

Production Cognitive Capital as a measurement of Intellectual Capital

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ABSTRACT

At present, knowledge plays a key role in the new economy. Nevertheless, its measurement as Intellectual Capital has not been possible from a certainty vision for the states, events and entities, leaving aside the complexity of organizations. This work proposes a paradigmatic shift where the fundamental support is the relational–semiotic condition of human organizations; any deviation from its strategic goals could be explained through the closeness between language and the action emerging from language. Defined as Coherence and Congruity (Sustainability) Management, the process named NETOUT allows increasing both coherence and congruity through co-participating in decisional modeling, and transferring repulsion interactions to organization areas that re-signify the conflict. Configurations arising from Sustainability are Production Cognitive Capital and constitute a measurement of Intellectual Capital.

1 INTRODUCTION

Knowledge Society and Knowledge Economy are concepts coined in the XXth Century to highlight the role of knowledge as key and differentiating element of economic growth. Hence, intellectual capital, defined in the simplest possible terms as knowledge generating value, has become the subject of study in many research works (Petty, Guthrie 2000). However, there exist as many definitions of Intellectual Capital as there are researchers devoted to the study of this matter.

A possible explanation to the above is that Knowledge-based Economy, as a value generation process, is fundamentally characterized by its uncertainty condition. This is based on that knowledge production is the result of organization's relational dynamics which does not allow locating a productive source in a person but in the network. Under that condition, knowledge generation involves a permanent uncertainty reorganization which we define as crisis. Finally, to round out these ideas, we call innovation to the art of reorganizing uncertainty or crisis.

The above mentioned leads us to the schema shown in figure 1 (a), where uncertainty, crisis, and innovation are the cornerstones of the intangibles world.

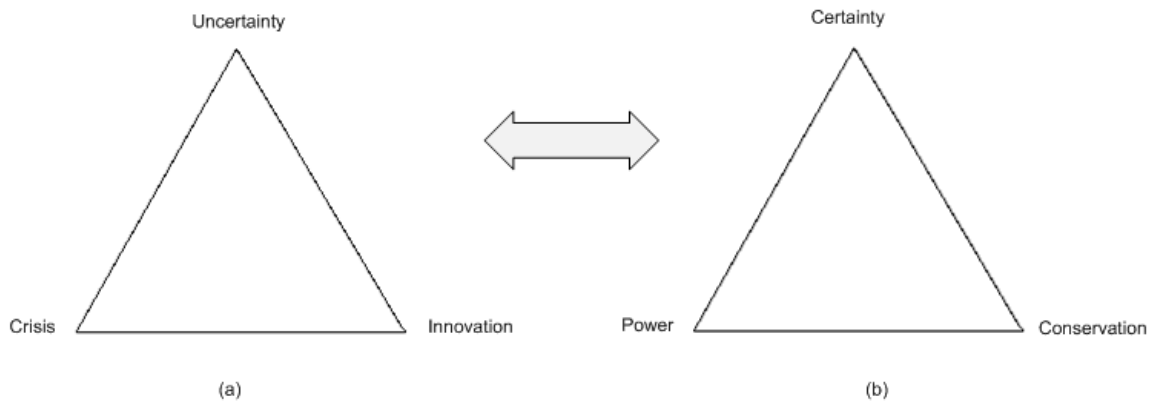


Figure 1. Tangibles and Intangibles Worlds.

By the other hand, object economy, the more traditional view, may be explained through another scheme, shown in figure 1 (b), whose cornerstones are certainty, power and conservation.

Here, certainty is bound to the permanence, to the object itself. Power and Control are a means used to “press” knowing where, when, and how. Finally, the idea of conservation is the appropriation over the capital, leading to richness through consumption.

The worlds shown in figure 1 are not exclusive but may coexist and be integrated, leading to a “better” configuration which is obtained “rotating” the (a) side, superposing both, leading to a virtuous hexagon shown in figure 2.

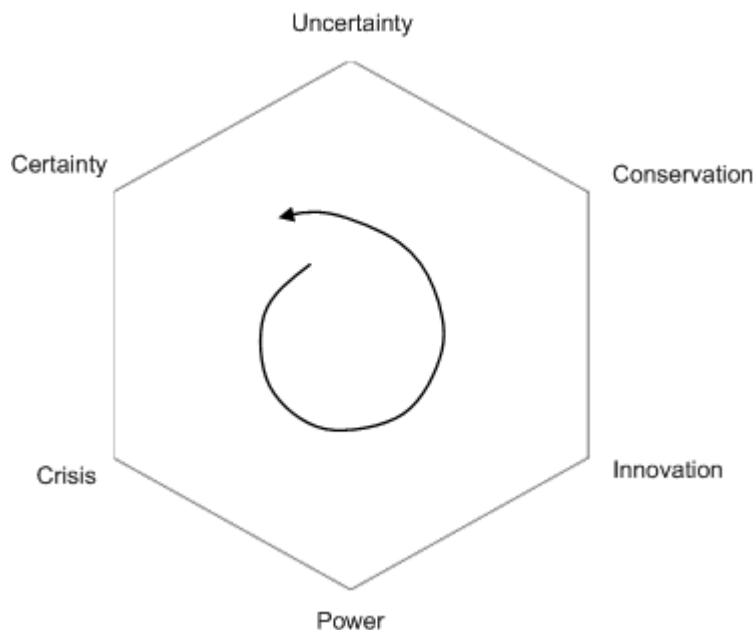


Figure 2. The Virtuous Tangible/Intangible hexagon.

As shown in figure 2, there are two apparently opposite “worlds”: tangibles and intangibles, coexisting,

and the hexagon is called virtuous because the two opposite worlds are co-active, generating emergence or synergy instead of reduction, as in the ying-yang metaphor, and it is possible to make a “leap” from one world to the other, depicted in a spiral movement. Thus, we may have, for example, a leap from innovation to uncertainty (in knowledge production), where tangible economy will enforce profit conservation; another example, innovation is always trapped between power/control and conservation.

The above leads us obligatorily to a change in our approach, from an objectual-dyadic view to a relational-tryadic one.

2 BACKGROUND

The Relational Approach

Relational Theory is an explanatory system basing its operation in the relation as a sense and world generation process. For this theory, the relational unit in cognition is *Organism-Entorno*, opposite to the classic proposal of organism and environment (Malpartida and Lavanderos, 1995 and 2000). The Surroundings of the observer are unique and permanent relational configurations of territoriality (code generation for bonding and belonging) for this one.

We spoke of Co-circumstantiality in the distinction of units, implying, as much the definition of the observer like the definition of the observed unit. The observer constitutes itself in the act of distinction as a unit.

