

Chapter 2

Bases for the Ecosystem Organization of the University

There are multiple approaches to the Theory of the Organization depending on the discipline of choice. If we also take into consideration that each approach depends on the historical circumstances, we can imagine how diverse and complex the points of view are. In addition to the sociological or administrative focus of the organization, we will add a certain “ecosystem complexity” that we discussed before; therefore, the issue cannot be reduced to a linear model or a theory with methodical clarity, which requires confronting and recreating the different perspectives.

So far we have examined the firm relationship between organization-knowledge-system that provides the perspective of complexity. This section will seek to recover the dimensions of the organization that are relevant for our approach, trying to evade the rhetoric regarding the major problems or the isolated description of details disconnected from the context.

Finally, we will try to understand the dynamics of governance in the *power-truth* dialogue (Michel Foucault et al., 1992) that *self-organization*, *heterarchies-networks*, etc. involve to understand the management of polycentric governance (Elinor Ostrom, 2010a) of the organization.

Order Is Free

The emergence of organizational values and patterns of “order” must be examined from a systemic and evolutionary, rather than a reductionist perspective. In complex dynamic ecosystems, emergence occurs through self-organization. Kauffman (S. Kauffman & Levin, 1987) believes that Darwin’s Theory of Natural Selection has been overrated in evolution as the only source of order. The argument is based on the fact that order is generated as an inevitable and natural product of the intrinsic dynamics of the ecosystem itself. Kauff-

man's hypothesis is that natural systems achieve maximum creativity, adaptability and self-control while moving towards chaos.

Similarly, Bak (Bak et al., 1988) maintains that complex systems tend to self-organize in a state of critical equilibrium and demonstrated how a system can organize itself in a critical state.

Self-organization is endogenous and responds to internal dynamics, even when there are external incentives. In search of an evolutionary explanation for hierarchy, Simon (Herbert A Simon, 1962), argued that even minor interactions between the subsystems contain enormous potential. Kauffman's findings regarding Boolean networks coincide with Simon's approach: if interactions between actors are strong, a small change affects the whole system even in a possible critical chaos.

More than diversity in an ecosystem, importance lies in the relationships and interactions between actors: Internal negotiation of resources, the determination of forms of government, the management of common goods (Elinor Ostrom, 2011), the distribution of authority, and the definition of the projects that are of interest to the organization and keep it alive.

Exercising leadership in an organization requires the freedom to produce relationships and interdependencies based on common resolve rather than the control of individual roles. In addition, it requires promoting personal development and seeking to ensure that it contributes to the common good, which would not be possible without the exercise of creative freedom.

According to Crozier and Friedberg (Crozier et al., 1990) the freedom of the actors is associated with the limits that the organization imposes on their actions. For Ibarra E. I. Ibarra Colado, 1999) the importance lies in the possible solution to the dilemma between the determinism of contingent reasoning and the voluntarism of the strategic reasoning of the Theory of Organization.

The fact is that the organization and the expected "order"⁹⁴ cannot be derived from obedience and voluntary acceptance of subordination. Therefore, we need to question the processes of normalization and systems that negotiate liberties based on pseudo-political leaderships and socializations oriented toward controlling consciences and commitments

94 If evolution is a necessary feature in self-organizing processes, then order can involve a new non-order or order as a result in a higher state of organization.

Motivation, participation and leadership must not be reified as tools that permit the implementation of everything that is imposed. Liberty guarantees the production of knowledge and the organization's systemic cohesion based on its ideals to translate them into governance capability.

The capacity for self-organization will combine personal and collective interest and facilitate ethics as a *skill/know-how* that seeks to steer human action in a rational direction (Orts, 1996). This knowledge-know-how can only be generated in an environment that enhances personal and collective capabilities without subordinating them to the instrumental reason of technical know-how.

The existence of *ethical skills* that indicates how to choose between one path or another implies the existence of people who are free to act, no matter how conditioned our freedom may be.

Ethical interdependence of the common and private interests of the actors comes from the systemic capacity to self-organize. Such context will permit assuming responsibility in freedom. Responsibility is only possible through shared, long-term projects, because it is formed by the character, goals and objectives over time and the cultural development of the organization. This is possible only with free actors who can assume responsibility and accountability for these projects.

Those responsible for the production of knowledge are the very actors of the organization and their relations and interactions. In other words, responsibility for creating new knowledge does not exclusively lie with the departments or groups of experts. This does not negate differences in rank between the roles of the actors but emphasizes that the production of knowledge is the result of a dynamic interaction between them.

Thus, freedom makes sense for the actors of the ecosystem organization, as some are more involved in practical daily work while others have more experience in managing the organization. Some have practical information that they often find hard to transform into knowledge, while others may be more aware of the wider perspective and general context. Only combining these two sides will make it possible to break the ambiguity and decipher the reality of the context.

We acquire knowledge not just passively but everyone must interpret and give meaning to it. What makes sense in one context may change or even lose meaning in another. Self-organization channels the transformation of the tacit/explicit continuum (Ikujiro Nonaka & Takeuchi, 1995) into a production of knowledge that makes sense.

Regardless of their rank, all actors will, therefore, implement shared projects that help them make sense of their own experience, creating concepts that identify common characteristics and bring together activities to form a single whole, even though some of these may seem absurd. They act as a bridge between visionary ideals and the apparent chaotic reality of those that are pragmatically executed. They combine what *should be* and what *is*.

In an Ecosystem University freedom not only makes sense to make possible the organization-system⁹⁵ on the basis of an emerging self-organization, but it is a *condition sine qua non* to free it from the anesthesia of the known, of patterns or explanatory manuals that people traditionally follow; in short, from the risk of seeing the future as a simple extrapolation of the present. Creating relevant and transforming knowledge is only possible when those willing to dialogue and taking a chance on the fecundity of uncertainty and disorder have the freedom to be imaginative and take decisions.

Ordering disorder by means of a system organization produces an endless number of interactions that will create order and more disorder at the same time. Consequently, they lead the organization into a state of non-order or a new order of a higher level. Thus, *order is not only opposed to disorder but also complementary* (Edgar Morin et al., 1994). In an Ecosystem University this dialogical reality is possible provided that the university and those who act in it, are free. The critical sense is constantly renewed by the dialogical perspective that encompasses contradiction and complementarity between structure and action, determinism and voluntarism, understanding uncertainty, knowledge and ignorance.

Freedom is a basic condition to permit the actors in the Ecosystem University to assume their capacity to make knowledgeable and creative choices. Another is the individualistic conditioning imposed by the *regulatory market* that demands from the University to produce professionals trained to be winners on the – egocentric – market. Individuality constitutes the most blatant sign for the destruction of freedom; it destroys any type of relationship and interdependence (the basic condition for systemic self-organization) denies society and produces competitive, confrontative and increasingly fearful peo-

95 Morin uses the concept of organization to explain the concept of system; for him, system is a “global unit made up of interrelated elements whose interpretation constitutes an organization... it is a combination of different elements that are interdependent... it is not identified with the phenomenal object, it is projected onto it” (Edgar Morin, 1974).

ple. Prison becomes the safest place, since no one enters or leaves, but at a very high price – the total loss of freedom.

The Ecosystem University must not lose its importance as a producer of society and a product of society, if not humanity. Closing the gap between critical sense (*raison d'être* and direction) and instrumental reason implies collectively cultivating imagination, transforming tacit knowledge into explicit knowledge in order to arrive at the consciousness of the time.

It is essential for the Ecosystem University to facilitate its actors with an environment that breathes autonomy, interdependence, reciprocity and social pedagogy, all of which are fundamental for building a society on based on freedom. Freedom is a *sine qua non* for a self-organization that values ethical know-how and produces relevant knowledge.

A completely ordered system is unable to produce anything new and interact with its environment; we need crises to face up to the unstable order of which life is made. Only that way will evolutionary leaps develop shared principles and values that facilitate understanding and collaboration. The order-disorder relationship of the organization-system is an expression of creative freedom, and acquires the character of a complex system able to self-organize.

Interaction and interdependence produce community and culture as a result of the continuous tacit-explicit transformation of knowledge, establish proposals for dialogue and communication links between actors, and convene communities around the projects that produce such proposals.

Therefore, good management of the organization requires anticipating but not predicting the future; monitoring and enhancing relationships and interdependencies to increase the richness of knowledge production and the capacity of self-organization, which implies that people must be free to decide their own future. They must be able to plan, value others, and determine the course of action.

The management of the organization implies looking at reality as a social construction (Matus, 1987) with a complex and participatory view, assuming responsibility for the situation in which the organization lives, and offering a living response as an alternative to what is imposed. Another type of management restricts freedom on paper and once it is implemented, it also corrupts the realities and contexts with which the Ecosystem University must interact.

Managing the organization with imagination, requires intelligent answers and a vital commitment to freedom of the Ecosystem University and its

actors. This book proposes to monitor the interactions and interdependencies that produce knowledge through the entropy of the Ecosystem. Analyzing entropy will allow us to understand highly complex phenomena within a system in a relatively simple way and quantify them in a global vision of this system.

The Ecosystem University is a complex and dissipative open system.⁹⁶ Its horizontal structure and the need for independent interactions between its components require a vision of its macro-state in correlation with its micro-state.

According to Prigogine, “*dissipative structures are islands of order in an ocean of disorder*” (I Prigogine, 1997). An Ecosystem University is creative, has the capacity to generate new structures beyond the simple aggregate of its components, is capable of reinventing itself, and thus must conceive ways to generate order from disorder. From chaos and lack of balance it builds new complex organizations; entropy known as the tendency to disorder is linked to the dynamism and creation of the new.

The extent of entropy can provide important information to understand the potential for restructuring and recreation from uncertainty and the possibilities of generating new state structures that constitute a potential for self-organization that “*demonstrates the adaptive capacity of the system... emerges using the correlation, aggregation and recombination of agents and/or systems; self-organization is the evolution or co-evolution of the system*” (Arévalo & Espinosa, 2015).

While it does not seek to exactly calculate the complex problems of the organization-system, the proposed entropic analysis seeks to focus on them from a *utopian and free reason* vantage point to enhance what is properly human, its capacities, innovation, critical attitude, the audacity to seek untrod-den paths, and to allow the individual to twist the rules, manage and create own spaces of freedom (Vignaux, 2013).

96 The term *dissipative structures* is used because they are sustained by a continuous “dissipation” (or consumption) of energy; their characteristics are: self-organization: the spontaneous emergence of order; irreversibility. once it has taken a bifurcation, the system cannot go further back than the last point at which it bifurcated; unpredictability: the system is uncertain and cannot predict where it will evolve; dependence on small changes in the bifurcation points; and dependence on initial conditions: the system keeps a “memory” of the movements of previous bifurcations, which means that since it is uncertain the probabilities of choosing one bifurcation or another can be described in terms of probabilities: chaos is not chance, but pseudo chance (García Velarde & Fairén Le Lay, 1980).

Sense (direction and raison d'être) and organization can exist in disorder. They show a complex dynamics in which others are not treated as manipulable but identified as actors capable of building autonomy and freedom to exercise their own socially responsible life projects.

The Common Pool Resource as a Biotope

Let us bear in mind that a biotope means the geographic space and the specific environmental conditions in which life develops. By analogy, this paper has talked about a Common Pool Resource. This section will elaborate on this relationship to help us understand the conditions necessary for the organization and management of this common pool resource that facilitate the individual and collective development of the community that depends on it.

An Ecosystem is complex and, above all, uses *shared resources*. The question is how to understand the shared resources in the University. It makes sense to distinguish between common goods that refer to *resources and systems*, and common goods that refer to *property rights regimes*. The University corresponds to the first case, given that it is an *Ecosystem of shared resources* that include *goods and economic and knowledge production regimes*, regardless of the rights of private or public property that are exercised over the University. In this paper we will refer to these resources as stocks.

The capacity for self-organization and determination of the people who make up the academic community in the University, which has repeatedly been assigned importance in this paper, does not imply that they have property rights to the University. These rights can independently be public or private; to enable the university to exercise autonomy, one must understand the management of its resources as common.

The Common Good does not exist *per se* but is the result of action; a socio-political-economic construction derived from a correlation of forces that define it through exchanges and specific actions. According to Morín, it is the product of a kind of symbiosis of two different sources: one is the inclusion in a community in which all members feel solidarity - a kind of *Gemeinschaft*,⁹⁷ and the other, *the various conflicts and rivalries*.

97 For Weber, social action can be related to the economy in various ways, according to the sense of purely economic objectives, understood in some way subjectively by social actors: (i) to meet needs or profit, i.e. economic community (*Wirtschaftsgemeinschaft*); (ii) or it can also use economic practice itself as a means of obtaining results of another kind rela-

We need to seek answers in the form of a dynamic balance to:

- To what extent do economic or socio-political forces ultimately define the “good”?
- To what extent is it acceptable to separate economic and social aspects from the institution of the common? As if the practice of rational politics⁹⁸ must not be confused with production and exchange.
- To what extent is the condition of the shared and collective commons⁹⁹ a political guarantee of the good? (Juncosa Blasco et al., 2019)

The Ecosystem University includes: *poiesis and praxis*,¹⁰⁰ which it combines because its *purpose-outcome* is *institutionality* and its *purpose-objective* is *autonomy*. From the purist perspective of the economy of a community that seeks to satisfy needs on the basis of work and the exploitation of resources starts on the false assumption of unlimited needs and resources.

Ecosystem dynamics opens a new perspective with a focus on guaranteeing good *individual* performance that results in good *common* perfor-

ted to community objectives: economic community (wirtschaftende Gemeinschaft). (iii) Or also in the sense that the community in its actions combines economic and non-economic effects; (iv) or even neither of these cases. (Weber, 2014)

98 The position of Habermas (Habermas 1987 Active Communication Theory critical of functionalist reason) and Arendt, on the separation of the economic and the common, could be explained from the totalitarian experience of the 20th century. It seems that the somewhat desperate protection of communicational action was the answer to economic colonization. Although the communicative action (central approach of his hypothesis) is fundamental to reach consensus, the communicative action of the collective resources is based on modes of communication-exchange that implies a political economy of the word. A communicative model that privileges the exchange, which recognizes that the word is not an innocuous act but an exercise of the synergies produced by an exchange of knowledge and the construction of values that transcend the “ethics of control” and the “programmed organization” is even beyond the intermediated negotiation between individual and corporative interests.

99 A condition that does not derive from the sense of private property of each plot of land that together makes up a larger body, or from the sense of the common-public of the Athenian democracy and *res publica romana*, but from the use of a specific good on which we all depend regardless of who exercises ownership.

