5. The stylized topology of $SIL$**

*Source*: author.

<u>Discussion</u>

- the disks in Figure 5, expresses, by their areas, exactly the rapport between the sizes of three categories of laws in the societally incident law, that is:

$$H_{SIL} > M_{SIL} > F_{SIL}$$

*Nota bene*: we cannot say that there is a relation of inclusion between them, because they are, conceptually, distinct ton each other. All we can say is that the share in $SIL$ of the $F_{SIL}$ is the greatest, then follows the $M_{SIL}$, and the smallest share if that of $H_{SIL}$.

Obviously, the share of the categories of law in $SIL$ are inversely proportional with their volatility.

- in fact, the topology of the $SIL$ is analogous enough to Lakatos proposal to save the theory from the Popper's axe, namely for a two layers topology of the paradigm: a hard core, and a peripherical belt, so that the refutation of a hypothesis/conjecture affect at most the peripherical belt, not always the hard core (Lakatos, 1999);
- in line with Lakatos's proposal, the highest volatility of the ”legislation” regarding the behaviour is assignable to the component $F_{SIL}$ of $SIL$; a medium volatility is assignable to the component $M_{SIL}$, and the lowest volatility id assignable to the component $H_{SIL}$;
- this means that many changes in $F_{SIL}$ will generate few changes in $M_{SIL}$ and many changes in $M_{SIL}$ will generate few changes in $H_{SIL}$. *Nota bene*: one could calculate here, either in an abstract way or in an empirical one, some divisors of impact from $F_{SIL}$ to $M_{SIL}$, and, respectively, from $M_{SIL}$ to $H_{SIL}$; by combining the two divisors, of course, a divisor from $F_{SIL}$ to $H_{SIL}$ will can be calculated.

### 9.2. A sui generis co-evolution between functionality and behaviour

As is known, the functionality of a system means the relationships, of any nature, among the system's components, inside the system's membrane, while the behaviour of a system means the relationships, of any nature, between internal components of that system and the system's environment (usually formed of other systems). It is interesting to examine if there is a co-evolution between the two actions of a generic system, namely, between the functionality and the behaviour. Next, some basic considerations on this topic are provided.

*9.2.1. The necessity*

Remember that the functionality is a label for the set of interactions located inside the system's membrane, namely, among the system's components, while behaviour is a label for the interactions that occur between the system's intra-membranatic components, on the one hand, and the system's environment, on the other hand. The necessity of the co-evolution between functionality ($\mathcal{F}$) and behaviour ($\mathcal{B}$), which could be denoted with $\mathcal{FB}$ model, is supported by at least the following considerations:

- the functionality has, as one of its *raison d'être*, the interaction with the system's environment, to ensure the sufficient conditionalities for survival, and improving the system concerned, so the functionality necessarily interacts with behaviour;
- in turn, the behaviour has, as one of its unavoidable effects, the required change in the functionality, as a result of providing the improvement of the future behaviour;
- this double (logical) dependence between functionality and behaviour, sustains the idea of the necessity of that dependence.

*9.2.2. The possibility*

The interactions under functionality, and the interactions under behaviour, cannot become interactions between functionality and behaviour without some similarities between the functionality's interactions and the behaviour's interactions occurring. These similarities could refer to the following:

- the nature of the functions working intra-membranatically, and that of the functions working trans-membranatically, is the same, since the system concerned is the same;
- the trans-membranatic functions, i.e., the behaviour, are the same functions working intra-membranatically, with the difference that are oriented to the system's environment, not to the system's internality.

*9.2.3. A sketched mechanism*

The interactions between $\mathcal{F}$ and $\mathcal{B}$ occur at the aggregate level of the two categories of interactions. This means the co-evolution $\mathcal{FB}$ is not observable/identifiable for each of the involved functions, either operating for functionality or for behaviour, but for the two distinct sets of (relatively homogenous) functions of the two categories of processes. At the same time, it must be mentioned that not every functionality-function or behaviour-function is involved in that co-evolution process, but only a part of each of the two sets of functions. Let us make some notations:

- $\mathcal{F}_i^e$: the sub-set of the set of functionality-functions which are involved in the co-evolutionary process;
- $\mathcal{B}_j^e$: the sub-set of the set of behaviour-functions which are involved in the co-evolutionary process;

- $G_{\mathcal{B}}^{e}$: the genotype of $\mathcal{FB}$, located within the $\mathcal{B}$;
- $P_{\mathcal{F}}^{e}$: the phenotype of $\mathcal{FB}$, located within $\mathcal{F}$;
- $\mathcal{M}_{\mathcal{FB}}^{e}$: mutation, located within both $\mathcal{F}$ and $\mathcal{B}$;
- $\mathcal{W}_{\mathcal{B}}^{e}$: transcription of the mutation, located within $\mathcal{B}$;
- $T_{\mathcal{F}}^{e}$: translation of mutation, located within $\mathcal{F}$;
- $F_{\mathcal{F}}^{e}$: fitness of mutation, located within $\mathcal{F}$;
- $S_{\mathcal{B}}^{e}$; selection of mutation, located within $\mathcal{B}$.

Figure 6 shows how the co-evolutionary process of $\mathcal{FB}$ pair unfolds.

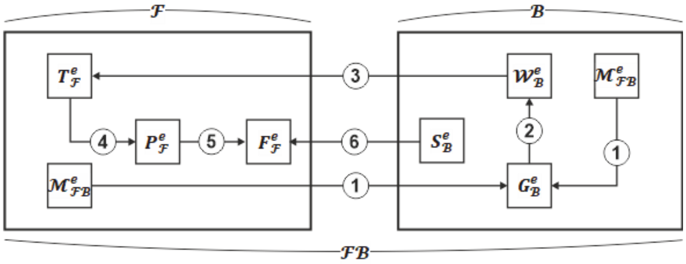


**Figure 6. $\mathcal{FB}$ co-evolutionary model**

*Source*: author.

*Nota bene*: however, how are the two sub-sets mentioned above that are involved in the co-evolutionary process selected? I will provide the following considerations in this matter:

- firstly, it must be said that there can be some functions belonging exclusively to the behaviour of that system—those functions are, of course, ”de jure” selected for the co-evolutionary process;
- secondly, some functions of functionality process can be much more involved in the system’s behaviour than other such functions—those functions are very good candidates to be selected for the co-evolutionary process;

Obviously, depending on the state of affairs, the two sub-sets of functions are not invariant, namely, there is a ventilation that changes the structures in question.

*9.2.4. Some epistemological consequences*

The most important consequence of the co-evolutionary process of the pair $\mathcal{FB}$ is the non-invariance of both functionality and behaviour. Another one refers to the already ”established” presumption that the function is generated by the structure. Although this is, obviously, true, some functions, for both functionality and behaviour, could emerge from the mentioned co-evolutionary process, within the same structure. In fact, probably, we should accept two sources for emergence: (a) the very structure—let us call this source the structural cause; (b) the synergy of functions. Probably the co-evolutionary process influences both sources, either by mutations within the same structure (i.e., under the label of synergy), or by changing induced directly to the structure.

## 10. ADDITONALLY, ABOUT SYSTEM VS. NETWORK

### 10.1. Preliminaries

We have seen that a system emerges from the network by gaining a higher degree of heterogenization, namely by constituting a leading component, on one part, and driven components, on the other. The problem that arises here is: is the reversibility of a system to a network possible? I shall expose my opinion as follows:

- to become a network, a system must lose its hierarchic configuration, that is, it must lose its leading component;
- from an entropic point of view, to lose the hierarchic structure is equivalent to an increase in entropy, since the degree of homogenization of the system increases;
- in non-anthropic entities, of course, the second law of Thermodynamics introduces a natural propensity to transforming the systems into networks;
- however, in anthropic entities (artefacts), which are, essentially, dissipative systems, the hierarchic structures tend to be preserved and, rather, to increase the heterogeneity by creating supra-systems, as shown above;
- consequently, the two categories of systems (non-anthropic, and artefacts, respectively) have opposite propensities to change from system to network. As we are interested, in this research, by deliberative systems, i.e., artefacts, we can conclude that there is a strong inertia in preserving the constituted systems from becoming the (previous) networks.