If all the unit is a Co-construction, the objectivity principle will have to be applied then to the process by means of which the unit is defined (distinction acts). In this sense, we can define the objectivity of an operating form, like the explanation of the mechanisms of units generation.

In the relational process, the objectivity does not talk about the territory or nature (to be experienced), but the process of obtaining the map (reformulation of the experience), that is to say, which are the criteria, explicit rules, alternatives or conventions or implicit statements reporting construction process of models in general and explanations in specific.

The relational view compels to think that knowledge constitutes territoriality (Lavanderos and Malpartida, 2005), by way of networks configurations within a process which itself designates as value. This means that the notion of value in the network configuration is located in the exchange activity with other networks instead of the network itself.

The Relational Organization Approach

Relational Organization Approach (ROA) is a way of studying organizations coming from relational processes –viewing processes, rather than substances, as the basic forms of the universe–. ROA prioritizes change over conservation, novelty over continuity and emergence over reduction.

Creativity, change, disruption, and uncertainty are the main topics of a relational view.

This approach looks at relationships as fundamental, and does not require the existence of states, events, and entities, but insists on unpacking them as distinctions from culture which emerge as complex processes involved in –set of activities and transactions that take place and contribute to– their constitution.

Relational view relies on anti-dualism, i.e. the recognition that everything that is has no sense apart from its relationship with other things, and, therefore, long established dualisms such as mind and body, reason and emotion, humanity and nature, tangible and intangible, object and subject, need to be overcome.

In a tangible economy, object language (nominalization) has been the condition to overcome intangible world demands. Thus, if we define Organization as a relational system (set of relational processes), semiotically organized from the culture, as a legitimator of the above mentioned, then, knowledge production can be defined as the result of code structuring which generate intentionality to accomplish a determined product/service development process.

Related to the above, we can state that a concept like Intellectual Capital will have no sense if it is bounded to accumulation ideas. So, it is much more appropriate to speak about Production Cognitive Capital instead of Intellectual Capital. Production Cognitive Capital should be defined as a code system (semiosis) intentionally aimed at goods/services production. A first difference between them is that Production Cognitive Capital is sharper, focused on processes. Naturally, as any code needs to be interpreted, this process generates uncertainty, because there is a gap between the code intention and the associated action; a smaller gap means less uncertainty.

Production Cognitive Capital is located in the Business Intelligence scope, since it facilitates decision making through the comprehension of current functioning and action anticipation, generating a consistent direction facing complex scenarios.

The above definition allows assessing semiotic structure effectiveness in the productive process through closeness evaluation, which is called coherence. This involves a paradigmatic shift in business view and R&I (Research and Innovation) role, which would directly impact the associated strategies development. Because of that, design efforts associated to R&I must be driven from the relationship among those strategies to the form of knowledge associated to its development, since this one would explain in a better degree the generation of value of use and value of exchange in the new economy scope. Production Cognitive Capital must be understood as the knowledge or configurative process associated to both values, which is a feature only found in the relational process. The above implies that an increase in Production Cognitive Capital is in strict proportion to the relational quality of the network which produces it; in other words, a rapprochement between the argumentative line and the associated action degree (coherence).

A desirable consequence of this development would be an increase in network coherence and, hence, in Production Cognitive Capital as company value. In this new scope, knowledge generation would be a natural process aligned with organization's "emotional state", which is supported by three cornerstones: Cognition, Semiotics and Interactivity.

The present chapter is aimed at looking for alternatives, both theoretical and methodological, to assess Production Cognitive Capital. For that purpose it is divided in three sections: Cognitive Sciences ¿what is knowledge in an economy scope?; NEUS method as an approximation to Production Cognitive Capital assessment; and Inventing an organization as relational states structure.

3 APPROACH.

3.1 Cognitive Sciences ¿what is knowledge in an economy scope?

Knowledge theoretic and scientific analysis in all its dimensions are known as Cognitive Sciences. Information technology is usually the most visible aspect of this huge research and applications field whose main concerns are knowledge, information and communication (Varela, 1998).

A first approximation to “Knowing” arises from the symbolic school, which defines cognition as information processing in terms of symbolic computations or symbol manipulation based on rules. To this school, symbols must adequately represent an aspect of the real world (Varela 1998).

A second approximation comes from the notion of emergent properties and their self-organization (Sun and Alexandre 1997), and since the orientation in the reformulation of cognition is related to connections, this approach was denoted as Connectionism. In this case, the strategy consists not in symbols and rules, but in the connective dynamics among elements. For this School, Cognition is the emergence of global states in a network made of simple components, the validation of which takes place in the relation of a correspondence between the emergent status and the resulting structure for a given cognitive aptitude.

The above mentioned schools may be classified as representational, mainly because representation supports cognitive activity according to the definition provided by these schools. In the opposite way, there are the non-representational schools characterized by the Enactive and Relational schools.

The Enactive school states that cognitive aptitudes are linked to lived experiences (Varela et al., 1992). Cognition is no longer a device that manipulates representations but makes a world emerge through an effective action: a history of structural coupling that enacts (brings forth) a world.

The central idea to enaction is stating common principles to a linkage among sensory motor systems explaining how the action may be perceptually guided in a world that depends on the perceptor (Varela et al. 1992).

Finally, the position of the Relational School assumes as irrelevant the existence (ontogeny) of a pre-stated world as a condition for the observer cognition. How we know is explained as the generation of configurations (narrative) whose associative structure is determined by the culture. This way, we go from an ontological approach, whose objects have existence by themselves, to an epistemological approach, in which the distinctions are generated on the basis of the observer culture. These configurations (distinction operations) are taken by the observer networks that share meta-configurations organized for bonding guidelines (what one makes a part of himself/herself) and belonging (what one becomes a part of) which is defined as territoriality (Lavanderos and Malpartida 2001). The observer does not exist as an isolated individual but as a component of the cultural network which determines its configuration making approach.

Intellectual Capital definitions and their implications from the cognitive schools perspective

From the symbolic school standpoint, if a company’s knowledge is a reality which can be assessed and reduced to symbols, then an observer would have a universal character and could make an invariant narrative with regard to the knowledge given so he/she has the operations which make its representation possible. But, can knowledge be represented on the basis of its physical characteristics? And, if this were so, which should be these physical characteristics to allow their representation, apart from the associated semiotic rules?