100 According to Aristotle (citing Nicomachean ethics), human activity is divided into: *poiesis* which is defined by productive or technical action and *praxis* which is defined by the means and the exercise of the same activity. For Plato, *poiesis* acquires the sense of an institution (to go from being to being to quote Plato), and *praxis* is defined by the objective of this purpose which is autonomy. The commune is both because it has as its finality-delivery institutionality and as its finality-objective autonomy.

mance and which, in turn impacts the *common* of all members,¹⁰¹ in spite of their possible reciprocal and lasting competition, which awakens their interest in an *ideal* and *material* way.

However, monopolistic tendencies and individualistic economic considerations are in the way of building communities, and even more so of building the *common*. The reason is that the merely ideological life of a community is not an objective goal that would be as appreciated as economic interest.

We have to understand to what extent the *logics of capital* modify human behavior and to what extent it is *to act economically-politically-socially* that modifies the logics of capital. To act economically-politically-socially emerges from the experience and knowledge produced by experience;¹⁰² it means rationalizing the activity (discerning opportunities, options and possibilities), which leads to a new action.¹⁰³ Practical action, therefore, articulates a scientific knowledge of the economic activity and the economic act (applying such knowledge in the action) is based on economic science (Juncosa Blasco et al., 2019).

The common good of the Ecosystem University will be achieved when the community distinguishes and combines the *rationality of the ends* (*Zweckrationalität*) with the *rationality of the values* (*Wertrationalität*) (Weber, 2002), i.e. a society governed not by a *rationalist* but a *reasonable* logic for the life of the members of the community.

Ostrom has demonstrated that there are forms of socio-economic activity and production that depend on communities and where political economy has failed (Elinor Ostrom, 2011). In a certain way, the paradigm of the commons exists parallel to neoliberalism, which favors commercial objectives and the building of markets, but at the same time, acts in the opposite direction when it motivates the establishment of rules that allow collective action, turning cooperation into a kind of antidote for the capitalist logic of competition.

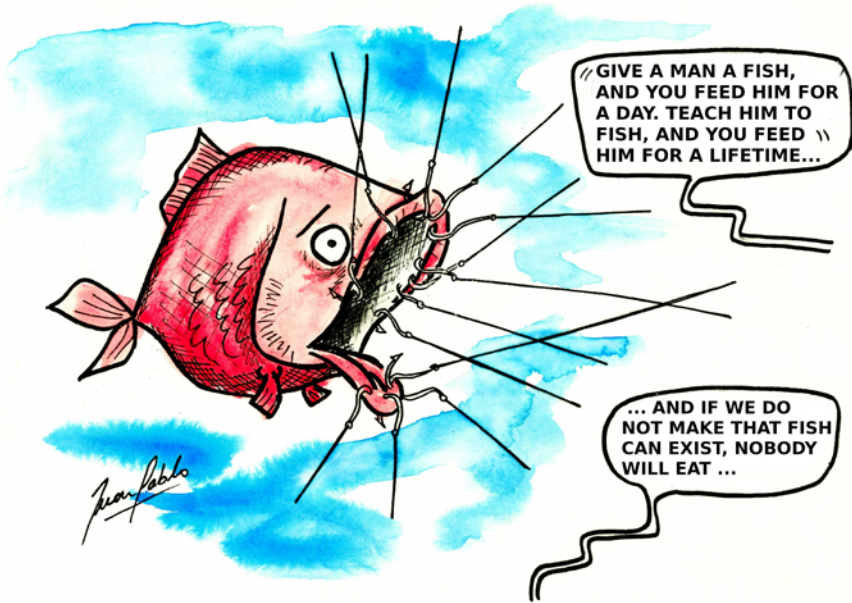
101 Schumpeter shows that economic thinking can become confusing when it ignores the abyss by conceiving that maximum performance is incompatible with maximum profit and proves that the second implies the first. Schumpeter: Capitalism, socialism, and democracy.

102 Experience is related to thought experience that helps create knowledge and rationality (*Erfahren*) rather than with practical experience (*Erleben*). Weber: Economy and Society

103 Aristotle calls it practical rationality because it is not based on proposals but programs and decisions of a logistic order, this “logisticon” calculates and rationalizes action. Aristotle: Nicomachean Ethics

The *Management of common goods* involves a dual tension; on the one hand, the relationship between community action and the groups that own the property (public or private), and on the other, the internal logics of self-organization for the management of the Common Good. While these two tensions may be conflicting, they are also rewarding and derive from the way in which the community understands the *use, governance and sustainability* of the *Common Pool Resource*¹⁰⁴ and the characteristics of human behavior such as *competition for use, parasitism and overexploitation*.

Figure 15
Appropriation-provision



Elaboration: Salgado-Guerrero, J. P.

While there is no magic formula to solve these dilemmas, a continuous spiral of ecosystem maturation, evolution and sophistication is possible. It will require

¹⁰⁴ Ostrom uses the term Common Pool Resource, which this paper understands as the whole of goods and moral or cultural values that belong to a community (Elinor Ostrom, 2011).

- *Collective action* (Sandler, 1992) which results from shared wills.
- Mechanisms of *self-governance*, resulting from *knowledge and shared wills* combined with *congruent and supportive institutional arrangements*.
- *Rynergistic networks*, i.e. social fabric and organization, social recognition, reciprocity and public opinion that motivates people to do things *well* and to do the *right things* (Beer et al., 2009), i.e. *optimization rather than maximization* to guarantee sustainability.

Some studies try to see human behavior in conditions of freedom to obtain common benefits. The prisoner's dilemma¹⁰⁵ for example, which is a non-cooperative, non-zero-sum game, refers to two suspects who are imprisoned, each in solitary confinement. The prosecutor is convinced that they are guilty but lacks sufficient evidence to convict them. He tells each of them that they may or may not admit to the crime that the police are certain they committed. If neither admits it, then the prosecutor will charge them with minor false statements and both will receive minor punishment; if both confess, they will be prosecuted, although he would recommend minor penalties rather than a harsher sentence; if one confesses and the other does not, then the first one will be treated leniently for cooperating, while the latter will get to feel the full force of the law. In terms of years of imprisonment, these are the possible outcomes:

Table 6
The Prisoner's Dilemma

Prisoner 1	Prisoner 2	
	Does not confess	Confesses
Does not confess	1 year each	10 years for prisoner 1 year and 3 months for prisoner 2
Confesses	3 months for prisoner 1 and 10 years for prisoner 2	8 years each

Source: Ostrom [131]

Taylor (M. Taylor & Ward, 1982) argues that a Two by Two game, such as the Prisoner's Dilemma, will encourage actors to take a certain decision since

¹⁰⁵ According to Cunningham, the *Prisoner's Dilemma* was developed in the 1950's by mathematician A. W. Tucker from Stanford University (Cunningham, 1967).

each prisoner must prefer non-cooperation. The author considers that the real situations (given the dynamics in decision making) in themselves are not dilemmas of the prisoner, and proposes another alternative such as the *Chicken Game*.

Biologist Garrett Hardin (Hardin, 1968) warned of the dangers of overcrowding; analyzing cattle herders who share common pastures, he describes how each of them seeks personal benefit and grazes as many cattle as possible with a disastrous effect. Hardin: “*ruin is the destination toward which all men rush, each pursuing his own best interest... free use of the common good will ruin everyone*” (Hardin, 1968).

Olson (M. Olson, 1965) argues that it is necessary to influence people's decisions so that they carry out *collective actions* through a system of *incentives*¹⁰⁶ that makes them work toward a common goal. He argued, however, that there was the problem of *parasitism*: one individual reaps the benefits of the commons without contributing to their maintenance.

Although these metaphors and analyses portray the future of humanity as gloomy, we must accept them as challenges since they fail to take into account fundamental factors such as:

- *One thing is open access and another management of common goods.*
- Only individualistic behavior is taken into account, but there may also be individuals or groups working for common benefits and managing common resources, provided there are adequate conditions, appropriate rules and conflict resolution mechanisms (Feeny et al., 1990).
- Communication in systems is not taken into account.
- Relations, interdependencies and natural synergies in human beings are in fact eliminated.
- The possibility of what Polanyi called the *countermovement*¹⁰⁷ is unknown as Hardin's solutions only go two ways: privatization or statism.

106 Considering the development of the Theory of the Organization, the theories of *occupational well-being* emerge along with *occupational psychology*, and although they initially arise with the intention to reconcile the position against labor exploitation, people start to design techniques and program aimed at managing and constitute people's identities with respect to discipline and work practices to facilitate consensus-finding processes for the organization (E. I. Ibarra Colado, 1999).

107 Karl Polanyi suggests the possibility of a counter-movement that emerges from society to protect itself from the contradictions presented by the market based only on exchange as a form of social integration. Since, for him, a market regulated by the invisible hand is utopian, an institution of this type could not exist for a long time without annihilating

- It has been confirmed that individualistic action is caused by the imposition of an economic system often against common wills (Christian Felber, 2012).

While any of these approaches may be useful for understanding aspects of the common good, their concepts have been overexploited as realistic models when, in fact, situations are much more complex and dynamic. Hence, instead of analyzing why a person feels trapped and sees no way out, it would be better to think about how people can find ways to increase confidence,¹⁰⁸ and organize themselves¹⁰⁹ to produce reciprocity agreements; diversity and complexity mean that not all the dilemmas of the common good can be solved and that solutions require cooperation.

Ostrom (E Ostrom, 2008) seeks to understand how a group of actors in an independent context can organize and manage themselves to obtain common benefits even though they may be tempted to live at the expense of others or act opportunistically. According to Ostrom, people's behavior depends on how they experience, consider and evaluate the costs and benefits of their actions, and how they perceive the ratio between these actions and the results, since the latter also establish a cost-benefit relationship.

The author analyzes the behavior of the actors that participate in a *Common Pool Resource (CPR)*, which she refers to as *appropriators and pro-*

the human and natural substance of society. Polanyi's effort to investigate the economic models of pre-capitalist societies recovered a concept of reciprocity and redistribution with respect to the sharing of labor, thus showing that it was not only possible to find ways out in harmony with the values of society, but that these existed throughout the history of humanity (K. Polanyi & Sánchez, 1992). In the Ecuadorian context, we do not need to go back that far in time. Following a proposal by the indigenous movement, Sumak Kawsay raises the relevant values beyond their social conception: integral humanism, communitarianism, plurinational community democracy, plurinationalism, unity in diversity, self-determination, sovereignty, independence and international solidarity. Based on community knowledge and practices, they propose the harmonious relationship of man with nature, establishing the concept of harmony as mediating between individual and group interests. (Confederación de Nacionalidades Indígenas del Ecuador, 2007).

108 The theme can be deepened in the compendium made by Adela Cortina in a text that summons a group of thinkers around ethics and trust (Cortina Orts, 2003).

109 Let us bear in mind that the concept organization is necessary to explain the systemic conception, the system is a "*global unit constituted from interrelated elements whose interpretation constitutes an organization... it is a combination of different interdependent elements... it is not identified with the phenomenal object, it is projected on it*" (Edgar Morin, 1974).

viders. She argues that when actors act independently, total benefits tend to be smaller than if they had used a joint strategy. This is why they feel compelled to establish an organizational mechanism; individual action alone cannot pursue or encourage shared interests or purposes (M. Olson, 1965). This does not necessarily imply the need for creating some type of organization, but it rather calls for *self-organization* on the basis of systemic, interdependent, circumstantial behaviors, i.e. combining and coordinating activities without changing a shared culture (Kreps et al., 1982).

Ostrom's approach is particularly important for this work because it raises the issue of *governance of the common good* not only from the classical paradigms such as *the Prisoner's Dilemma* (Dawes, 1973) (Luce & Raiffa, 1957) but also considers that the problems of the management of the commons are characterized by *collective action* and therefore by the problems related to *appropriation-provision*. It, therefore, establishes two initial assumptions: (i) *appropriators in CPR situations face a diversity of appropriation and provisioning problems whose structures vary from one situation to another, depending on the values of the underlying parameters*, and (ii) *appropriators move continuously between different fields and levels of analysis* (Elinor Ostrom, 2011).

Congruence between *appropriation-provision* implies the constant search for a balance between (Elinor Ostrom, 2011): The adjudication of the flow of appropriate resources to diminish the conflict around the allocation of rights and the destruction of resources. This occurs when too many actors appropriate the common resource,¹¹⁰ or when actors take larger quantities of the resources because they have greater capacity to use them.

The dependence of the actors on the CPR of limited access, denoted by the capacity to access resources according to community rules, as well as the supervisory mechanisms of compliance, makes the University a different structure from that of the Prisoner's Dilemma, and a decompensation of the equilibrium privileging appropriation helps the actors to survive in any production factor beyond applicable rules (Townsend & Wilson, 1987).

Another problem regarding appropriation is the temporary access to resources due to heterogeneity and uncertainty, which can put certain actors

110 The term *common property resources* is used in relation to a resource with limited access, i.e. where a group of appropriators are jointly dependent on the system to have access to the resources.

in privileged positions. If actors perceive that access to resources is unfairly distributed, they may become unwilling to invest in activities that provide for the common pool resource.

The problem of appropriation and its regulation has to do with the organization for supervision and control, which implies a modification of the organizational structures and the normalization of the whole university, and establishes relations of strategic behavior between the appropriators and the supervisory councils.¹¹¹

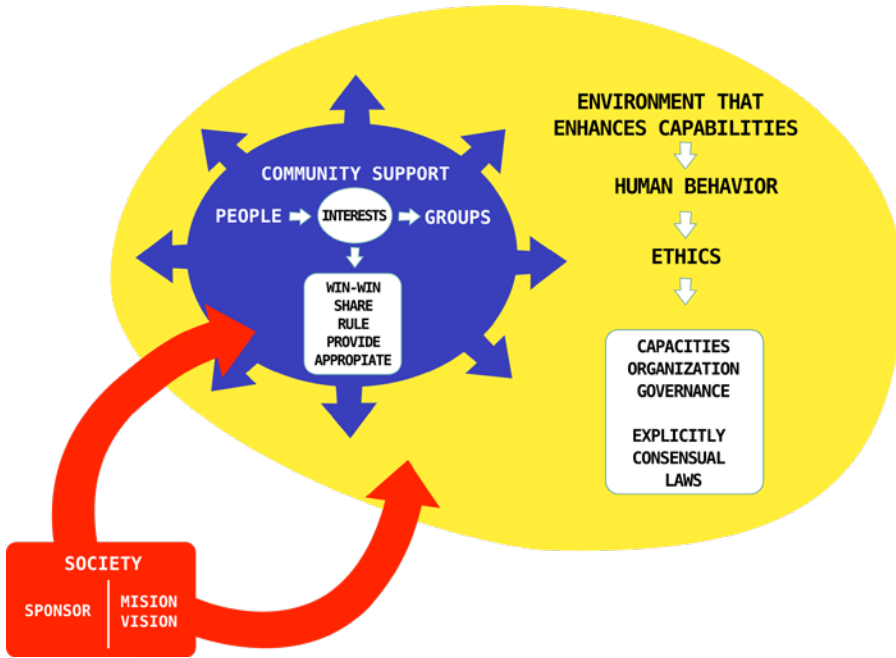
The effects of the very diverse ways of assigning responsibility for building, restoring or maintaining the Ecosystem University (Common Pool Resource) that provides resources. If the actors provide independently, their contribution may be less than optimal for the construction and maintenance of the Common Good.