### 10.2. Some developments

In this last paragraph, some analyticity will be done in the topic of (dynamic) relationship between system and network, as understood in their general/abstract sense. More exactly, the following three questions will be answered: (a) are there degrees in the systemicity of a generic system?; (b) are there propensities, either in systems or in networks to transform in, respectively, networks or systems?; (c) are the transforming between systems and networks manageable?

*10.2.1. Degrees in systemicity*

Since a hierarchy can exhibit degrees of its strength, it seems that we can have degrees of systemicity of a generic system. Namely, systemicity is a property directly proportionally correlated with the degree of the system's strength. To take some examples from society: the communist political regime instituted a very high degree of the power of the state over civil society, while a free and democratic society exhibits a much lower power of the state over civil society. We say that, in the first case, the degree of systemicity of that system is high, while, in the second case, such a degree is low. *Nota bene*: of course, intermediate cases can exist as well: for example, the societal systems in which co-exist a centralized political power, and a decentralized economic life. At any rate, it seems that we must accept these degrees of systemicity as generated by the power held by the leading component of a generic system. Obviously, the degree of systemicity is inversely proportional correlated with the degree of networkhood—in fact, in a relative expression, the sum between the systemicity degree and the networkhood degree is 1.

*10.2.2. Propensities*

The issue of the propensities of a system to network, and, reciprocally, of a network to system is a little bit more complicated. This complications is originated in another question, namely: is it easier to acquire or to lose a property? This foundational question comes form the fact that a system emerges from a network by acquiring a new distinct property while a network emerges from a system by losing an existent property. Logically, it seems, *prima facie*, obvious that a property is easier to be lost than gained, consequently the propensity of a system to become a network is greater that the propensity of a network to become a system.[29]

## REFERENCES


[1] Bejan, A. *Constructal Theory of Social Dynamics*. Springer,(2007).

[2] Dinga, E.. *Economic Resilience During Overlapped Crises—Antifragility, Sustainability, and Autopoieticity*, Palgrave Macmillan—Springer Nature, (2025).

[3] Dinga, E. *The Economics of Social Justice and Societal Evolution—An Epistemological Approach*. Palgrave Macmillan—Springer Nature, (2026).

[4] Lakatos, I.. *The Methodology of Scientific Research Programmes*. In Philosophical Papers, vol. I (eds.: J. Worrall, and G. Currie), (1999).

[5] Maturana, H., Varela, F. *Autopoiesis and Cognition: The Realization of the Living*, Springer, (1991).

[6] Peters, E.E. *Fractal Market Analysis: Applying Chaos Theory to Investment and Economics*. John Wiley & Sons, Inc., (1994).


## NOTES

[1] See the debate about universals in the Middle Ages.

[2] In Spencer-Brown's sense of the (abstract) separation.

[3] Of course, a given membrane could belong to two or even to all the three types.

[4] The isolated entities do not communicate/interfere in any way with their environment, the closed entities communicate/interfere with their environment only by informational means, and the open entities communicate/interfere with their environment by all means: substantial, energetical, informational. *Nota bene*: for example, the entropy law (the second law of Thermodynamics) acts only related to isolated and closed systems, while in the case of open ones, the dissipativity adjusts the law's action.

[5] It is obvious that the same set of intra-membrane elements can constitute different systems, based on different common attribute/s considered. Consequently, a system is personalized by an attributive operation.

[6] Since a system, according to its structure, can have more functions that are objectified, the concept of role embeds the convergent functions into a macro-function. If the system exhibits a single function, then the role and the function are identical (or equivalent as the output).

[7] The today discussions about artificial intelligence are still ambiguous when considering that the devices with artificial intelligence could learn per se, i.e., they could be capable of self-learning) and even could establish their finalities—establishing a finality by their own means is equivalent with establishing a purpose. But this implies that the devices of artificial intelligence have consciousness, which is too much, at least in the current stage of knowledge.

[8] More exactly, it has an inauthentic purpose: the authentic purpose is held by the human being „responsible" (either as creator or user) for the artefactual system in the case.