From this perspective, only objects can be represented which we associate to the quality of knowledge, in fact in most of the works on Intellectual Capital, knowledge is presented as a quality-determined form. This is a distinction which, on the one hand, presents the object in this case and which, on the other hand, accompanies the quality in which it is presented. To put it in other words, it assigns a name to the object that is presented, and on the other hand, it is associated to a sentence to express in what feature such an object is presented. Here the presented object is knowledge, and it is presented in a feature of intangible objects.

Let us examine the definition of Intellectual Capital offered by Stewart (1998), “it is the sum of everything everybody in a company knows that gives a competitive edge”. This clearly shows that knowledge is conceived as an object so that it may fulfill the condition of the sum. This same conception is repeated when researchers divide intellectual capital into human, structural and relational capital.

Another way in which knowledge manifests is as an object state, though expressed through a series of intangibles (Andriessen, 2001). This author selects a set of distinctions allowing describing knowledge as a way of accumulation. By way of an example, we can quote the idea of managing information, patents, manuals, etc. The latter implies a reifying of the knowledge process. From this perspective, knowledge is homologous to socially useful work as it is conceived as the root cause for the generation of wealth. Seen from this perspective, knowledge acts as the causal cumulative force, a sort of “stock” which the members of an organization possess. Therefore, the amount of knowledge should be proportional to the amount of individuals who make up the company, which, by reduction to the absurd, would imply that companies with a greater intellectual capital should be mega-companies.

At this point, we could well sum up that Intellectual Capital is conceived in most cases as a concept that can be represented on the basis of producing objects which are associated to the quality of knowledge. This allows us to create an illusion of measure, since we can quantify the number of objects associated to that quality, reflected in believing that the observer’s universality condition and its descriptive invariance which makes it possible to speak of human resources accounting and financial balances. Likewise, the objectual idea of representation leads us to the design of multiple indicators, all of which are different, even those from companies belonging to the same industry. This has a direct impact on the impossibility of establishing distinctions for each indicator as to how much is good and how much is bad, low level of interpretation by the investors and what is more important, not being able to establish how the indicator and the creation of value are related. On the stated above, we may say that issues arising from the multiplicity of Intellectual Capital measurement and management approaches derive from the fact that knowledge is conceived as arising from symbolic representation, or as an object.

If the symbols must leave the scene, which one of the cognitive schools would enable us to establish the groundwork for an epistemology of Intellectual Capital?

Towards an epistemology of Production Cognitive Capital

From the above it is deduced that, as a general rule, intellectual capital definitions are seen as a symbolic conception, which brings as a consequence a multiplicity of models and indexes. Because of it, at this point we analyze the constitutive to build the intellectual capital from the schools: connectionist, enactive and relational.

From the connectionist or internal representation school view, the interest is in the processing rules that respect the semiotics of internally represented knowledge that generates value. In this domain, knowledge would be an emergent of the communication process, an interpretation which an observer makes of the interaction between two observers. Hence, knowledge would be a representation of a relation between oneself and some other party. This implies establishing equivalences determined by language, in terms of number, and by culture in relation to the diversity of knowledge which generates value. The latter could explain the problem that indexes are all different, even those in companies that belong to the same

industry, in addition to the ambiguity in the investors' interpretation. The basic issue of this approach is the notion that relationships can be represented as internal computations of entities and instants (Von Foerster, 1972). Hence, intellectual capital would be seen as a final representation, in the physical sense, a product of a relational element, the company, whose internal structure (the specific organization), is an internal representation of that Intellectual Capital. Even though this approach eliminates a series of obliged assumptions such as objectivity, their main limitation is the access to the internal structure or the form in which the relational process acquires sense and meaning, not for an individual, but for the network. And, hence, Intellectual Capital would be "computable" in terms of operations of the representation which this structure makes, something very close to the vision of the company, operations which have shown very little effectiveness in their application.

Knowledge is neither a thing nor the property of a thing, because it primarily addresses to a process; it cannot be localized independently from the network that generates it. Hence, it follows that it is not possible to represent knowledge as an object. Knowledge accounts for relational aspects, which implies that it is not possible to describe a relational element that generates knowledge as an internal representation of a knowledge structure. Because of this, there is a burst of indicators, under the form of companies that determine them and, due to dissatisfaction, these indexes are changed by the same companies within a given timeframe.

Based on the above, if we cannot represent knowledge, we must give up this idea seeking refuge in non representation. Next, we shall analyze the possibilities that non representational cognitive schools offer us facing the operationalization of intellectual capital definition.

If knowledge emerges as action in the world (Varela, 1998), that is, if knowledge that generates value makes emerging a world of meaning, then, Intellectual Capital is a set of actions accepted as such. There would exist, then, an operational closure or autonomy, which in the organization context would allow making the distinction in that set of actions which constitute and are network-generative, making possible its emergence as such. Even though this approach, designated as enactment, allows us to remit ourselves to the process and not to the object, it does not enable us to assess Intellectual Capital in an operational manner.

This statement is based on the following sentence: "knowledge is at an interface among mind, society and culture, and not in one or even in all of these elements. Knowledge does not pre-exist in any form or place, but is enacted under particular conditions" (Varela et al. 1992). The question arising immediately is: what are the particular conditions allowing knowledge enactment which generate value? Due to this same situation, under certain particular conditions the computation of these depends on the observer describing them and on the network for which they are described. In other words, what has been enacted will be an enacted translation made by a narrator, a return to subjectivity but, at the same time, without any representation.

Upon the above stated, it would seem that the computations associated with Intellectual Capital should already operate from the observer, though in the art of narrative, the latter understood as a configuration, a product of operating in culture, the fruit of organizing the relations as semiosis, that is, highly significant networks generating value for the organization. In order to achieve the latter, we shall take the relational vision, which compels us to think that knowledge constitutes territoriality (Lavanderos and Malpartida, 2005), that is to say, code generation for bonding and belonging, by way of configurations of the networks within a process which itself designates as value. The latter means that the notion of value in the network configuration is located in the exchange activity with other networks.

Relational theory establishes that transactional activities across different networks allow territorial value equivalence associated with the object as located configuration in the relation and not in the object as such.

It is then the network activity and the structure supporting it what constitutes Intellectual Capital. Thus,

knowledge definition in intellectual capital becomes located then in the exchange mode and in the configuration type in which it makes sense to be exchanged. Therefore, we may talk of intellectual capital assessment as the structural expression of the relations which culturally determine those configurations in terms of the value notion which generate territoriality. From this perspective, knowledge as an object disappears, and what is accumulated is the relational strategy for the production of value configurations that allow, due to the high degree of semiotic equivalence, their ability to transact with other networks.

Upon this basis, what must be assessed is the network relational structure to an extent such that, for different contexts, the intellectual capital value is the consistency of the configurations which have sustained the organization of the network, allowing its conservation.