The problems of provision are not only related to building the CPR, but also to the extraction of resources, that is to say to setting the limits so as not to affect the resource itself. It is essential to establish the relationship between the choice of an individual strategy and the choices made by other actors, as well as to establish the dependence between the solution of supply problems and the solutions to appropriation problems.

While these problems could be solved by various approaches, there is agreement that the models for collective action (Oliver, 1980) imply different assumptions and different conclusions. University governance must therefore ensure the participation of society in the university and abandon endogamic or autarchic governance of the university for the university as otherwise dialogue would not be possible between instrumental reason and critical sense (direction and *raison d'être*). That way we shall be able to rethink governance systems by mixing representative collegial bodies and gregarious bodies (groups) that are not subject to the political dynamics of representative democracy. That will regulate personal interests by common interests, endowing them with positive synergies to facilitate communication for change in an ecosystem that enhances the capacities of the individual and the community (J. P. Salgado et al., 2017) (Figure 16).

111 Gardner defines this interaction as the *play between detection and deterrence* (Gardner et al., 1990).

Figure 16
Ecosystem University, environment that enhances capacities and society

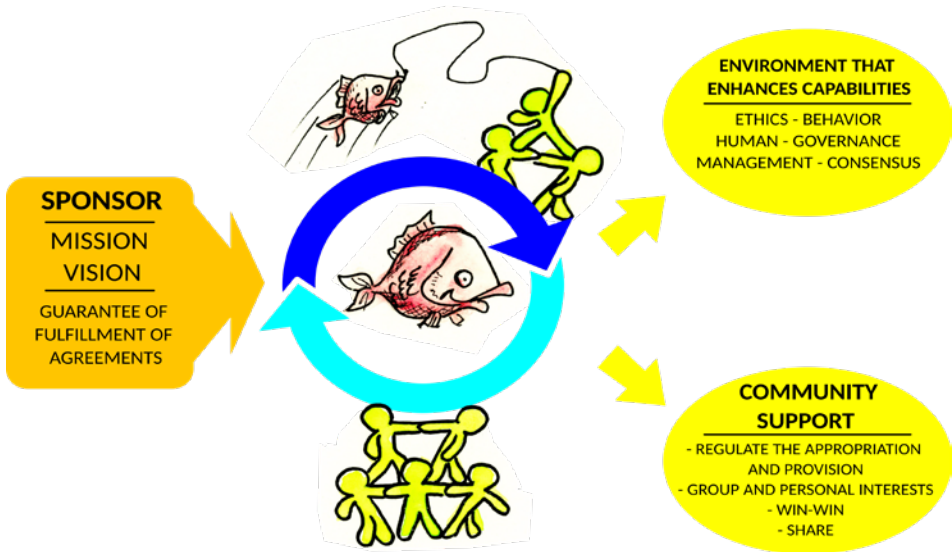


Elaboration: Salgado-Guerrero, J. P.

A representative collegiate body, which we shall call the *Monitor Council*, both for public and private Universities comes from the State or the Promoters. Their mission is to ensure that shared agreements or constituted norms are complied with, thus guaranteeing not only the *raison d'être* of the University as a product and producer of society, but also guaranteeing that the logics of appropriation-provision of Ecosystem actors are possible in a sustainable non-equilibrium equilibrium.

On the other hand, the formation of *Collective Action Councils* among the actors guarantees congruence between *appropriation provision*. These Councils set the rules for the use of resources and these are approved by consensus with the participation of the majority of the actors whose strategies are affected. Therefore, these will assume that others are familiar with them, accepting that the council supervises compliance (Figure 17).

Figure 17
Monitor Council and Collective Action Councils



Elaboration: Salgado-Guerrero, J. P.

The main concern regarding the establishment of the rules are the dynamics and the constant change of the organization of the groups and therefore of the University. This also implies flexibility regarding the rules of the game that must always be taken in agreement with the actors. In this regard, Ostrom establishes changing and flexible organizations in contrast to restricted and rigid institutions (Elinor Ostrom, 2011); these establish the following mechanisms:

- Changes in the rules used to regulate actions at one level occur within a generally “fixed” set of rules at a broader level (which can only be modified by the Monitoring Board).
- Changes of the rules at higher levels are generally more difficult and costly to implement, which increases the stability of mutual expectations between individuals who interact according to a set of rules (which can be modified by Collective Action Councils).

Table 7
Rules and levels of analysis

Rules	<i>Constitutions</i> Board Monitor (Promoters)	<i>Collective Choice</i> Councils of Institutional Governance (Collegiate Governance Bodies)	<i>Operatives</i> Collective Action Council (Self-Organizing Councils)
Levels of analysis	Constitutionality	Collectivity	Operativity
Processes	Formulation Management Adjudication Modification Macro monitoring	Policy design Administration Adjudication	Appropriation Provision Specific monitoring Imposition

Source: Ostrom (Elinor Ostrom, 2011, p 110). Prepared: Salgado-Guerro, J. P.

That way, the University can combine the institutional and internal aspects and the external significance of its presence. The ecosystemic principle of emergence sustains the validity of the norms for collective “bottom-up” action based on experience and intuition. Once consensus emerges, the monitoring body guarantees the decrease of the value permeating the community “top-down”.

This shared Ecosystem, which enhances capacities, feeds the organization-system of the CPR University.

The research Ostrom carried out on the common good identified the following *design principles characteristic of long-term institutions*(cf. Ostrom, 2011, pp. 167-185):

- Existence of clearly defined boundaries.
- The rules of use are consistent with local conditions and appropriation-provision dynamics.
- Individuals who are affected by the rules may participate in modifying them, i.e. collective action arrangements.

- Appropriators and providers are accountable for their behavior to themselves and to external authorities, i.e. monitoring mechanisms and mechanisms for self-monitoring.
- A graduated system of sanctions is available.
- There are simple and effective conflict resolution mechanisms.
- There is minimal recognition of the rights of appropriators to form their own self-organized groups without being questioned by external authorities.
- The interdependent tasks of *appropriation-provision*, as well as those of *supervision-sanction*, *conflict resolution* and *government activities* are organized in multiple levels of activities and in a nested structure.¹¹²

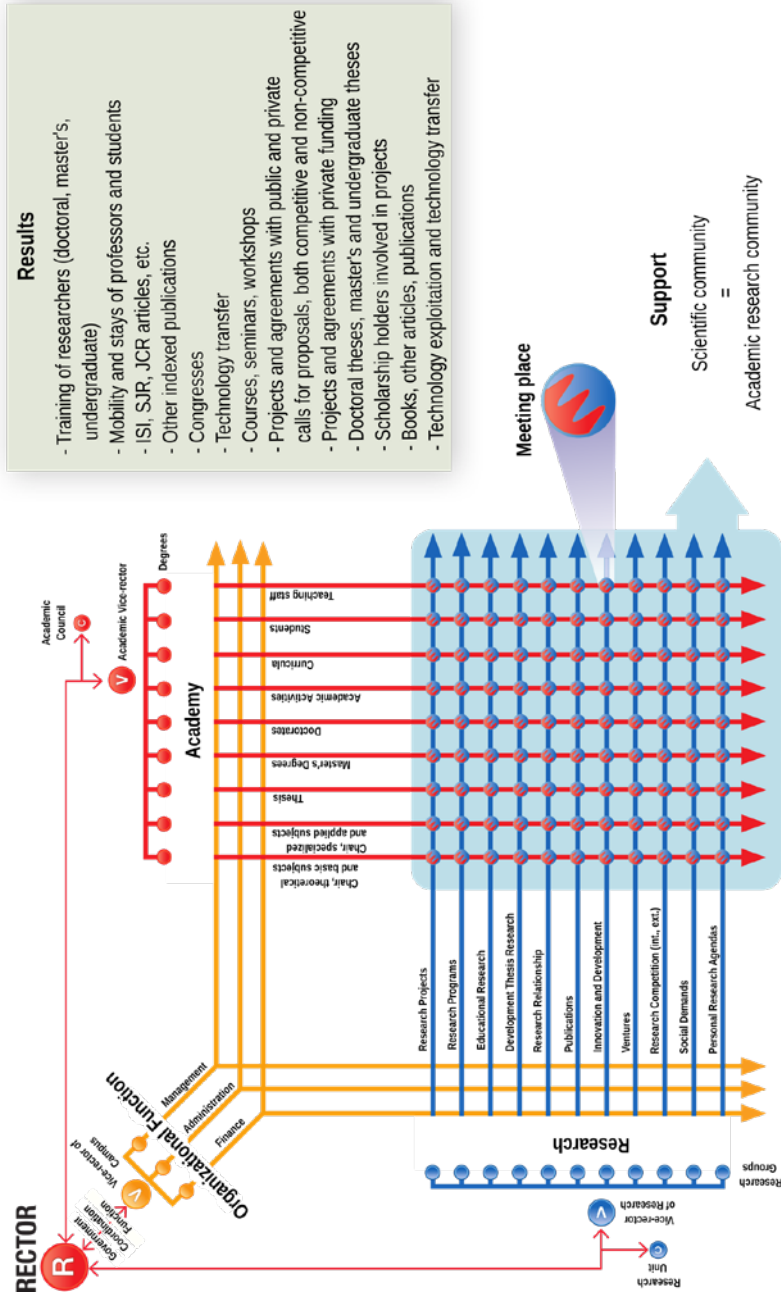
University governance takes place in what we shall define as *meeting places* (Figure 18), where the multiple flows of research and teaching functions intervene; we need a model of university governing bodies that interact in an uncontrolled rhizome, and that plans from below through action (Cazorla et al., 2017). The university community will encounter regulated collective interests as a movement of provision and sustainability of the university, and the individual interest of appropriation of what the university offers.

The *ecosystem organization*¹¹³ approach of this book extrapolates the logics of nature to understand the Theory of the Organization. Without absolutist pretensions, it tries to collect some particularities of more than three million years of evolution and to combine them with coinciding approaches by distinguished theoreticians throughout history. It may leave a feeling of *disorder*, but its strength lies precisely in its ability to discover and explain reality from a *different perspective of order*, where there is no need for controlled or strict linkage because there are other elements that facilitate monitoring and managing its projection from the management of the knowledge that the organization itself produces. The order remains elsewhere, hidden in the personal and community development that sustains the Common Good.

112 The author uses the term nested enterprisesshen activites are organiyed in multiple layers, when Common Pool Resources (CPR) are broad systems.

113 The *Eco-systemic Organization* proposed in this work does not compare with the Organization's approaches to ecology. The former proposes an analogy with nature in order to understand the organization as a *living organism that enhances the development of people*; the latter focuses on the processes of creation, change and disappearance of organizations as a result of "natural selection" in the midst of a "*capital jungle*".

Figure 18
UPS Teaching-Research fabric



Source: Salgado-Guerrero, J. P. (Herrán Gómez et al., 2014)

For Ostrom *social capital* in institutions is as essential as *physical capital*,¹¹⁴ and the construction of the institution (as a consequence of the essence of what is instituted) is a sociological, political and economic process. Cooperation in community implies economic know-how on the part of the *commune* that takes care of the *commons*. In other words, the creation of political conditions that permit and stimulate self-government resulting from shared decisions, negotiations of the interests between users and suppliers, as well as the negotiation of the individual interests between the users themselves, and all of it with the imperative of sustaining a common pool resource.

In the absence of a *policy of the common*, the management of the common pool resource is limited to operate according to market needs and results. This destroys autonomy¹¹⁵ and self-organization,¹¹⁶ thus reducing the whole to a simple linear regime.

The management of the *Biotope - Common Pool Resource* does not create a crisis on the market, since it is one of the mechanisms the Ecosystem University uses to interact with the environment. Yet, when it conditions the

114 For Ostrom, establishing rules means an investment in the capital stock that brings a profit. (Elinor Ostrom, 1994).

115 "University autonomy, in order to be a producer and a product of society, is that which makes the university independent of all economic and instrumentalist logic and, thus, enables it to reaffirm social, moral and cultural values, recover the supremacy of the person over capital and of society over the market, and orientate its economic sustainability towards this superior objective. This autonomy transcends the classic independence of the forces and intervention of the State, and values them rather as generators of opportunity and a source of energy for rebellion in search of freedom. It also motivates the constitution of synergies based on reciprocity, shared values, common interests, channelled towards emancipation, making it possible to conceive problems and determine the answers, because "the notion of autonomy can only be conceived in relation to the idea of dependence" (Edgar Morin, 1984, p. 222).

116 It is the synergies based on reciprocity that, mixed with the capacity for self-organization, are the foundation of university autonomy and at the same time of the community-university. It is the capacity for self-organization that combines personal and collective interest and makes ethics possible (the Aristotelian ethical praxis that can be translated as politics) as an economic know-how that aims to guide human action in a rational sense [367]. This economic know-how can only be generated in an environment that enhances personal and collective capacities for the common good, but does not subordinate them to the instrumental reason of technical knowledge. The community-university builds its autonomy from the self-organization and self-poiesis of the base groups of the communal community and the personal development of those who compose them, therefore, it is itself a fabric that houses projects that build the common good.

market or commercial logics, it marks a critical distance with them by questioning their ability to solve almost all economic and social problems (Comeliu, 2002) by inventing and creating new forms.

The only mercantile transactional logics¹¹⁷ can render the university commune anachronistic because they threaten social links by strengthening individualism. Such logics must be superseded by the contractual sense¹¹⁸ of exchanges that oppose any strategy of privatizing life and are a guarantee of the sustainability in time of the Common Pool Resource (Herrán et al., 2018).

The Environment That Enhances Capacities Such as Biocenosis

The ecosystemic principles that comprise the organization-system of the University based on a common pool resource (biotope) and the fabric created by the teaching-research interaction (biocenosis), make up the combination necessary for the Ecosystem University to host life (Figure 19). Just like a living being that draws on anything for life - light, water, etc. - and develops through its own metabolism; the people of the University community develop autonomously, but not independently of what their environment can provide.