[9] If the embedder of the individual autonomous purposes is a „person" with authoritarian power (e.g., a dictator), then the different, new purpose can be contradictory with some or all of the „old" individual purposes. Sometimes, the „voting" procedure can be eluded in the authoritarian case.

[10] This is why the necessity is perfectly predictable once known.

[11] Regarding the „evolution" of natural systems some considerations will be made elsewhere, by accepting that they need a principle of evolution (or development). For example, the constructal law (Bejan, 2007) proposes the maximization of useful (no matter from what point of view) flows that intersect, spatially, temporally, or processually, the systems in the case (more exactly, their… dendrites). As I shall show, Nature never maximizes something, but always minimizes something.

[12] Within the society also act laws that are not codified as positive laws, for example, the moral/ethical „laws", or the

divine „laws" (instituted by religions and their sub-lunar institutions—churches).

[13] The opposition to the social necessity is exactly the logical content (meaning) of the concept of free will. The free will cannot oppose to natural necessity but only to the social one.

[14] However, by social „vote", the subjective systems (theories, mythologies, art objects, and so on) can enter Popper's third world, so becoming artefactual symbolic systems.

[15] Here, in the semiotic meaning, namely, something that stays before us not for itself but for another thing.

[16] It is easy to observe that a reaction without an action is impossible—if the action lacks, the reaction is, logically, an… action. Even when a reaction comes before the action, for example, in an anticipative context or based on a feedforward, conceptually we have, in fact, an action.

[17] The natural systems include, obviously, the biological systems/entities.

[18] The possible (or potential) relationships among the components are, of course, of relevance. In fact, we can talk about real (i.e., actual) functionality and potential functionality. The potential functionality depends on some conditions that have, in turn, a potential character. In any case, it is useful to know the potential functionality together with the conditionalities required to move that potentiality into actuality.

[19] We have, here, somewhat, a causal circularity: a system emerges if a leading component exists or emerges. In fact, the leading component and the system as such arise concomitantly, being mutually and temporally determined.

[20] For example, a monopoly in the economic field.

[21] Remember the Biblical assertion (Matthew 4:25) „For whoever has will be given, but whoever does not have will be taken away even what he has", that seems to have had the intuition of the positive feedback of the today's cybernetic theory.

[22] A (perhaps) interesting examination of the gathering of connections to the most „appreciated" nodes could be made by the intriguing proposal of the constructal law (Bejan, 2007), especially that the connections among the nodes can be viewed as... dendrites with spatial forming.

[23] An examination more analytical could identify some saturation thresholds (for example, in terms of the number of connections, perhaps as weight in the total number of connections) or, let us say, sufficiency thresholds, for either reversibility or irreversibility, etc. However, the objective of the present study does not encourage us to more develop these investigations, here.

[24] Here, the word know is taken in its signification consecrated by Santiago School on the cognition, under the influence of Humberto Maturana and Francisco Varela (1991), with their theory on autopoiesis.

[25] We remember that, for us, the complicatedness of an entity (system, in this case) addresses the degree of difficulty of describing, logically as well as quantitatively, the functionality and behaviour of that system. So, we make the crispy distinction of complicatedness from complexity—by the complexity of an entity/system, we understand the state of the entity/system which contains free will, i.e., which contains humans, the only living entities credited (by now) as endowed with consciousness, that is, with the capability to oppose to the social necessity (*Nota bene*: not to natural one!), namely to manifest free will. So, a system can be very simple but complex, or, vice-versa, very complicated but simplex (not complex). While the complicatedness has a historical character (new developments of science can reduce the degree of complicatedness, as was defined above), the complexity does not have such a historical character - as long a system contains humans, it is complex eo ipso. It is to be mentioned that complexity is observable by observing the presence of unpredictability, a direct and necessary effect of the presence of free will.

[26] System's growth implies only an increase of the established mark (numerical value) of the definitory parameter of the system, while the development implies structural changes.

[27] Obviously, only human beings, i.e., cultural beings, can have free will.

[28] I would make a parallel with the concept of morals (Dinga, 2026), which is the intersection (i.e., commonly agreed) of the individuals' ethics.

[29] From this abstract consideration, one could develop an argument for the auto-catalytic (based on positive feedback) profile of a free and democratic society to oppose the authoritarian regimes.