As can be inferred from the above, talking about knowledge and value is to make a reference to the relation as a process. Consequently, it is not possible to generate universal rules for building a unique semiotic structure.

Is in this sense that cognitive sciences contribute with an appropriate guide as regards the implications of including intellectual capital in the representation and non representation domain. The first makes possible to recover external elements and project internal ones, thereby rendering intellectual capital non-viable as a process and inevitably reducing it to object accounting. In the second case, enactment is incomplete because it maintains the observer/setting duality, which makes unviable to understand intellectual capital as a network relational process. Finally, the relational school allows the design of basic computations of Intellectual Capital, as it locates the process as emerging from decisional history made up of the relational form or network structure, determined by the culture and conservation of territoriality. The latter, then, permits modeling the decisional process and the interactive and relational structure of the network in relation to its semiotic production of value exchange. It is at this instance where intellectual capital indexes become structural descriptors of the decisional process.

Summing up, epistemological foundations that better interpret the Intellectual Capital spirit in the XXIst century are in relational theory. This allows the development of a new vision of Intellectual Capital, which emphasizes the organization of the relations determined by a culture.

If we look deeply inside through this point of view, we can define a company as a process of relationships determined by its culture and organized according to the exchanges of bonding and belonging codes among people which guide the decision-making process for value generation. Therefore, Intellectual Capital –as knowledge which generates value– emerges from the consistency of the relational process between the structure of the organization and the decisional process within that structure.

In conclusion, Intellectual Capital measured as coherence and congruity is defined as Production Cognitive Capital. From relational epistemology we can deduce that intellectual capital can not be conceived as an object, but as a process, the Production Cognitive Capital.

The Management Process. Description, explanation and tautology.

If we define the management process as a system of actions towards achieving a goal, then the success of the last one depends fundamentally, from the relational vision, on the coherence among what is described, the associated explanation and the legitimacy of the tautology to the relational network. The description of the actions does not endure any logic, as Bateson points out (Bateson, 1980) it is a series of facts about which we do not know how they get interconnected. By the same, the explanation will not supply any information more than the already owned by the description. It is then the tautology or connective form applied to the description which allows connecting the actions generating sense to the series of facts contained in the description for a certain context. Then, when we refer to the tautology legitimacy, what we state is that for a command relational network, an instruction not necessarily achieves an explanation generating decisional coherence, this means that the narrative should match what it is going to be done

with what finally is done. This way, the Production Cognitive Capital (PCC) references the legitimacy degree of the tautologies used in the productive management process. This is, the greater the tautological legitimacy the greater the coherence in the management process which will have as consequence a relational network highly co-organized (semiotic production), cohesive (use value), coordinated, decentralized and with high power of exchange or congruity (change value). Then, it is a matter of understanding PCC as the semiotic-aesthetic effective exchange which allows the network to act cohesively to achieve a goal. We understand semiotic-aesthetics as relational configurations generating effective and affective belonging and bonding. The above could be exemplified in the following way: it is not enough that the leader generates orientation in the actions with high explanatory value, fruit of the applied tautology, but also it shall be legitimized in the subordinates affections or confidence.

On this base we have developed the NEUS method which is shown next.

3.2 NEUS method as an approximation to Production Cognitive Capital assessment

3.2.1 Introduction

The Production Cognitive Capital evaluation process is named NEUS (Network Evaluation for Unbalanced Systems), which is aimed at reducing incoherence and incongruity through a joint participation in the decisional modeling, managing difficult interactions by means of reconfiguring the relationships, improving this way both coherence and congruity.

NEUS is focused in explaining and evaluating network linking state on configuration exchange basis (narrative) and action schemes or interactivity (behavior) that have meaning for this network context.

Production Cognitive Capital arises from relational processes sustainability between the organization structure and its decisional process, and its evaluation can be supported by two parallel processes: meaning exchange (semiotic configurations) and interactivity.

Semiotic configuration exchange is the process that generates meaning equivalence from the used narrative. Narrative arises from the cognitive type that generates it, linked to semiotic recursive circuits' presence, and the possible meaning in the exchange process, named Structural and Semiotic Equivalence respectively.

On the other hand, interactivity is related to organization's behavioral dynamics, which is understood as the approach or rejection process among stakeholders, when a decisional process occurs.

Then: $PCC = f(NCA, NSA, NIA)$

Where:

- PCC is the Production Cognitive Capital
- NCA is the Network Cognitive Affinity
- NSA is the Network Semiotic Affinity
- NIA is the Network Interactivity Affinity

3.2.2 Network Cognitive Affinity in the decisional process (NCA)

In essence, human activity is based on semiotic operations, particularly language; thus the base of distinctions as cognitive operation generates connective structures in the reformulation speech with regard to a question. These structures arise from connection type and number among concepts used in an explanatory process. Semiotic relationships relate to terms or words presence in any series as the paradigmatic ones are to joining terms or words without specifying a particular way. Speech paradigmatic axis translates essential, stable, accepted, and implicit relationships for a certain network.

From this, an analogy is established among the axes of the speech, the distinctions and the used relationality, in the following way:

- Speech Syntagma (distinctions from a base question).
- Thinking Paradigm (connective network of distinctions).
- Type of used associations or terminological relationships: associative or causal.

The following are some rules or outlines that allow connecting the syntagmas:

- Attainment: Concepts in which the presence of one affects other, the connection is temporary. The simplest scheme is causality.
- Association: Concepts overlapping their meanings in the relationship.

From the above, it is established that the discursive process, from its base of distinctions, generates a configuration of concepts by means of consecutive and associative connectors. In the case of a network, for every member the type of configuration expresses the affinity degree among them when building the explanations.

The specific methodology for this kind of modeling is based on the Cognitive Map concept (Ackerman et al. 1995), a system that charts the reasoning line of the observer as concepts and connections (Figure 3), where rectangles S_i represent the semiotic line, connectors the paradigmatic line, arrow connectors the attainment, and simple connectors the association; P_1 is the question that rules the context and S_5 is the potential attractor. From this structure, it is possible to carry out different types of analysis, for example: speech attractors, terminal elements, opening elements, and concept centrality. With this, it is possible to find out that some reasoning concepts centralize and rule the connectivity of ideas and concepts, so that they allow characterizing the cognitive speech type. The cognitive map accounts for the paradigm from where the observer builds its observation. This technique allows to structure, analyze and generate meaning for different problem types. Cognitive mapping can be developed directly in an interview, allowing the observer to build and argue, as the problem arises.