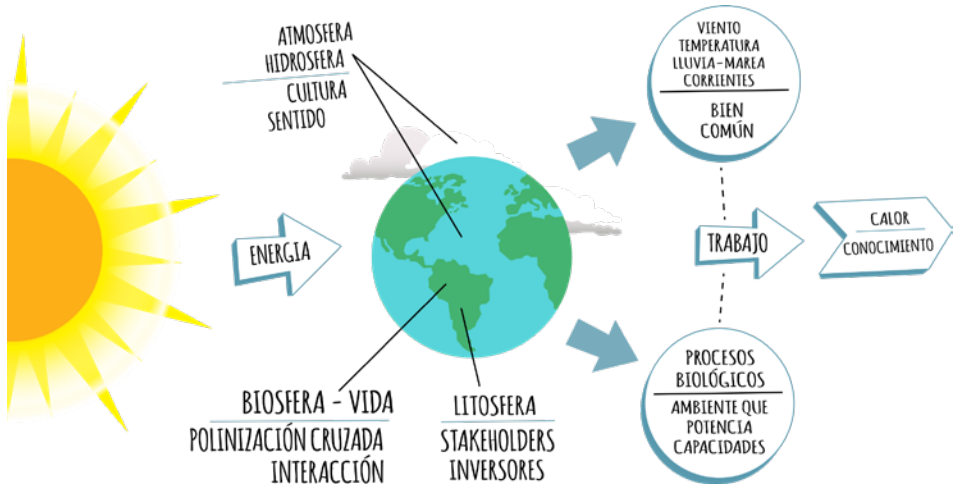
The ultimate goal of the Ecosystem University is to develop individuals into free and responsible citizens, i.e. people who can live a full and creative life by developing their potentials. If the real challenge of development is the human BEING,¹¹⁹ one would have to think of development *for, through and of* the person as the driving force of the University.

117 In the commercial relationship the needs and their satisfaction are unlimited; the private appropriation of goods, services and the necessary payment instruments constitute the fundamental elements.

118 The social contract models are based on the sustainability of the common good; they are, therefore, long-term and not immediate, comparable to marriage and labor contracts.

119 Nussbaum approaches the perspective of human development for higher education in the shadow of "society and economy" and sees it resting on four pillars: *plurality of values* (no only economic), *solidarity and sensibility with respect to human rights*, *recognition of interrelations and interconnections* not only with regard to commercial relations but all relations that allow us to think of a connection, development and promotion of well-being (Martha Craven Nussbaum, 2010).

Figure 19
Analogy 1 of eco-systemic macro processes



Elaboration: Salgado-Guerrero, J. P.

As for higher education, the centrality of the person has meant a constant challenge that universities cannot ignore; Boni and Gasper, for example, have defined three fundamental roles (Boni & Gasper, 2012): (i) the role of necessary education to become professional, (ii) the role of developing emotionally rich and mature people, who are capable of acknowledging and assuming their responsibility, (iii) the role of having competent guides (teachers) to analyze the responsibilities and potential contributions that the University offers to human development.

Nussbaum refers to human development as the ultimate end of society and to economic development as the instrument of the first (M. Nussbaum, 1997). Through Sen's contribution (Amartya Sen, 2001) on promoting training for the freedom to direct one's own life and good living, the *capability approach* can be conceived as an expression of active development in terms of the capacity to *be and do*, beyond economic *functionalism*.

The *Capability approach* is of unique importance for this book because of its characteristic *System of elements and nodes* that form the concepts that can give new meaning to education and training by providing keys to under-

stand *Human Development*, in addition to corresponding – as we said before – to the *Biocenosis* of the Ecosystem University.

A Community that develops in an Environment that potentiates the Capacities of the Teaching-Research Fabric and a common pool resource in the Biotope, and that considers liberty as its fundamental value, i.e. the capacity to choose a life that values the common goods as capacities for its own objectives (Amartya Sen, 2014), the University Community focuses on developing people's potential and recognizing their capacity to promote and organize themselves.

In this case, capacities go beyond elementary freedom and constitute the set of opportunities from which to choose and *act* on (Martha Craven Nussbaum, 2012). Choice and action are stimulated whenever opportunities can be used for developing the being and doing rather than the utilitarian dimension of the individual. In other words, the University is capable of acting in society through the two genres of action defined by Aristotle: *productive-creative action* (poiesis) focused on results, and *practical action* (praxis) focused on the means (Aristóteles et al., 1970).

According to Amartya Sen, the *functions* constitute the well-being of the person (Amartya Sen, 2014, p. 76), represent the acquisition of one or more capacities, and describe what a person can do or be, and thus, improve his living conditions in the sense of *well-being*¹²⁰ (Amartya Sen, 2014, p. 63). This ability to *function better than in other environments* illustrates the ability to freely choose opportunities and therefore determines a person's lifestyle (Amartya Sen et al., 1991). Sen calls this *ability to function* (Amartya Sen, 2014, p. 64), which becomes the constitutive basis of a person's BEING.

Martha Nussbaum describes at least three dimensions for understanding capacities:

- Internal capacities (Salgado-Guerrero et al., 2017, p. 28): Personal characteristics and abilities, intellectual and emotional capacities, health, interiorized learning, acquired or developed capacities of perception, interaction with the social, economic, family and political environment. Internal capacities are not innate but rather form and develop in every life context.
- Innate capacities (Salgado-Guerrero et al., 2017, p. 31): Also referred to as *basic capacities*, they are the innate faculties that facilitate every

120 Well-being is a reference to *buen vivir* (Amartya Sen & others, 1999, p. 36).

person's development and formation; being basic requires subsequent intervention to provide the necessary elements to develop a person's internal capacities.

- Combined capacities (Salgado-Guerrero et al., 2017, p. 29): The result of the combination of internal capacities and the socio-political-economic conditions where the individual can choose his/her *function*. Internal capacities can emerge only if permitted by the conditions of the context. Hence, it is the context that potentiates capacities.

The three terms *functioning*, *capability* and *agency*¹²¹ converge in Sen's approach. The notion of a person's *agency* refers to the relationship between objectives¹²² and values that motivate this person (Amartya Sen, 2014, p. 85), i.e. the person's capacity to implement events and actions to achieve objectives, taking into account that agency belongs to a context: the University as a Common Good.

By virtue of achieving the objectives, an individual's agency has to do with self-determination, self-regulation and autonomy. A person and state of being or acting (agency) can either result from an individual's actions or the conditioning of the context. Thus, we can identify two dimensions: effective relations of a persons expectations as well as the freedom to meet them. An environment that potentiates people's capacities does not lock them up in classrooms to hammer accumulated "knowledge" into their brains, but offers the students opportunities to achieve the objectives that they and their community value.

Hence, a person's well-being does not only depend on his activities, i.e. his functionality, but also on his freedom and opportunities (*capacity*) to fulfill a *function*, choosing a response, because the freedom of action and social, economic and political opportunities are interdependent.

121 The term *agency* can be understood in literature of pedagogics or social development as the *capacity to do or act*. It is directly related to *autopoiesis*, which for Aristotle is *productive action* (poiesis) that is result-oriented [54]. Plato defines the term poiesis as "*the cause that converts anything that we regard as non-being into being.*" (Crespo Güemes, 2007). Sen "refers to what a person may wish – as s/he attaches value – do, be" (Amartya Sen, 2014). The value of agency implies the concept of freedom to act, the inherent agency of an action starts from the subject, but is generated within social and learning contexts (Massimiliano Costa, 2014).

122 *Telos* from Greek τέλος is a Latin word that refers to an "end", "proposal" o "objective" used in philosophy.

Figure 20
Environment that enhances your capacities



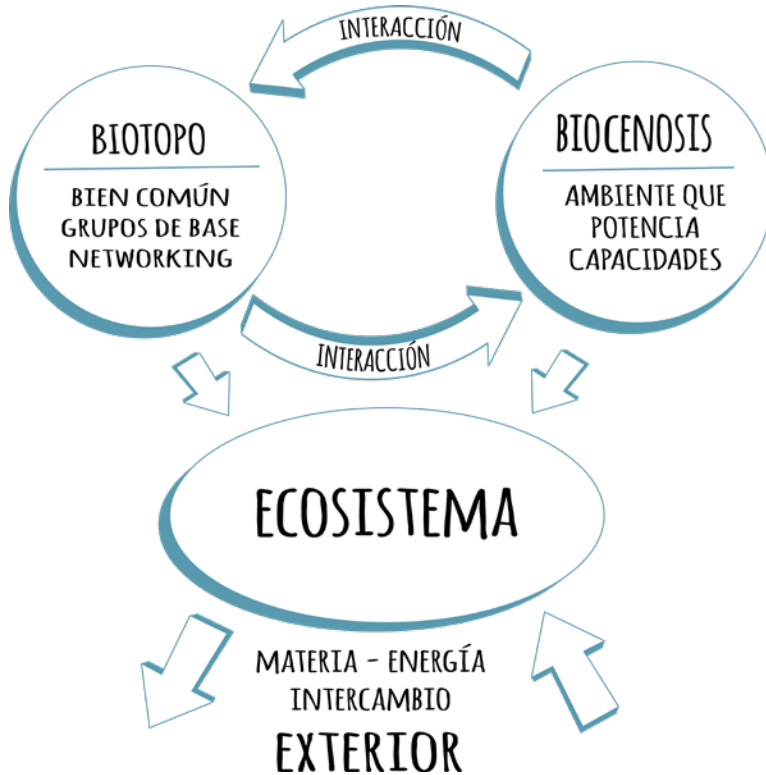
Elaboration: Salgado-Guerrero, J. P.

An Environment that Enhances Capacities offers the conditions to develop *internal capacities* by working on the potentialities to enable people to become agents. Put differently, each person should acquire the power to develop internal capacities as an expression of the right to lead a dignified life with options to choose from and become a bearer of values and end in itself (Martha Craven Nussbaum, 2002, p. 79).

We have to look at higher education as an Environment that Potentiates Capacities (*biocenosis*), that expresses specific socio-political and economic conditions of the Common Good (biotope), a synthesis of the *Ecosystem organization* that produces *life-learning* (Figure 21).

The context of higher education, therefore, becomes the place of profound learning (profound experience) thanks to culture, the creation of implicit and explicit values, and the generation of meaning and symbols that extend and expand over time (Banks et al., 2007, p. 12). In other words, if we consider the perspective of the combined capacities of Nussbaum (M. Nussbaum, 1997) and Sen's notion of agency (Amartya Sen, 2001), the so-called *meeting places* and what happens in them become relevant: the ways to promote learning, the ecosystem organization for decision-making and participatory processes. Nussbaum (Martha C Nussbaum, 2001) addresses the issue in terms of interdependence between social factors and individual capacities, the *combined capacities* as an impetus for the development of internal capacities (M. Walker, 2005).

Figure 21
Analogy 2 of eco-system macro processes



Elaboration: Salgado-Guerrero, J. P.

The interactions between the University for the Common Good (*biotope*) and the Environment that Potential Capacities (*biocenosis*) converge into a unit that focuses on the person with the following characteristics¹²³:

- The social dimension of learning: Nussbaum refers to Dewey and Montessori to point to the need for action as educational institutions are characterized by passive listening whereas they should be places

¹²³ Ellerani approached the dimensions described below and, by going even further, argues that the valorization of the *quality* of superior education should be based on them (Ellerani, 2017).

where students can act (*agency*), identify, discuss, and solve problems (Martha Craven Nussbaum, 2010, p. 81)]. Therefore, the Ecosystem University needs to have the sensitivity for the context, become a product and producer of society (in all dimensions: historical, economic, cultural) to fully use the potential of students and teachers alike and enable them to develop their capacities as an expression of a life that has many choices and turns everyone into a bearer of values (Martha Craven Nussbaum, 2002, p. 79).

- The logics of *appropriation-provision* implicitly promotes social agreements that take into account existing or potential opportunities as well as internal transformation as an effect of learning caused by the potential of agency to gain access to opportunities. Combining the social dimension of experience and reflection on action^{124 125} will produce an interpretation of agency as a process of Sen's *Capability Approach*. In addition, it exposes a mechanism that inextricably links *combined capacities* to Nussbaum's *internal capacities*.
- The learning processes are continuous: Centrality of the person implies the possibility of self-organizing not only the environment in which one studies,¹²⁶ but also one's own learning objectives according to the forms and development methods of one's internal capacities. The notion of continuity of learning engages the temporal regulations of the University (semesters and terms) in which students need to "acquire" a certain "knowledge" in a number of subjects. A good understanding of learning strategies and knowledge production is remindful of *learning how to learn*. It is the dual-track interaction with the context that forms agency and strengthens combined capacities, and it is here where the Ecosystem University acquires its sense (direction and *raison d'être*).

124 The continuous cycle of communication-action-knowledge helps to project the possible futures of the ecosystem organization according to the collective feeling and the relevance of the context. Herrán proposes a similar practice in the field of social development (Herrán Gómez, 2015).

125 Nonaka-Takeuchi recognize that knowledge begins with the individual and interaction between the individual and the community produces shared knowledge in the midst of a dynamic tacit-explicit spiral, in which the mediation of the group is fundamental to facilitate the interaction (Ikujiro Nonaka & Takeuchi, 1995).

126 Self-organizing the environment in which one learns does not imply mastering it but being able to respond to it.

- Participatory processes: This process is non-*idealistic*¹²⁷ but connected to action (i.e. the possibility of *agency*) and its corresponding development of praxis, involving context (which develops combined capacities), in addition to the development and acquisition of people's internal capacities.

Nussbaum¹²⁸ put together a list of capacities that need to be developed:

- The capacity to analyze problems and arrive at conclusions without the intervention of any authority.
- The capacity of moral judgment acquired through critical reasoning and based on the search of valid and real arguments.
- The capacity to think of the Common Good and not only of one's own benefits.
- The capacity to see the Community to which one belongs as part of a greater if not a global order-complex, and thus understand the need for interaction.¹²⁹

We are talking of an Environment that Enhances Capacities through offering opportunities to develop critical capacities and imagine new possibilities for oneself and others. All sides are aware of their interdependence and seek to transform realities through learning and developing knowledge. The participative process in this ecosystemic university assumes value as an exercise of citizenship and therefore of democracy - not as a simple form of governance but as a process of participation and continuous communication.

In the area of the university, Walker (M. Walker, 2005) develops a research project to identify analogies with the Capabilities Approach; Piergiuseppe Ellerani (Ellerani, 2017) describes them from the pedagogical perspective; following is a list of the analogies:

- Practical reason, such as the ability to develop choices in an informed, critical, intellectually sharp manner to build a socially responsible life project in an uncertain world.

127 It is not a question of ideological processes of politics, but of a democracy that includes the exercise of citizenship in the midst of the Ecosystem University.