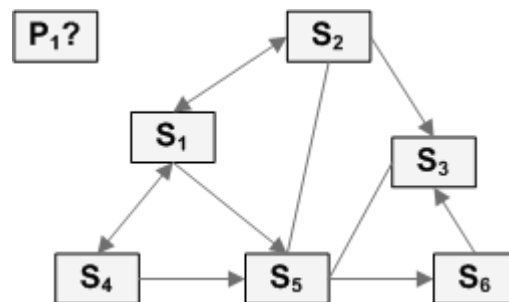


Figure 3. Example of a Cognitive Map.

The narrative structure is generated as a cognitive map, from concepts within the scope of decision-making problems inside the organization, as well as their connections. Maps are compared, trying to

establish significant differences among speech structures. The criteria used to evaluate if there are differences among speeches is focused, on one hand, in the conservation of the "attractors" of the generated structures, and in the presence of semiotic circuits. An attractor is a concept that guides and centralizes the construction of explanatory ways or argumentation; it is obtained from the calculation of centrality of the elements that compose the cognitive map. On the other hand, the comparison of every context discursive structures is focused on observing the presence or absence of circuits, specifically the presence of "recursive semiotic circuits".

These criteria allow to explicit explanatory routes (sequences of concepts that generate meaning), from which the generative mechanism of the explanation is shown. Types of analysis used and their aim are:

- **Centrality Analysis.** Prioritizes the connective density around syntagmas and their connectivity domain. The aim is to show the presence of centrality elements ruling the reformulation ways.
- **Circuit Analysis.** Extracts circuits generated by semiotic model concepts. If there is recursion (process a procedure goes through when one of the steps of the procedure involves rerunning the procedure), the complexity of the explanation structure and its way of association with other processes are predicated. When a closed circuit is formed, it generates a complex chain of argumentation.

From this, the Cognitive Type Affinity (NCA) is a function of the narrative type generated by the connectivity (attainment and association) and the recursion degree or number of present circuits when the centralizer is compared with the rest of the network.

With this, the Cognitive Type Affinity (NCA) equals to: $f(\text{CRT}_j \text{ versus } \text{CRT}_i)$

Where CRT is the connective-recursive type which allows getting the structural equivalence degree, when the members of the network are compared with their boss or centralizer. CRT is obtained from the predominant Connective Type (CT) and from the circuits presence or Recursion Degree (RD) by means of a matrix arrangement of both.

Connective Type (CT)

CT is calculated from the affinity/closeness among the connective types of the centralizer (CT_j) and the rest of network members (CT_i). This way, CT_j is equivalent to the number of Dominating Connection divided by the number of Total Connections, whose values are ranked in categories of Dominating Connective type (causal or associative).

Once CT_j is calculated, the connective dominance is calculated for the rest of the nodes of the network (CT_i). If the connective type of a node is inversely proportional to CT_j dominance type then it takes the category of opposite. For any purpose, the subscript j is assigned to the Centralizer and the subscript i to the rest of the network.

Recursion Level (RL)

RL is calculated from the rate of circuits over a heuristic value of 10. This way, RL_j (centralizer) corresponds to the Number of circuits of the centralizer divided by 10. This operation iterates for all network members.

As previously mentioned, CRT is obtained from the matrix arrangement: CRT_{ji} where j equals to $(\text{CT}-\text{RL})_j$ and i equals to $(\text{CT}-\text{RL})_i$, values taken by the matrix are qualitatively determined. This way, when comparing the Centralizer j and the Collaborator i the Cognitive Type on the recursion is prioritized. In the case that CT of both is Associative; the distinction is determined by the recursion.

Once CRT_{ji} is obtained, it is ranked in five categories depending on the closeness obtained after comparing CT-RL of the centralizer to each member of the network.

Two individuals have a high NCA inside the network if their cognitive maps are close. This means that, facing any question, people making up the network structure the solution in a similar way; therefore, they have close structures or forms, allowing them a better possibility of coherence, scenario that propitiates Production Cognitive Capital generation.

Network Cognitive Affinity (NCA)

The type of feature associated to the description of the Network Cognitive Affinity is based on the idea of building an “organizational mesh” from the communication process. For the same reason, an organization is compatible if the cognitive structure (way of establishing an explanation in a context) is common for its members. In other words, they obey the same paradigmatic type. See Table 1.

Table 1. Cognitive Affinity categories in the scope of the network.

Value	Category
$0.75 < NCA \leq 1.00$	Cognitively Homogeneous
$0.50 < NCA \leq 0.75$	Cognitively Allied
$0.25 < NCA \leq 0.50$	Cognitively Loose
$0.00 < NCA \leq 0.25$	Cognitively Heterogeneous

3.2.3 Network Semiotic Affinity in the decisional process (NSA)

A second step in the development of NEUS is to evaluate speech closeness, according to its content; i.e. to evaluate the semiotics associated to Cognitive Map structures.

An indicator of this is the speech attractor and, as defined previously, it is the one that centralizes the connections in relation to the universe of concepts composing the map. According to Bateson (1980), it is an *explanatory principle*. The attractor can be understood as the concept that rules the meaning of the speech. Semiotic equivalence is calculated from this base, which implies to establish the closeness among the attractor of the boss and the attractor of every member of the network. Semiotic equivalence from the attractor is calculated from certainty and similarity conditions.

The relationship established among attractors is named "relata", forming the following typology:

- Hyperrelata: Context shared by all, is equivalent to the base question.
- Hyporelata: Vertical concepts, different natures, there is no relationship.
- Holorelata: Member-class concepts, coincidence of constituent parts, equal idea.
- Merorelata: Member-class concepts, horizontal, establish inclusion.

When comparing the meanings of the attractors, there are two big categories arising to which these can ascribe, concepts whose relationship with the centralizer’s attractor are of different nature, for example: “Corporate image” versus “Create internal learning cycles”, where the first one comes from a strategic scope and the second one from an operational scope, i.e. in spite of being under the same hyperrelata or context, the explanatory principles that support the centralizer speeches versus its collaborator are in different hierarchical levels, which qualifies as hyporelata.

Another big category refers to holo-merorelata types, which explains the equivalence degree in terms of meaning. Of both, the holorelata is where the biggest resemblance is established. As an example, the attractors “Corporate Image” and “Institutional Prestige” correspond to the same relata.

Likewise, the category of merorelata is established when there is a smaller equivalence degree between two concepts from an inclusive relationship (one is part of the other). Example, in the scope of planning “to define roles” is part of “Corporate image”.