128 Nussbaum develops the following capacities, taking into account the nation as an extended community. For the present work, these capacities will be dimensioned to the context of the University (Martha Craven Nussbaum, 2010, pp. 42-43).

129 Morín (Edgar Morin & Lazzari, 2001) argues that the education of a set of capacities leads to an opening to assume a process of liberation of the minds. That way we would get people who can *merge* the sensibility and vigilant attitude as citizens of the world.

- Educational resilience, i.e. the capacity to negotiate risks, demonstrate perseverance in one's studies, accept educational opportunities, adapt and respond to difficulties, and be self-resilient through ambition and hopes.
- Knowledge and imagination: be able to use critical thinking and imagination to understand the complexity of science and form a moral judgment. Willingness to learn: be able to awaken curiosity and desire to learn, and therefore be aware of your limitations and ignorance, maintain curiosity, and be an active researcher.
- Social Networks and relationships: be able to respect yourself and others, show empathy, compassion, honesty and generosity, interact with others, keep eyes and ears open.
- Emotional integrity: be able to develop emotions to imagine and understand things, be empathetic, to have judgment and awareness.
- Physical integrity: to be safe and free from all forms of physical and verbal abuse.

An Environment that Enhances Capacities develops the previous characteristics without *instructions* and is based on the ecosystemic organization that allows people to experience this culture; where the daily life permeates the way in which people act (agency) and makes them grow from inside, like a plant that nobody *makes grow*, but grows by drawing on its environment.

The characteristics listed above suggest that although this Environment that Enhances Capacities is intentional, it does not eliminate the complex aspects of life. Immersion is accelerated to enhance the capacity for response that resides in the internal capabilities. It brings up the constants of the Ecosystem that cross it transversally: *Uncertainty, Diversity and Complexity*.

An Environment that Enhances Capacities (biocenosis) is one that through its system of values and its components expresses a context that generates the *socio-political-economic* conditions that are the synthesis of a *culture of innovation* around *knowledge*. In other words, far from being an isolated bubble, the Ecosystem University is affected by society and develops in its interior conditions similar to *diversity, complexity and uncertainty*. This way it brings out every person's capacities (J. P. Salgado et al., 2017). This *context-biocenosis* is a *supportive context* (Evans, 2002) (Ellerani, 2017).

This environment is determined by two basic characteristics for the existence of a Biocenosis that must be understood in relation with Biomimetics, which we discussed earlier. To generate the Environment that Potentiates Capacities, the University must not succumb to the *phantom of specialization*. Although the study of science requires specialization, it would be impossible to understand it without complexification. Moreover, an environment characterized by freedom of action and self-organization could not be understood either from the perspective of *competition for having* as a paradigm of human development; in the light of nature, we therefore need to understand another way of competing that is based on the BEING.

With respect to knowledge production, the Environment that Enhances Capacities has important implications in the Ecosystem University; Nonaka-Takeuchi define knowledge as “justified true belief” (Ikujiro Nonaka & Takeuchi, 1995); it is created from information and gives it meaning through interpretation (Kriwet, 1997). In other words, when knowledge is *explained* by the causes that produce it, and is *understood* by the reasons that explain it, it is the result of an investigation or research of its reasons and causes.

Hence, university education rather than *teaching* knowledge *explains* it (Sánchez Parga, 2003); students are not supposed to *learn* contents (that they are likely to forget once they wander off to their *passive memory*), but *understand* what they hear, and will in turn be able to *explain* it.

Learning as such is not shared but is transmitted. Conversely, knowledge is *understood* as it can be *explained*, and can then be shared by those who have understood it.

The Community of the Ecosystem University starts from the logic of comprehension-explanation of science, and its value lies in the reciprocity in dialogue of knowledge on the part of its members. It constructs the free flow of ideas and the space-time dimension, where it is possible to *emulate* and reappropriate the knowledge of others; therefore one needs to relativize *copyright* and take a qualitative leap to the *right to copy*. To emulate corresponds to the spontaneity of the exchange of energy;¹³⁰ for nature to optimize cycles is more important than to maximize competition.

130 This book develops an analogy between energy-knowledge from a thermodynamic metaphor. See glossary of terms.

The value of emulation¹³¹ for building knowledge lies in the fact that others become necessary for one's own improvement; this produces the cyclical dynamic of reciprocal improvements, which generates a social bond in addition to sharing the qualities, objects and contents of knowledge, both in science and in professional virtues or performances. It also produces participation in the common and shared goods of knowledge (Hess & Ostrom, 2007).

On the contrary, and far from establishing social relations, meritocratic competitiveness produces inequality and will finally exclude or eliminate others. Such misinterpreted competitiveness throws people into a battlefield that only knows winners or losers, "... *where the dominant class hijacks the future to the detriment of the young*" (Petrella, 2007).

Action-communication-knowledge is therefore a more important cycle for the Ecosystem University than dominating predatory and self-referenced rankings; the action that does not ignore the level of implied theoretical understanding encourages a cyclical process where old information is understood and once assimilated has a great potential to produce practical changes. We are talking about an abductive fusion (Charles Sanders Peirce, 1998) between what is already understood and new ideas. This cycle that has no beginning or end, much less comparative scales between individuals, calls on the Ecosystem University community to show greater appreciation for its identity (that forms identities among the actors), and at the same time promotes the dialogue of knowledge that builds new practices and knowledge.

Organization and Transformative Knowledge: Product of the Biotope and Biocenosis

The perspective of a *living* organization as presented in this book - opposed to that of a *machine* organization - shows the following characteristics:

- It potentiates the growth of people as the center of the organization.
- It puts the production of knowledge, whether general or organizational, before the production of goods and services.
- It combines knowledge (the real) and truth (scientific)

131 *Emulation* is derived from the Latin *emulatio*, meaning to imitate or equalize. In this context, the objective could resemble the other, even to overcome it as a way of personal or even mutual improvement.

- It is based on the transformation of knowledge into a tacit/explicit continuum (Ikujiro Nonaka & Takeuchi, 1995)
- It relies on self-organization and the consequent formation of organizational values that emerge bottom-up and then consolidate by consensus top-down.
- It exchanges knowledge and reduces the gap between the organization society, thus lending the organization's knowledge relevancy and a transforming potential.

The combination of the necessary structure, i.e. biotope or common pool resource, and the agency and functioning capacity of the Environment that Potentiates the Capacities, or biocenosis, form a cycle that feeds one dimension into the other. They constitute the basis for the dissipative system that works like a hurricane, where human development and knowledge production go hand in hand and are feasible only when created in community.

In the Ecosystem University, knowledge production refers to the enriching process of its construction, but not to a mistaken vision of the product. This differentiation makes the process of knowledge creation the center of the hurricane of the Ecosystem University; its movement creates all possible developments, synergies and exchanges, necessary communication and exchanges with the environment, etc.; it is a matter of orientation more by means than by ends.

Japanese Zen Buddhism, which emphasizes the unity of body and mind, offers a comparable vision. It goes beyond the *organization that learns*¹³² with the mind and not with the body, it connects the knowledge produced with the existential reality of those who produces it; therefore, all emotions are valid when it comes to creating knowledge, and all human development creates knowledge and all knowledge leads to action that transforms reality; this vision attaches special importance to *trial-and-error* learning, which Peter Senge¹³³ considers to be an illusion. Creation in an organization is not about assimilating bits of data and information but about a process of personal and organizational self-realization. Therefore, the personal relationship (ideals

132 "Learning organization" is a concept developed by Senge, who studies the model that is deeply rooted in the traditions of western administration, from Frederick Taylor to Herbert Simon. It is a vision of a company like a machine to "process" information (Senge, 1990).

133 Senge writes about the learning organization, although it appears like a perspective of the organization that is still utilitarian.

and ideas) with the company's identity and mission become fundamental. Creating knowledge means creating a company; it is not the responsibility of a chosen few for strategic planning - R+D+I -, but of everyone involved in the organization.

Nonaka-Takeuchi offer a particular approach (Ikujiro Nonaka & Takeuchi, 1995), that, in line with Polanyi (M. Polanyi, 2009), asserts that knowledge begins with the individual. At the same time it also recognizes the interaction between the individual and the company for organizational knowledge, as well as the mediation of the group to facilitate the interaction.

The centrality of groups is fundamental in Nonaka-Takeuchi's model, although providing spaces for dialogue and decision-making may imply conflict or disagreement; paradoxically it is precisely this contradiction that motivates individuals to question premises and oppose visions and points of view, and this gives meaning to their experiences of knowledge production.

An ecosystem organization is a community of communities, where the formation of groups is diverse not only because they are different from each other, but also because of the members that make up the group, either because of their ranks, knowledge disciplines, experience, personality, etc. This is a fundamental factor when responding to internal or external demands.

Combined with the ability to create and use it, knowledge is considered the essential foundation for any organization (Nelson, 1991) (Leonard, 2011) (Sveiby, 1997). Therefore, organizations tend to adapt to new circumstances by seeking to innovate and create knowledge and foster recreation. We can understand innovation and creation of organizational knowledge as an amplification of knowledge generated by individuals, and crystallized as part of the organization's knowledge system (Ikujiro Nonaka et al., 1996). Organizational knowledge is presented as a dialectical process that creates new limits through the dynamic interaction between agents-structures and the transformation of tacit-specified-tacit knowledge into an unfinished spiral (Ikujiro Nonaka & Toyama, 2003). The first of them, agent-structures are two ways of looking at action and the separation from the two types of knowledge that provide a basis for the continuous interaction between tacit and explicit knowledge. The second duality, tacit- explicit knowledge,¹³⁴ coexists within a person by maintaining a separate nature and interacting with each other. Ex-

134 *Tacit* refers to what is known and explicit tow what is expressed (M. Polanyi, 2015).

plicit knowledge is transmissible in formal, systematic language while tacit knowledge is deeply rooted in action, engagement and participation in a specific context.

Knowledge creation is a continuous and self-transcending process that helps produce a new worldview and new knowledge (Ilya Prigogine & Hiebert, 1982). Therefore, Nonaka-Takeuchi (Ikujiro Nonaka et al., 2000), argue that organizations create knowledge in a dynamic way, proposing a model of knowledge creation called SECI, which is considered a process of knowledge creation through the conversion of tacit and explicit knowledge.

In the first instance, the SECI process, also called knowledge conversion spiral [406], seeks to convert tacit knowledge into explicit knowledge, and vice versa. In short, one can identify four modes of knowledge conversion: socialization - from tacit to tacit; externalization - from tacit to explicit; combination - from explicit to explicit; and internalization - from explicit to tacit.

1. Socialization. Socialization is a process of exchanging experiences aimed at creating tacit knowledge, shared mental models and technical skills. An individual can acquire tacit knowledge directly from others without using language. This process studies how apprentices work with their masters and learn through observation, imitation and practice. The key to acquiring tacit knowledge lies in practice. Without shared experience it is extremely difficult for one person to project himself into another person's thinking process. The mere transfer of information will often make little sense if it is abstracted from the associated emotions and the specific contexts associated with the shared experiences. Furthermore, meetings are not limited to project team members, but are open to any employee who is interested in the ongoing project developments. In these debates, the qualifications or the status of the commentators are never questioned, but criticism without constructive suggestions is taboo. Nor is it exclusive to the development of new products and services, but it is used to develop management systems or corporate strategies. Such a view is not only a forum for creative dialogue but also a means to share experiences and increase mutual trust among participants. Camps for exchanging ideas represent a mechanism through which individuals seek harmony by engaging in physical and mental experiences. In short, socialization is based on the transmission and creation of tacit knowledge through direct experience, usually from one individual to another through observation, imitation and practice.

2. Externalization. Externalization is a process of expressing tacit knowledge to explicit concepts. In other words, it is considered a process of knowledge creation par excellence, in which tacit knowledge becomes explicit and takes the forms of metaphors, analogies, concepts or models exposed mainly in language. However, expressions are often inadequate, inconsistent and insufficient. Such discrepancies and gaps between images and expressions help to promote reflection and interaction between people. The mode of externalization of knowledge conversion is typically seen in the process of concept creation and is triggered through dialogue or collective reflection. Concept creation often uses and combines the methods of deduction and induction.

By creating new and explicit concepts of tacit knowledge, externalization holds the key to knowledge creation, making sequential use of metaphor, analogy and models. Thus, this creative and cognitive process manifests itself in similarities and discrepancies, which often leads to discovering new meaning or even the formation of a new paradigm. Contradictions between two thoughts in a metaphor are then harmonized by analogy, which reduces the unknown by highlighting the “commonality” of two different things. People often confuse metaphor and analogy. The association of two things through metaphor is mainly driven by intuition and holistic images and does not seek differences between them. Association through analogy, however, is based on rational thinking and focuses on the structural similarities and also the differences between two things. Therefore, analogy helps us to understand the unknown through the known and bridges the gap between an image and a logical model. Once the concepts are made explicit, we can shape them. In a logic model, there should be no contradictions and all concepts and propositions should be expressed in a systematic language and coherent logic. In short, externalization articulates tacit knowledge through dialogue and reflection from the individual to the group through metaphor, analogy and model development.

3. Combination. Combination is a process that organizes concepts into a knowledge system. This mode of knowledge conversion involves combining different bodies of explicit knowledge, where people exchange and combine knowledge through documents, meetings, telephone conversations or electronic communication networks. Reconfiguration takes place through techniques of classification, disaggregation, addition and categorization of explicit knowledge by integrating them into broader concepts.

In short, explicit knowledge is collected from the group and transferred to the organization, then combined, and edited or processed to form new

knowledge. The new explicit knowledge is disseminated among the members of the organization via communication networks. Databases on a large scale can facilitate this mode of knowledge conversion.

4. Internalization. Internalization is a process of incorporating explicit knowledge into tacit knowledge. When experiences - through socialization, externalization and combination - internalize in the tacit knowledge bases of individuals in the form of shared mental models or technical knowledge, these turn into assets. To create organizational knowledge, the tacit knowledge accumulated at the individual level is shared with other members of the organization and will consequently initiate a new spiral of knowledge creation. For explicit knowledge to be tacit, it helps to verbalize knowledge or diagram it in documents, manuals or oral histories. Documentation helps people to internalize what they experienced, thus enriching their tacit knowledge. In addition, documents or manuals facilitate the transfer of explicit knowledge to others, which helps them to have their experiences indirectly.

Internalization can also occur even without actually 're-experiencing' other people's experiences. In fact, when a large part of members share the mental model, tacit knowledge becomes part of the organization's culture. So the point is to acquire and learn new tacit knowledge in practice to convert organizational into individual knowledge through personal experience, simulation and experimentation.

Figure 22
Knowledge Spiral



Source: Nonaka and Takeuchi (Ikujiro Nonaka & Takeuchi, 1995). Elaborated: Salgado-Guerrero, J. P.

The ecosystem perspective introduces the concept of self-organization, the basis for autonomy. This characteristic increases the possibilities of finding unexpected possibilities as well as motivating the actors to create new knowledge. This new communicated and shared knowledge in turn produces fresh, but this time collective, knowledge.

A knowledge-creating organization, as Nonaka & Takeuchi called it, allows autonomy to be the product of an *autopoietic* process,¹³⁵ in which the whole is not the result of the *addition* of the parts or an *analysis* of the subordination between them, but autonomy continuously controls all the changes that occur within it.

The concept of *evolution amidst fluctuations of chaos* requires creativity on the part of the organization to achieve new order. Gleick (Gleick & Berry, 1987) argues that these fluctuations are different from disorder because they maintain a certain “non-recurring order,” whose pattern is difficult to predict. But they help break routines or habits, as each rupture causes a questioning and reconsideration of the existing premises. This leads to the creation of knowledge and takes the organization to a higher level of collective action.

This creativity is possible in the midst of chaos only if the actors have the possibility to exchange knowledge through dialogue and effective communication. Active reflection is practical research, it takes place independently of theories and can redefine them. Furthermore, the value of dialogue is that it can strengthen the commitment of the actors. For this we need to allow for ambiguity since only ambiguity can facilitate fluctuations and the consequent change in the parameters of people’s thinking by externalizing their tacit knowledge.

If organizations adopt an open attitude toward environment signals, they can exploit ambiguity, redundancy or noise in order to improve their own knowledge system.

Redundancy can be understood as loss of efficiency, unnecessary duplication, waste or overload of information; from a complex perspective, the

135 *Auto-poiesis* is a Greek word that is composed of the prefix *auto* (for itself) and *poiesis* (creation, production) and was introduced as a concept to define life (Varela et al., 1974). Maturana notes that living beings are dynamic systems in continuous change. The interactions between the elements of an autopoietic system regulate the production and regeneration of the system’s components, having the potential to develop, preserve and produce its own organization (Varela et al., 1974). The concept of autopoiesis has spread to other areas beyond biology (Froese & others, 2010) (Luisi, 2003) (Varela et al., 1974), although no formal measures have been proposed so far. Of interest may be Plato’s conception of the term *poiesis* as “the cause that converts anything we consider not to be into being” (Crespo Güemes, 2007).

creation of knowledge requires the communication of experiences and concepts that may not be immediately necessary for others, but nevertheless, the action of sharing enables the individual to transmit tacit knowledge and thus transform it into explicit, that is, the individual can *explain what she understands*¹³⁶ by feeling what she is trying to say.

Redundancy in the superposition of functions or the superposition of states of knowledge production also increases the cost of producing it, at least in the short term (later the cycle will be optimized). Therefore, it is important to find a balance between efficiency and resilience (which has redundancy as its basis) as we shall see later on. The ultimate reason for seeing the University as being “*the critical search for truth and the production of knowledge*” seems to be challenged today by its inability to act against the backdrop of the changes of society, and to remain trapped in the logics and discourses of a *market society*. Yet, these logics, which the University should act against, subdue the production of scientific knowledge, critical thinking and university teaching, making it impossible for the university to conceive of a different society.

Who defines what a University should teach? The answer involves the concept of university autonomy in the present situation, freeing the university from the temptation to turn into a machine of ideological market reproduction.

When the university submits itself to market values such as competitiveness, profitability, marketing, cost-benefit and replaces research with simple consulting, it chains its autonomy to the production of knowledge and domesticates it, stunts critical thinking and, what is worse, degrades its academic quality into simple supply and demand of professional training in response to the needs of the labor market.

One would be mistaken to seek to *evade* this dynamics because the tension with the market forces is inevitable, as societies have always had a market. On the other hand, it is not a question of fighting the market economy with solutions purely based on economic criteria; the solution must come from the *political governance of the economic* and not from an *economic gov-*

136 The explanatory capacity of reality and self-criticism and of what surrounds us in the face of the dominant powers and discourses, guarantee the production of knowledge in the university. The need for spaces, places and meetings for university reflection are increasingly necessary to build a science with a conscience within an academic community. If we feel the need to understand and explain, and add the multiple points of view as critical reasoning that result from subjectivity, we will have multiple developments of knowledge.

ernance of the political; an economist counterattack to the system would end up being more of the same.

An ecosystemic organization that produces knowledge, among other alternatives, indeed offers the university the possibility to *respond with autonomy*, questioning and exercising a force for change within the system itself, given that the production of relevant and transforming knowledge enables the university to think about itself and the society in which it is embedded.

Production of relevant and transformative knowledge implies the following:

- Not to confuse information with knowledge, promote unique albeit conflicting dialogue between critical and instrumental reason. We need to go beyond managing data and information that satisfy consumption and utilitarian demands to produce knowledge with communication and action in society.
- Conceive knowledge as a potential for human development, which favors its promotion and transforms its surroundings into an environment that enhances capacities by virtue of a common good. This implies going beyond understanding knowledge as a mere generator of wealth, since this perspective leads to manipulating it as a good of concentration and inequality. It reifies it as a commodity that produces social asymmetries regarding access and use.
- To understand knowledge as a dialogue between science and know-how, to seek truth not only in what is true but also in what is real, which allows the person to produce knowledge that responds to specific endogenous epistemologies, favoring systemic logics and going beyond a unidirectional logic, where some produce knowledge and others use it.

The knowledge produced by the university is relevant because it comes from social validation, it values differences, is based on the interaction of networks and groups that seek the meaning of what surrounds them in the midst of an intentional environment that enhances human capabilities.

The promotion of an Environment that Enhances Capacities understood as the integration of academic and extra-academic contexts strengthens the Teaching-Research fabric.

The production of relevant and transforming knowledge reduces the gap between University and Society and is based on Knowledge Management

strategies that enhance the dynamics of the tacit-explicit continuum within it, as can be seen in Figure 23.

The *explicit-tacit transformation* related to *emotional heat* (Bratianu, 2011) as shown in the *ecosystem model of knowledge management* proposed in Figure 23 as being related to the cycle of *transformative knowledge* (relevance and pertinence of results) and *social validation* (consolidation, credibility, social opinion, satisfaction of needs). Tacit knowledge is “*deeply rooted in the action and experience of an individual, as well as in the ideals, values or emotions it embraces*” (Ikujiro Nonaka & Takeuchi, 1995).

Motivation or emotion is fundamental in the process of internalization; the feedback produced by social recognition, credibility, etc. triggers the search for explanations; the individual generates, classifies, selects and connects information to give meaning to a new belief, thus converting models, formulas, etc. into capabilities^{137 138}.

Tacit-explicit transformation is linked to *cognitive work* (Bratianu, 2011) which, in the *hurricane of knowledge-organization*, links in an ecosystemic way the spiral of *knowledge* with the cycle of *communication-action*, which is based on the dialogue of know-how and knowledge (Figure 23). *Cognitive work* can be understood as the transition from a thought, belief or knowledge to a physical sensation that triggers an emotion.

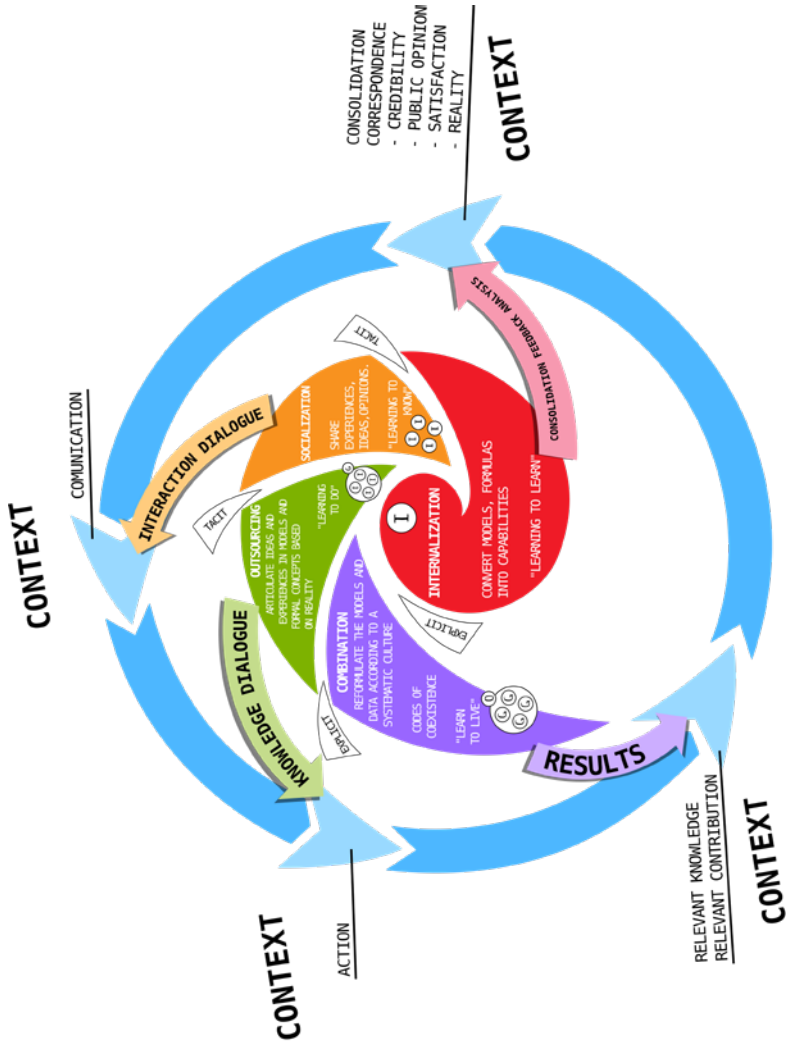
Communication-action with the environment allows us to project reality without generating a gap between theory and practice, it permits us to articulate ideas and experiences in formal models and concepts according to reality, that is to say, externalization, achieving tacit - explicit transformation.

As mentioned above, regarding the ecosystem as a dissipative or open system means that the very dynamics of its functioning sustain it to continue functioning in the manner of a hurricane (Figure 23), i.e. the exchanges of energy-knowledge with the environment produced by its dynamics at the same time produce the spiral of the tacit-explicit continuum.

137 Peirce defines as abduction the process through which the receiver through his own logic (which is unique) constructs his own hypothesis to explain what he has perceived as novelty (intensity). This process begins simply by receiving the signal (content) of data that carry a novelty that needs explanation (Charles Sanders Peirce, 1998).

138 Broekstra summarizes the cognitive work on motivation by establishing four principles: (i) if the person feels competent to face a challenge, (ii) if he understands the purpose of what he is willing to do, (iii) if he understands his environment as favorable to learning, (iv) experiences positive emotions that motivate learning; people can use cognitive resources when they have control over the intensity, duration and expression of their emotions (UNICEF & others, 2016).

Figure 23
Hurricane of Knowledge-Organization.
Shows an ecosystemic model for knowledge management



Elaboration: Salgado-Guerrero, J. P.

The university-society gap is the difference between what the university must know and what it does know, or by what the university must do and can do; narrowing this gap implies providing the university with sufficient flexibility, adaptability, capacity for internal and external reflection, and therefore the capacity not only to respond to the demands of the context (Zack, 1999), but also to assume and transform them (Broekstra, 1998).

The university and society are in a *dynamic balance* (without implying order), which enables the university to respond to change and absorb knowledge from its surroundings. The knowledge of the University depends on the flow of knowledge from society to its interior and the creation of relevant knowledge that is communicated to and shared with the outside.

Far from exercising control, the administration will monitor and stimulate the continuous relationship between tacit and explicit knowledge through processes of communication/action with the environment, and thus promote the development of people in an Environment that Potentiates Capacities.

Communication-action-knowledge forms a spiral, as it favors the continuous transformation of explicit tacit knowledge on the one hand, and, on the other, helps to project the possible futures of the organization according to the collective feeling and the relevance of the context.

It is precisely the *improbable pairs*¹³⁹ that trigger the process of communication-action-knowledge, which is why management must encourage this encounter, even though in many cases it is considered to be even inefficient. Later on, we will see how *redundancy, diversity and uncertainty*, although they relate to efficiency, are also linked to resilience, which is an elemental requirement for evolution and therefore development.¹⁴⁰

Earlier we discussed the concept of resilience in connection with the university in greater detail and defined it as follows:

"The capacity of evolutionary self-organization, based on the production of relevant knowledge to interact with the changing conditions of the environment, allowing it to give a proactive response, which imagines, thinks, creates and acts on the characteristics of its identity."

139 An improbable pair is a dyad of actors who establish synergies but would probably not have met without an external Stimulus.

140 Ulanowicz argues that system overload serves as a mechanism to maintain system integrity and provide future support. In other words, redundancy is the price that needs to be paid to guarantee evolutionary leaps and therefore development (Ulanowicz, 2000).

The interaction between the *socialization-externalization-combination-internalization* spiral and the *communication-action-knowledge* spiral produces and feeds on the *resilience* of the Ecosystem University.

University administration therefore needs to understand how to produce resilience and understand its balance with the other variables of the Ecosystem such as efficiency, sustainability and entropy. A semantic construction based on the analysis of entropy, enables the University to partially embrace the fields of knowledge in groups and the knowledge codified in the organizational culture, using the information of the states of knowledge production, as well as the products and results of those states, as we shall see later on.

The Synergetic Action Base: The Group for the Ecosystem University

The Ecosystem University is the result of the transformative action of its members and can be understood as practical action (*praxis*) and productive action (*poiesis*).¹⁴¹ Both transform reality to create something new - the *finality-outcome* is the *institutionality*, and the *finality-objective* is *autonomy*. In the case of practical action, the intention of the subject is fundamental and in *poietic action* the intentionality of the outcome or the product is independent of the subject.

The conjunction of these two forms of action is of significance, since the positivist reason that is guided only by the ends and results can transver-
salize the community of the Ecosystem University and make it lose the reflective capacity of the means and therefore the political and social action to become only economic. Putting the individual at the center of all university action implies orientating him toward *ethical praxis*¹⁴² and turn the action into a productive technique that is subject to the ends.

141 According to Aristotle (1970), human activity is divided into poiesis, which is defined by productive or technical action, and praxis, which is defined by the means and the exercise of the same activity. For Plato, poiesis acquires the sense of institution, and praxis is defined by the objective of this purpose which is autonomy. The commons represents both as its aspired outcome is institutionality, and its aspired -objective is autonomy.