On the other hand, the concept of certainty is related to the possibilities of interpretation associated to the attractor, in a given context. This means that an attractor allowing a wide scale of meanings is classified as of low certainty, this impacts negatively on the execution of the decision-making process. For example, “Corporate Image” generates a wide scale of meanings, which diversifies and allows high degree of freedom in how it must be understood inside the network.

In the Cognitive Map scope, certainty is conveyed in the attractor’s environment structure. This way, there are concentrating (incoming connections) and dissipating (outgoing connections) attractors. Because these connections are causal and associative, they can be classified according to their dominance, forming three categories: Incoming Causal, Outgoing Causal and Stationary (equal number of inputs and outputs or associative dominance). Relationship coherence is analyzed between the certainty level of the attractor and its structure. This way, an outgoing causal low certainty attractor is highly coherent, but not when it is incoming causal. This is established from that a wide meaning concept (low certainty) needs to be explained by a high number of concepts (dissipates) to be able to give content.

Then, based on similarity and certainty, a matrix array in the form SC_{ji} where j corresponds to relata-entorno $_j$ and i to relata-entorno $_i$ is developed, values taken by the matrix are qualitatively determined. This way, when comparing the Centralizer j and the Collaborator i , the type of similarity (Relata) is prioritized over certainty. In the specific case of Hiporelatas, it is not possible to compare them, since by definition there is no relationship. When comparing Merorelatas, values are determined by the certainty generated by the attraction and dissipation structure.

Once SC_{ji} is obtained, the viability of certainty and similarity types generated by the crossover between the centralizer and each member of the network compared is analyzed. Table 2 shows the classification.

Table 2. Network Types after the loyalty degree of decisional speech reproduction.

Type	Status	Definition
Tuned up	$0.75 < NSA \leq 1.00$	Decisional process is completely reproduced by the network
Convergent	$0.50 < NSA \leq 0.75$	Decisional process is partially reproduced by the network
Divergent	$0.25 < NSA \leq 0.50$	Decisional process is inadequately reproduced by the network
Discordant	$0.00 < NSA \leq 0.25$	Decisional process is not reproduced by the network

From the Classification, it is possible to explain the differences, in the scope of action, between a control structure that designs an action scheme and the design implementation responsible team.

3.2.4 Network Interactivity Affinity (NIA)

Production Cognitive capital is constituted from success in narrative reproduction of company’s management associated to the executing relational structure (command).

Relationships are not measurable, since they belong to the information scope (Bateson 1973, 1980; Von Foerster, 1974). A methodological possibility is to deduce them from value judgments made by persons about their own colleagues in an organization. These judgments allow establishing action schemes which are translated to attraction or repulsion processes inside the network. Action schemes determining cohesion or disintegration are called network interactivity.

Establishing the organizational network configuration, from interactivity, is aimed to deduce relationship types allowing the organization to be carried out as a process. This network is constructed according to the affective-relative position of every actor inside the organization. Its construction is performed from what every member connotes in relation to other participants, from the company's daily activities.

The interactivity type of the stakeholder towards the question: how do you evaluate actor k competence against actor i to carry out a decision making process?

This interactivity process can change in time, generating a recurrent pattern, which is analyzed, evaluating if it is stable and sustainable as structure base. The stability, as interactivity type, is initially evaluated locally, this is from every actor towards the network and, later, local values are integrated into a global indicator.

NIA calculation is developed from the answers of network members to interviews. As an example, in the calculation of NIA between A and B, there are 3 "participants": A, B and R, being R the remaining members (neither A nor B) of the network.

Every participant expresses simple judgments (declaration), which are grouped according to:

1. A declares about (A versus B)
2. B declares about (A versus B)
3. B declares about (A versus R)
4. A declares about (B versus R)
5. R declares about (A versus B)

From the above, 3 values are calculated:

- D₁) Relative difference between 1. and 2.
- D₂) Relative difference between 3. and 4.
- D₃) Average of the relative differences between (5. and 1.) and (5. and 2.)

Every difference between A and B is calculated as: $|A - B| \times \frac{(A + B)}{2}$

Values are weighted (by p_i) and added, and the result is multiplied by a heuristic correction factor (k), being p₁ greater than p₂ and p₃.

In short, the Network Interactivity Affinity index between A and B (NIA_{AB}) is obtained from: $k \sum p_i D_i$

The resulting values are compound judgments of simple judgment comparison.

NIA values range between 0 (high level of repulsion) and 1 (high level of attraction), which is classified according to Table 3.

Table 3. Relationality of NIA values.

Type	Status
Reciprocal	$0.75 < NIA \leq 1.00$
Dealer	$0.50 < NIA \leq 0.75$
Complementary	$0.25 < NIA \leq 0.50$
Symmetrical	$0.00 < NIA \leq 0.25$

When having a network classified as reciprocal it is said that the dominating relationships regulate the differences among persons in such a way that, in case of divergence, these are lowered through coexistence quality. In case of a dealer network, the dominating relationships force to look for agreements to normalize coexistence. Finally, complementary and symmetrical relationships generate division and rupture; the complementary because of subjection to hierarchy and the symmetrical because of direct amplification of the discrepancy.

3.2.5 Production Cognitive Capital (PCC) calculation

Finally, when relating the three indicators previously described, a quantification of PCC is obtained.

It is important to emphasize PCC value in leading the network coherence state, this is essential as soon as it moves away from the idea of "reification" or objectualization of this intangible.

PCC analysis leads to a triadic interpretation of Cognitive Affinity (NCA), Semiotic Affinity (NSA) and Interactivity Affinity (NIA). It is necessary to emphasize that this process is complex, and reductionism shall be avoided in the interpretation.

Quantitatively, $PCC = \sqrt[3]{NCA \times NSA \times NIA}$

PCC takes values between 0 and 1 which are classified in Table 4.

Table 4. Organization's Coherence Classification.

Type	Range	Definition
Cohesive	$0.8 < PCC \leq 1.0$	High coherence
United	$0.5 < PCC \leq 0.8$	Medium coherence
Untied	$0.2 < PCC \leq 0.5$	Low coherence
Disperse	$0.0 < PCC \leq 0.2$	Very low coherence

This way, a decisional network which has compatible cognitive types of sintonic speech reproduction and a reciprocal NIA, classifies as cohesive.

As said above, the way from prescriptive to postscriptive logic in relation to what is understood as knowledge production, implies locating the creation of value (as PCC) in the decisional process coherence, which can be configured as: distinction-explanation-decision-action between objectives and goals, between actions and programs, i.e. to look for the alignment according to the narrative and action axes. Incoherencies produced are fundamentally due to insufficiency of communication support to control the difference between both axes, so difference amplification is generated, by cognitive type incompatibility or low certainty speech generation in decision making, or because in the daily affective ambience a symmetrical relationship freezes any possibility of network cohesion.