142 For Aristotle (1970), politics consisted of an ethical praxis composed of the political perfection of the citizen and the happiness of the polis, but since the Renaissance and the emergence of the cycle of politics and the State of the development of political forces and institutional powers, politics has transformed into a productive technical action that is defined by its results and works rather than by the intentions of the subjects.

The confluence of *praxis* and *poiesis* in a university commune¹⁴³ is based on the triple articulation of the dimensions of economy, politics and society. This articulation is complex as the sustainability, identity and autonomy of the commune depend on the absence of any supremacy of one dimension over another. For example, it is not the same to say *economy of politics* and *politics of the economy*, *the social of the economy* and *the economy of the social*, or even *social policy* and *political society*.

The synergic characteristic of the action expresses vitality, sustainability and productivity of the commune; it does not consist of individual features, but takes shape on the basis of shared rules that guarantee and continually restructure synergies. The Ecosystem University lives and grows by the vitality of the synergies that we must understand as interconnections that generate flows and mobilizes forces. Synergy guarantees the relationship between peers and discards the assumption that it is ethical to pursue the market logic of buying from others as cheaply as possible and selling oneself as expensively as possible. For Ostrom, the problem of managing the commons is characterized by *collective action* and, therefore, by the questions related to *appropriation and provision of the Common Good*.

In complex ecosystems, populations and groups (research groups, innovation groups, etc.) form in a functional way and depend on how their basic elements are organized (homogeneous interests, even if they become heterogeneous later on through the increase of entropy). Gregarious conditions and hierarchical organization are not imposed but emerge in a complex system (Levin & Segel, 1985) and over time restrict interactions and development (S. A. Kauffman, 1992). Common interests are superimposed on the characteristics of individuals, which is why we find cooperation not only within the same species (academic discipline) but also between individuals of different species (academic inter- and trans-discipline). On the other hand, it is important to note that gregarious patterns or hierarchical organization are a consequence of self-organization (Crawford S Holling, 1992) (O'Neill, 1986).

The integration of Research Groups, innovation, etc. beyond regulation, will depend on shared values and the motivations that bring them together, taking into account that the search for knowledge is interdisciplinary and trans-disciplinary.

143 Communitarity involves decision making often in search of balance and often in crisis. Community implies a set of already defined values.

The formation of the Research Groups abandons the traditional concept of a classroom group; the aim is to recover the academic space to think together and produce synergy for creative dialogue. These spaces are located in the dimension of the encounter rather than in the dimension of time and space. For example, producing an undergraduate thesis can help develop a theme for group research and also bring together doctoral students, teachers, master students and even undergraduates. These new spaces are related to the concept of “*wikiculture*,” which is characterized by open, voluntary and non-exclusive collaboration, where people cooperate to master a certain situation and, thus learn and produce knowledge.

What counts for the University is not the research project itself, but the group that deals with it. The diversity of this group multiplies the possibilities of learning and, with each action, spreads its initiative to a greater part of the university community. The Research Group will therefore be the driving force behind the entire Research System.

There are multiple spaces of encounter between research and innovation groups and university realities framed in a matrix logic between Teaching and Research. Each group is responsible for its own autonomy vis-à-vis the central body, so that the various bodies such as university departments, the rector’s and vice-rectors’ offices, and degree courses are satellites that complement the Research System. The initiatives of these departments mobilize the university research community.

We should point out that the academic logic and the flows that intervene in each place of encounter between the groups and the university reality, must not be confused with the administrative logic of the University. In other words, knowledge generation initiatives do not have to follow the same hierarchical and centralized processes of the administrative network. Academic logics obey a planetary system of research, where the group is the driving force, and regulation comes from the Collective Action Councils¹⁴⁴.

The base groups (Research, Innovation, etc.) have a dual function: as was said before, they are the place par excellence that assembles experience

144 The Collective Action Council is made up of representatives of the grassroots groups and is in charge of establishing rules for the use of resources that structurally affect action on common goods, in which the actors have property rights, guaranteeing congruence between appropriation and provision. This dynamic depends on the consensus of the interests of the actors in the university. These consensual rules defend the actors, they are flexible since they can be easily modified, but without concessions to accomplishment.

and the research process; however, they also generate academic innovation that provides curricular feedback to the careers and their research programs.

With regard to research agendas, we must differentiate between external and internal requirements. From the vantage point of the University it would be ideal that every degree course also includes research in a transversal way; each subject would outline the research components and the possibilities for or projects of research.

The multiplicity of meeting points between the different fields and Research Groups forces the sides to share and complement programs and research agendas and provide feedback. This creates an enormous potential since each field of study can be linked to several Research-Innovation Groups and vice versa.

The guidelines for the research agendas should encompass at least three basic criteria:

- Scientific developments and innovations.
- Social demands that also discuss future job opportunities for students.
- New academic developments in the University itself.

The Ecosystem University, and therefore the Research-Innovation Groups, currently face the challenge of responding to the demands of society, imposed mainly by governments and business, without being instrumentalized by political decision-makers, state logic or market forces. Academic and university research agendas must consistently maintain autonomy to guarantee the scientific nature of their production, the enrichment of knowledge, the constant scientific relationship and a positive relationship with society.

While the University must provide decisive responses to the demands from society, the production of original knowledge at the University (which is based on critical reason) can respond to social needs. According to the above, the dynamics of research constitutes a true driving force for developing a certain field of study, teaching the students, for the faculty and scientific achievements at the University. The feedback from research constitutes a virtuous circle that guarantees the identity of the University.

It is essential to ensure a sustained process of study and analysis of the activities of the Research-Innovation Groups. This function of research observatory can also be carried out by the Vice-Rector's Office for Research or by any other University authority that transforms data into information that is necessary to support University policies and strategies.

A knowledge observatory will guarantee an evaluation of the evolution of a given phenomenon and provides effective *intervention* instruments for bottom-up planning ¹⁴⁵.

Figure 24
Central driving wheels of the groups, graph developed from actual UPS data



Source: Salgado-Guerrero, J. P. (Herrán Gómez et al., 2014)

Self-organization is the most viable alternative for organizing an Ecosystem as opposed to hierarchical structures. With strong communication channels and synergies, the number of actors is less important to the ecosystem logic than their interactions. In dissipative systems, that we earlier compared the Ecosystem University with, one can understand where order emerges, but not under what conditions. Order and the most complex behaviors emerge at the edge of chaos, and the processes that lead the system to the edge of chaos are those of natural selection, mutation and recombination (S. A. Kauffman, 2000). For Kauffman, self-organization is the condition

¹⁴⁵ Below you will find an outline of the logic of non-linear planning based on voluntary guidelines that result from the emergence of identity values assumed by the organization. This process is explained in "competition from identity".

sine qua non for the survival of the system in the midst of chaos and also for ensuring that the evolutionary leap in the system takes place due to the need for adaptation (S. Kauffman, 1995). On the basis of self-organization, order emerges naturally in every complex system (Camazine, 2003).

People often see pyramidal structures as hierarchical and opposed to net-working structures (synergy), which are considered flat, although this is not the case, as pyramidal structures may not necessarily be hierarchical and may be quite useful under certain circumstances. Cumming deals with a comparable contradiction in connection with networking (G. S. Cumming, 2016); he manages to interweave the elements of networks and hierarchies as an organizational/structural continuum; the relationships between *patterns-processes* or *structure-functions* can be defined more clearly and more closely from the perspectives of *heterarchies*¹⁴⁶.

In a hierarchical system any leader will have major difficulties to know what is going on and will seek to exercise control in a unidirectional manner, which obstructs the path toward taking a critical distance and act on the basis of moral judgment. Inaction is equivalent to ignorance. The Ecosystem University must recognize its condition as a network that enables self-organization and use dynamic and rhizome structures that do not follow hierarchical but rather polycentric patterns (Elinor Ostrom, 2010b).

In the groups, the rhizome nodes appear and disappear, since they exist as long as the projects are carried out in the *meeting places* for common interests. Each time a rhizome breaks, it recomposes itself preserving its other-unit and connects any point with another point; it is not a “tree” structure with branches that form multiple units, but rather it is composed by directions or dimensions that change over time.

Contrary to a hierarchical structure with a defined set of points and positions, the rhizome is made up of lines that establish *dimensions* and *flows* that have no *territory*, but facilitates the metamorphosis of its *heterarchies*. Each *rhizome* instance manages its own autonomy in relation to the trunk, and also transcends in a diluted and vertically distributed way the university

146 Cumming (2016) manages to interweave the elements of networks and hierarchies as an organizational/structural continuum. Relating these concepts in a linear manner, assuming the network as a flat hierarchy and opposite to the vertical hierarchy, would limit the perspective on complexity. The relationships between patterns-processes or structure-functions can be defined more clearly and more closely with the context from the perspective of heterarchies. This term will be more appropriately define as “an unstructured order” later on.

instances already defined as departments, centers, fields of study or areas, etc. The *fabric* that results from the interaction between the prescriptive objectivity of the administrative and departmental structures with the creative subjectivity of the base groups, rather allows the emergence of knowledge creation initiatives, thus inciting a relationship of cooperation between peers rather than the manipulation of the subordinate.

The actors in the midst of this *fabric* will be able to use their initiative and creativity to confront the “imposed order” and, above all, uncertainty and complexity in a University that is always open to new meanings on which to exercise its transformation.

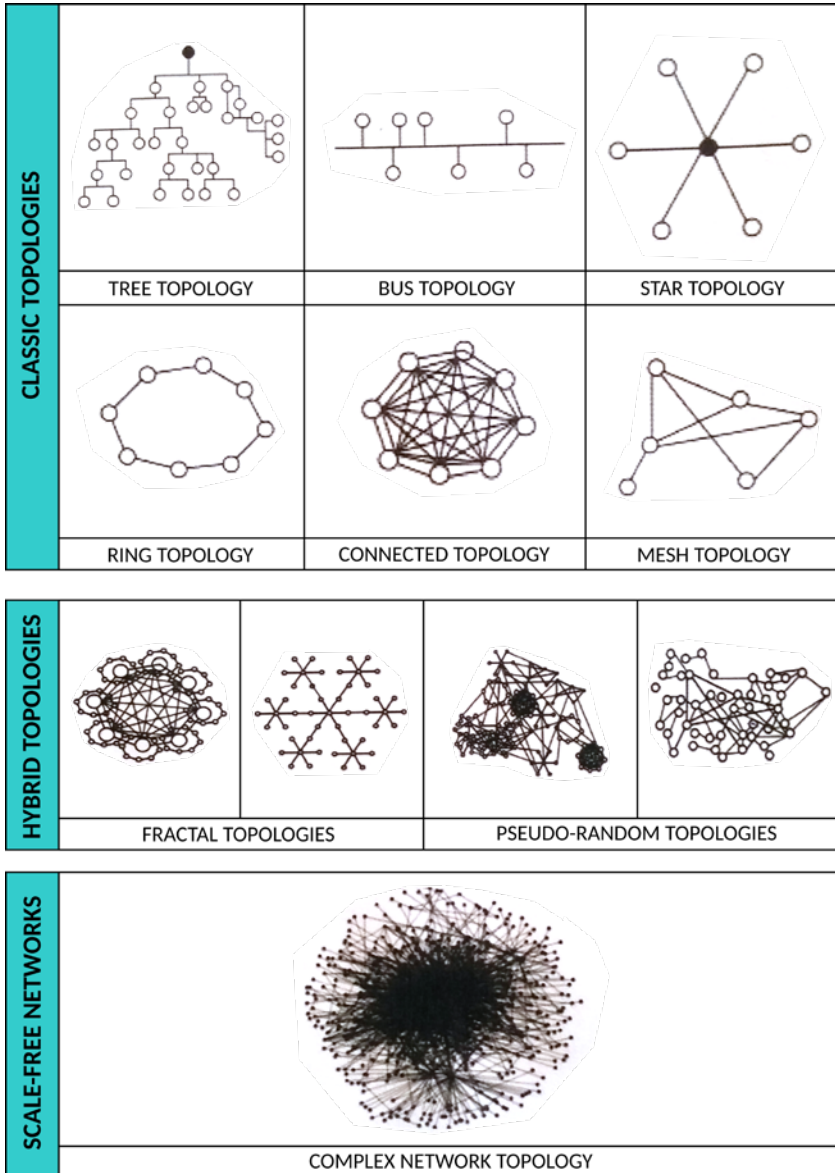
The Ecosystem needs to have a range of possible topologies of structures that are sufficiently diverse to allow the groups to operate as rhizomes in complex environments or make use of that complexity. These topologies must be in accordance with the behavior of the actors, groups, social systems and their interactions.

We therefore need to take into consideration:

- The morphological dynamics of the structures.
- Heterarchies permit nesting of any type of existing hierarchy.
- Reticular multiplicity.
- Communication in the lines of synergy to foster transformation.
- The rupture and recomposition on the basis of self-organization and according to the duration of the meeting places reflected in projects.
- A map of synergies based on experimentation that shows the possibilities of improbable pairs and shared interests of actors with the potential to create new meeting places.
- Accept uncertainty as a potential for creation, multiple possibilities for modification, establish or eliminate connections, change of directions, adaptation to the context.
- Optimization and randomization for the emergence of complex networks.
- Locality that does not imply geographical proximity but rather flows that intervene in a territory.

Criticizing the hierarchical control from a complexity perspective, Mezza (Mezza-Garcia, 2013) establishes a range of topologies which are analyzed to determine the level of *Bio-inspiration*. Our paper will use this range of possibilities as can be seen in Figure 25.

Figure 25
Classic, hybrid and complex topologies



Source: (Mezza-Garcia, 2013)

Actions-Synergies are not made up of units but are dimensions or changing directions; they do not respond to a beginning or an end, but are a means that facilitates growth and overflows. Synergies must not be confounded with unidirectional filial relations of a pyramidal type, which are free, spontaneous and produced by reciprocity and not subordination; therefore, they must always be constructed, produced, connected, modifiable, of multiple inputs and outputs, and defined only by the circulation of states.