Network state is dynamic. Although cognitive type is the variable showing the least possibility of change, this does not define network state by itself. This way the coherence can be improved managing speech decisional certainty and re-configuring interactivity, by generating participation in decisional modeling and modifying repulsive type interactions to non conflicting areas.

Coherence management evaluates decision-action configurations the network can take, as bending and stressing which occurs from the triadic cognition-semiotics-interactivity. These configurations are organization's PCC because they are legible not only to the own network but also to the external ones, with which they have decided to establish or to cut off relationships.

NEUS goal is the evaluation analysis and management of productive processes decisional coherence, generating a communicationally sustainable connective network, proposing configurations to manage the difference between the narratives to do and the doing of an organization.

3.3 Inventing an organization as relational states structure

In the current context, the value generation process roots in understanding the strategic role of intangibles, especially when speaking about knowledge. Obligatorily, this statement involves a paradigmatic change in the vision of business and the role of R&I (Research and Innovation) what would directly affect the development of innovation strategies. Taking the above as a basis, design efforts associated with R&I must be driven from the relationship between innovation strategies and the knowledge form associated with its development, since value generation would be explained in better degree in the new economy scope.

One feature constituting this relationship is expressed in the coherence degree, which is the closeness between the narrative of decision-making and the actions actually made. Therefore, a small gap leads to a high organizational coherence degree. Under this scheme, management is stated so that its results change, from a certainty vision to a confidence one. This separation from certainty responds to the fact that organizations must be understood as communicating networks, where transactions are organized and directed from culture–language relationship, so any operation–action is always an interpretation.

This uncertainty condition in the interpretation allows to venture, then, that the center of attention is not goal fulfillment, but coherence. By the same, it is through coherence that value generation might be explained, in a better degree, in the economy of knowledge scope. Managing coherence implies designing a strategy to reduce the gap between the narrative and the actions derived from the decision making so that, a lower gap drives to organization higher coherence degree.

Value will arise in every step of the production process assembly relationships as it controls the difference between the saying and doing scopes. But, where is this difference located?, what determines the difference between the narrative and the action scopes?. A possible answer is to explain it by means of two concurrent processes:

- Meanings exchange (effectiveness in command reproduction), and
- Network interactivity (behavioral process of rapprochement or rejection among actors, when carrying out a decisional process).

In other words, the network has a way of thinking and doing, fruit of its history of decisions, which is conservative through shielding or closure operations facing external agents. This means that a person joining a network to work for the first time will not understand the network working codes, although the words are the same he/she handles.

Simultaneously, the persons who make up the network do not necessarily understand what the boss pretends in decision making, what will generate uncertainty and actions will be far from the wished. These processes generate differences between saying and doing and are responsible of effectiveness and efficiency loss facing strategic operations.

An organization can be defined as a “constituted relational structure, from its culture, from narrative and behavior configurations for decision making in contexts of certain meanings”; then, the coherence concept binds closely to code and meaning notions as base operation. This leads us to reconsidering management, going from a certainty belief to a confidence sensation inside uncertainty or complexity. From the above, if we consider organizations as complex systems (since their operations are fundamentally processes organized in the language, which introduces the uncertainty condition), it does not turn out to be strange to observe, in practice, the low correspondence between strategic programs and their fulfillment actions.

Analogous to Network concept, we have defined **Rel** or Relational system, which allows locating organizational problems in the relations that emerge on its daily dynamics; the above implies that relational methods evaluate persons as entities in regard to others. If we take that into account, the low correspondence would be explained as a specific state of the relational structure associated to decision making.

Both narrative and interactivity are expressed in the relational structure quality which is defined from its co-organization, cohesion, conduction and coordination, named Co4. The Strategic Alignment process to improve business coherence and congruity has been named Co4 System Configuration (the whole –inside and outside– relational system).

One of the strategic results obtained from interactivity (NIA) and semiosis is the connective structure of the network. From that it is possible to derive the key players (Everett, M. G., and Borgatti, S. P. 1999).

The key player problem is compounded of two related but different questions about a social network.

Type 1, KPP-1, or KPP-Neg.

- It is the minimum set of k nodes which, if deleted, generate maximum perturbation or disconnection (augments the number of components or the mean distance) in the network, resulting in a residual network with minimum cohesion. They connect in high degree, allowing establishing “bridges” among all the actors; without their presence, the network fragments.
- Quantifies network fragmentation after deleting nodes in non-directed and non-weighted networks.
- To solve the problem, **Fragmentation (F)** and **Distance (F^D)** are measured in the network (graph).

$$\text{Fragmentation: } F = 1 - \frac{\sum_i s_i(s_i - 1)}{N(N - 1)}$$

$$\text{Distance: } F^D = 1 - \frac{2 \sum_{i>j} \frac{1}{d_{ij}}}{N(N - 1)}$$

Type 2, KPP-2, or KPP-Pos.

- It is the minimum set of k nodes, which is maximally connected to the rest of the network. Is used to assess the “transmission” or “dinamization” of ideas.

- One approach is the distance-weighted **Reach** (R^D), considering differences among individual routes.
- To solve the problem, the amount of connections among a set and the rest of the network (graph) is directly measured (**cohesion among sets**).

$$\text{Reach: } R^D = \frac{\sum_j \frac{1}{d_{Mj}}}{N}$$

The state of the whole organizational Rel settles from four concomitant processes:

- **Co-organization.** Code production to maintain the organization.
- **Cohesion.** Robustness of the resulting structure from the reciprocal relations determined by interactivity and Semiosis. This way, as more reciprocal connections, more network cohesion.
- **Conduction.** Is the ruling form associated to command, which goes from highly centralized systems (hierarchies) to decentralized systems (heterarchies).
- **Coordination.** Propagation quality (reach) among members of the network facing an event.

Which we have named Co4 relational structure, as shown in figure 4. In turn, Co4 is defined according to three generative conditions:

- Cognitive type or Knowledge (C),
- Semiotic process or narrative (S), and
- Interactivity or confidence (I).

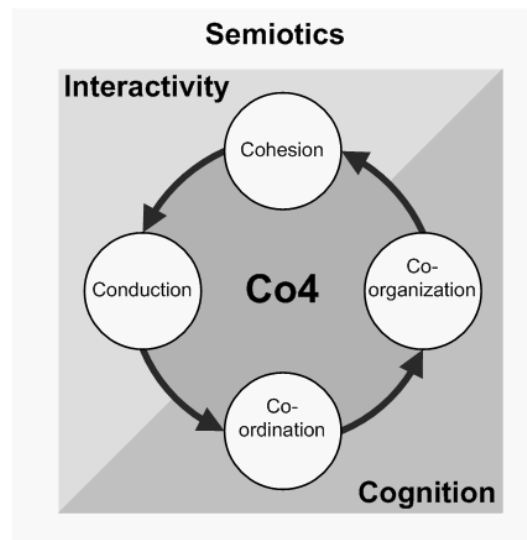


Figure 4. Co4 relational structure.

The qualitative expression of the four processes would be:

- Co-organization = $f(C, S)$
- Cohesion = $f(S, I)$

- Conduction = $f(I, S)$
- Coordination = $f(S, C)$

Note: C, S and I factors appear in different order, reflecting this way the difference in their relative importance (weighing) for every case.

Based on the above, if in an organization, considering its form of knowledge, they are not verbalizing the business key concepts and, at the same time, suspicion exists among actors; the possible result is a low sustainability between strategic programs and their fulfillment actions. The expression of that, in Co4 jargon, will be: low cohesion, low coordination, high centralization (in conduction), and low co-organization.

Once obtained the PCC (Cohesive, United, Untied, and Disperse), types are directly related to Co4 structure, which takes a value ranging between Highly Hierarchized (low cohesion, high centralization, low coordination, and low co-organization) to Highly Heterarchized (high cohesion, low centralization, high coordination, and high co-organization).

Netout Process

The art or process of Co4 improvement or reconfiguration, aiming to diminish the gap between the narrative of the decision making and their actual actions (coherence), consists of reproducing the conditions under which Co4 is generated, making business generative networks to emerge and reconfiguring those which do not contribute. This process has been defined as Netout. Depending on its location, it implies managing coherence (inside the network) and congruity (relating to other networks). The process consists of finding the network which generates business knowledge, consolidating it through the generation of semiotics or specific language, coordinated with action and change lines in repulsion interactivity types or dissociative behaviors. As a result from the above, the strategic alignment degree emerges from the language generation process and its harmonic spreading inside the network.

Coherence management through Netout can be done designing and implementing devices controlling the proper narrative field of the guidelines and the environment of the supporting relationships, strategically aligning to the managing decision making network. This alignment is translated to cohesion improvement, conduction decentralization, augmenting the relational system coordination and co-organization through integrated and configured communication channels, so that they are sustainable and, by means of which, the strategic lineaments are reinforced in the organization's day by day.

There is a set of tools which allow assessing the decisional process quality from the way of thinking (cognitive), the guidelines understanding degree (semiotic quality) and the environment or climate where the process develops (interactivity). This evaluation is established, on one hand, from the command strategic distinctions regarding those of their collaborators (cognitive maps, decision making programmable models) and on the other hand, of the interactivity state inside the team.

Co4 System Configuration allows, from results obtained in the diagnosis to establish a strategy for improving management sustainability. This process aims to elaborate narrative, by building a Strategic Scenario (S2). S2 is built by configuring four general criteria: Political, Economic, Social and Technical and twelve sub-criteria resulting from the combination of these. Every criterion and sub criterion generates a meaning context which allows comparing a set of business solution alternatives. The building process comprehends from cohesion up to congruity, organizing the team constituting a high link quality unit, both in narrative and interactivity.

4 FUTURE RESEARCH DIRECTIONS

In accordance with the results achieved when applying NETOUT in different organizations, future research lines are in two scopes:

- The development of models related to relational stability of Co4 configurations obtained from semiotic and interactivity variables. It is trying to use the molecular stability concept from quantum chemistry in connectivity configurations of way of obtaining viable stages that increase the Production Cognitive Capital.
- Associated to the intervention methodology of the relational systems. In this one, the research goal is developing techniques and methods which allow improving the Co4 state as regards the semiotic and interactivity structures obtained from the simulations which produce the wished change states.

The methods used at present by our team have resulted in high effectiveness, nevertheless, although we have achieved changes of state in the organizations, they respond more to a casual drift than to a strategy aimed to one or a set of states.

5 CONCLUSIONS

Today, there must be a paradigm shift, from object to relation. Relations constitute complexity, and result from Rel's culture. This way, uncertainty as a condition is added. The strategy to aboard this kind of system is understanding how territory narratives are produced and interchanged to generate meaning and action equivalence among relational systems. The above invites us to correct certainty-based criteria, specifically in what is named value creation through knowledge production. As stated early in the development of this chapter, knowledge is configurative, which translates into organizational structures highly dependent of their interactivity and semiosis; by the same, intellectual capital production is partially located at those organizational structures which are highly coherent; i.e. decision making, as an action, is very close to the proposed narrative corresponding to that action; strictly speaking, is where decision making supporting knowledge process is produced. From a relational epistemology view, we can deduce that intellectual capital can not be conceived as an object, but as a process, the Production Cognitive Capital.

Organization's Production Cognitive Capital shall be understood as the knowledge which generates the value of use and the value of exchange.

- The value of use is a function of organizational coherence; hence its generation depends directly on the cognitive type, semiotic quality, and trust.
- The value of Exchange is a function of congruity, which implies that the three factors (Cognitive type, Semiotic quality and Trust) go legitimated in an exchange relationship between two Rels.

Productive Cognitive Capital is the one that generates sustainability as a value generation process, so that its measurement shows the Rel's effectiveness in producing the organization's Intellectual Capital.

Finally, wealth generation in the new economy will depend on relationships quality which should structurally overcome hierarchies, moving to heterarchies.

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7 KEY TERMS and DEFINITIONS

- **Cognitive Sciences:** Theories and scientific analyses of knowledge in all its dimensions.
- **Coherence:** Closeness between narrative and its corresponding actions.
- **Congruity:** Emergent feature of the relationship among the command team and other networks inside and outside the organization.
- **Intangibles:** Use value configurations which, in the exchange process (exchange value), are transformed into assets.
- **Key Players:** Given a social network, there are members who play different roles, one kind, if removed, would maximally disrupt communication among the remaining members, and the other, who are maximally connected to all other members.
- **Knowledge:** Territoriality configurations, i.e., generation of bonding and belonging codes, by way of configurations of the networks within a process, which the network designates as value.
- **Production Cognitive Capital:** Knowledge generating use and exchange value in a productive context.
- **Relational Approach:** Epistemology which supports the knowledge process in any relationship, which configures as culture-determined effective and affective distinctions.
- **Sustainability:** Organization's conservative strategy, as a relational system, from structural or configurational changes in the relationships, determined from the culture.
- **Uncertainty:** Time-space location impossibility of extracting the difference between two objects.

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