A Teaching-Research Fabric for a Living Organization

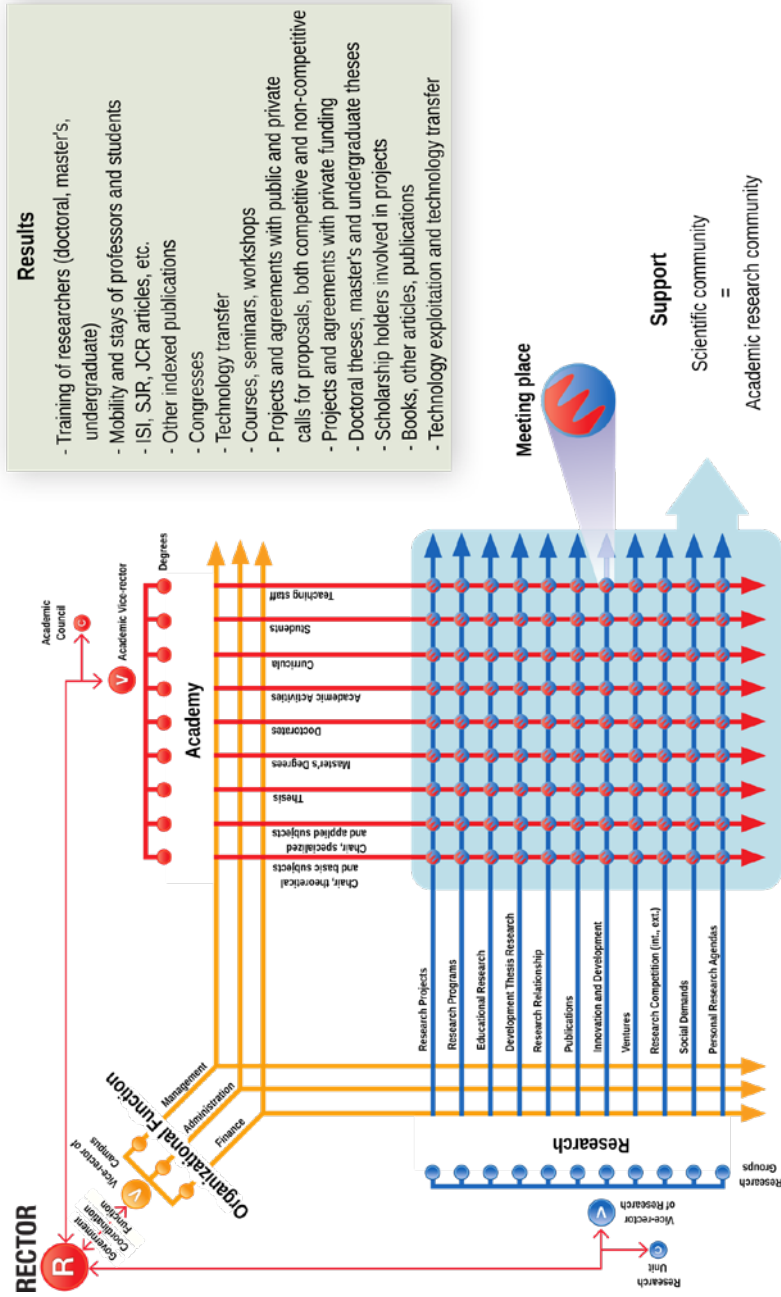
If we consider the Base Group (Research, Innovation, etc.) as the driving force of the Ecosystem, we need to put all university bodies at its service and give priority to the Teaching-Research relationship. This implies talking about a University that abandons the concept of the classroom, leaves its comfort zone to become a Community that is governed by values and interacts through flows of reciprocity, and where the regulations, organization charts and administrative logic respond to the dynamics of people.

We must give up the concept that only the formal is good, valid or true, and move towards the informal. This does not imply giving up or deforming formality, we simply have to find new forms. The exercise of conceiving of a new organic architecture motivates us to discover new ways in which the university community produces knowledge, answers problems, and even raises new questions that are born from the Teaching-Research nucleus. These situations arise from complexity and correspond to a spatial *fabric-organization* that enhances what we generally define as “meeting places” (Figure 26).

The *meeting places* are the product of the intersections of multiple flows that intervene in the creative and research dynamics of the University: professor, graduate and undergraduate theses, research programs of careers, groups, centers, teachers, external demands, internal demands, research competitions, publications, dissemination of results, linking research, technology transfer, innovation and development, entrepreneurship, etc.

The personal interest and every aspect of an individual's identity are related to a certain dimension, and this in turn *meets* with the dimension of the other. Shared interests and the search for meaning brings people together in a meeting place within the academic community that does research and builds motor cells, i.e. the Research Groups.

Figure 26
UPS Teaching-Research Fabric



Source: Salgado-Guerreo, J. P. (Herrán Gómez et al., 2014)

University research feeds on the experience of spaces and images that determine the process of personal socialization. The question arises of how we can establish planning as a method of governance and also as a flexible and effective tool, with the presumption of informality and sustained in original meeting places? How can planning not only respond to the demands of officials and evaluation agencies? We are obviously not thinking of any orthodox planning or design patterns that follow the illusion of formal accuracy and the prescriptive method that is derived from the rational model.

Such an approach to planning only draws the University on paper, finds it too diffuse and complex, and therefore projects it as nonexistent. There are situations that need to be dealt with by those who are familiar with them, and problems of synthesis that must be dealt with by those who are able to see the whole picture. Although there are common axes of articulation, it is impossible to find a homogenizing plan for everyone. Only if we adapt the processes to each case will we see the meaning of planning as a method.

Base planning, which deals with the problems of each node (Research and Career Groups) and their interactions with the multiple meeting places, weaves the basic network that requires central *integral planning*, which deals with the long-term generic problems. The groups themselves negotiate and strike agreements through a *socially disseminated university network*.

Nodal and *integral* planning must not only coexist, but also recognize the specificity and complexity through a framework of constant dialogue and accompaniment that guarantees life, unity and identity. To ensure that integral planning acts in accordance with *nodal* planning, requires communication based on self-criticism and a permanent effort of recognition within a *socially disseminated university network*.

The whole is not the simple sum of its parts, relationships are not monocausal, logic is not common-sense related. Instead, we are talking about a new way of recognizing the parts without losing sight of the whole - but from a holographic logic of multiple relationships. It is essential to recognize each group without losing sight of their integrated networks, as layers that interweave cultural, academic, political, and social relations, in local, national, and international environments.

The focus on the *integral* must propitiate meeting places, dynamic, flexible and horizontal places that can reinvent the rules and research practices.

The groups can produce multiple sprouts, the more the better, which are disseminated according to their practical usefulness. We must recognize them as a network based on multiple meeting places and they do not follow a hierarchical order because they belong to the order of creativity that may sprout from any point.¹⁴⁷

Ecosystems prioritize optimization rather than maximization, while mechanical or linear organizations tend to do the opposite. Ecosystem complexity implies a balance between *efficiency* and *equity*, it endorses a vision where these are not only opposed but complementary at the same time. Optimization implies adaptability to system functionalities, recycling information, processes and materials, as well as favoring multifunctionality (Biomimicry Guild, 2009). Maximization is only oriented toward efficiency, justifying the means and breaking the interactions and interdependencies of the network.

Favoring optimization rather than maximization is key to understanding the functionality of the organizational fabric, and trusting that self-determination and self-organization eliminate control, which may appear extraordinary at first sight. The key question is: can there be order without control? And consequently, can there be order in chaos?

Due to self-organization, structure and order can actually even exist in chaos (Fernández et al., 2014). The outcome may not be an ordered order but an organized order. It is a matter of imagination – according to Morin (Edgar Morin et al., 1994), – that order is not only antagonistic but also complementary to disorder. That is to say, if we try to put order into disorder and we resort to a systemic organization, this will simultaneously lead to order and to interactions that also cause disorder.

Pascal et al. argue that the use of control may, unintentionally, produce disaster (Pascale et al., 2000), which is why one must differentiate between control and order. The paradigm of machine organization has made us think that control produces greater efficiency, but the organization is organic and therefore does not function along the same rules, and control loses its meaning (Wheatley, 1993).

¹⁴⁷ The widely known two-dimensional matrix organization does not distinguish between financial and organizational support functions. Dostal introduces the third dimension by distinguishing three types of functions called Biomatrix (Dostal et al., 2005), from which Figure 33 was developed.

Therefore, the *fabric* of the organization must show the following characteristics¹⁴⁸:

- The contributive nature of knowledge and experience.
- The “realistic” nature of the individual task, which is determined by the overall situation of the organization.
- The continuous adjustment and redefinition of individual tasks through interaction with others.
- Understanding “responsibility” as not only limited to rights, obligations and methods (Responsibility for problems is not dumped on others).
- A commitment to the organization that goes beyond any technical relationship.
- A network structure of control, authority and communication. The sanctions applied to the conduct of individuals at their work are based on community interests and the survival and growth of the organization rather than on a contractual relationship as represented by an immediate supervisor.
- Knowledge can be located anywhere in the network; this location becomes the *ad hoc* center of control and communication and does not only rest with the organization’s head.
- Communication is also lateral, not only vertical, and works more like in the form of consultations than directives.
- A communication content that consists of information and advice instead of instructions and decisions.
- Commitment to the organization and to the “*technological ethos*” of progress and growth is more valuable than loyalty and obedience.

The organizational *fabric* is formed by the objectivity of the university management and by the subjectivity of research management. A vision that excludes one from the other would be mistaken, since from the management perspective they are complementary; nevertheless, we must not forget that from the perspective of knowledge production they are indissoluble.

The meeting places for teaching-research in the Ecosystem University are consolidated around three main pillars: the first pillar is the plurality of values, and encompasses not only those of economic utility that are backed

148 Burns differentiates between mechanistic and organic organization, the listed characteristics were developed based on his work on innovation management (Burns & Stalker, 1961).

by the markets; the second, the search for human development and well-being for all; the third, the recognition of centrality and reciprocity.

This approach allows us to analyze and rethink the processes and relationships confined to the disciplines and individual notions, to think and work on a conception of existential well-being and to look at Teaching-Research as the development and promotion of sound coexistence. Thus, Teaching-Research identifies with the mission of the University to place individuals at the center of its full and creative existence, and to develop their potential toward a life filled with meaning in the light of human dignity. It is necessary to combine the rational and sensitive aspects of the person to ensure an integral education that develops the person.

While it is true that the functional structure of teaching may require even a hierarchical order, the potential of this *fabric* lies in *subjectivation*. Starting from knowledge, subjectivity denotes perceptions, arguments and languages of communication with respect to the individual, which are announced by his or her particular interests and desires. From this premise, the student and the teacher, both of whom are engaged in research, will try to question paradigms to abandon the routines that prevent understanding reality in another way and, therefore, will develop critical reasoning that allows them to turn their backs on the purely instrumental and rationalist sense of scientific knowledge. Reading reality is not a simple extrapolation of a normalized present, and studying science needs a hands-on approach.

Research teaching always will consistently take a positive and proactive approach. Paradoxically, the lack of a predetermined direction is its strength. We need to recreate conditions of search and start from the question, not from the answer. We also need to rediscover the deep meaning of experience, of knowledge that goes hand in hand with life; to leave aside all established presuppositions and totalitarian truths, to abandon false truths that fall into the trap of the linear and lead people to talk about imagination, which means a break with education itself.

We derive the motivation (UNICEF & others, 2016) that turns us into active learners not only from intelligence but mostly from the meaning that we find in our lives, and therefore from sensitivity¹⁴⁹. Giving meaning or sig-

149 Pareto brings up concepts such as *social system and balance*, as well as the notions of *residues and derivations* to highlight the importance of emotions and values in social interaction (Pareto).

nificance includes inventing, creating, assuming, knowing how to explain, being capable of defining, understanding, knowing why we do what we do, integrating content and action. In short, the education of which we speak depends directly on our capacity to give meaning to things. Without research training, university professionals will be unable to ask and resolve questions, let alone exercise critical thinking with respect to ideas and give meaning to the world around them and their personal life project.

It is research that differentiates university education from any other, developing intelligence and logical thinking based on comparing knowledge, organizing, explaining, and thinking about it, and not simply learning about it. Therefore, teaching is not limited to transmitting knowledge, but develops the faculty of understanding it and explaining it. University students develop critical thinking and acquire the ability to question other ideas and make judgments about their own ideas.

The key to teaching research is that, by learning to unlearn, one seeks to understand the particular logics with which such teaching produces knowledge. The way in which we produce, research or think about knowledge differs depending on the subject matter. When teaching incorporates the form of investigation of each science, teaching itself becomes a search for and reconstruction of knowledge in itself. Therefore, teaching must incorporate principles, assumptions and motivations based on approaches to oppose prescriptive teaching, and opening itself up to the knowledge of each individual through analyzing assessment and understanding.

The approach conflicts with the established, modern principles of education that are regarded as state of the art in the globalized world and create the illusion that they will guarantee the future. We must change the strategy that seeks to acquire competencies through concrete skills, i.e.: from *know-how or how-to*, to: *how to know? Know why? For what? Know in what conditions?* (E. Ibarra Colado & others, 1993). Failing to do so, will destroy our ability to define the world around us. Our own critical judgment must be the condition and main pillar of education. It must go beyond the curriculum and focus on project relationships¹⁵⁰ and situations that permit the teacher and student to see the world from a different perspective, and start from the

150 The concept of project that emerges from orthodox planning does not coincide with the dimension it has from the eco-systemic viewpoint. In this case, the project is understood as a catalyst for synergies, a meeting place for creativity and freedom of thought, and at the

doubt of science. The greater the freedom of thought, the greater the risks that we take and the greater the maturity with which we must face them. A virtuous circle for the formation of the human *being*.

We must make that leap from what we learn to what we understand, in a process that involves thinking about the knowledge that we have acquired and sharing with the teacher the expertise of how to produce it. We must share practical research work. Scientific knowledge and scientific thinking cannot be learned, but must be understood (Sánchez Parga, 2003) in a progressive manner; the axis of which is research as a process of scientific production. Without teaching research there is no scientific production of knowledge and less awareness of scientific thinking. Therefore, the relationship between Teaching and Research is inseparable.

On the other hand, if we need to understand and explain and then take into account that subjectivity will create multiple points of view for critical thinking, we will observe multiple developments of knowledge, knowing that the development of thought always depends on creative dialogue that turns the intelligence of the first communicator into reflection of the second. We need a kind of wiki system to sustain this dialogue over time. That way, any advances made by students at a time are recorded as a basis for subsequent generations. This will continuously increase the complexity of thought and produce constant *rethinking-improvement* of the research agendas of each field of study that interact with the agendas of the research groups. All this taken together will sustain the University.

It is therefore a question of respecting the indivisible teaching-research relationship and knowing how to combine the corresponding objectivities and subjectivities. To help outline the paths, we could ask the following questions, knowing that the answers obey the specific space-time dimension:

- *How important is the integration of teaching and research management?* The functionality of teaching management presents difficulties with regard to coordinating the dimensions of projects because they are structured in different areas. Research management, on the other hand, tends to integrate the functions of teaching, given that the projects and the actors who execute them are transversal to the functions of teaching.

same time it empowers people to exercise their capacity for action, that is, it makes them agents of change and production of knowledge.

- *How critical is innovation for the functional teaching experience?* When the functional teaching experience sustains the vital structure, we need to evaluate potential disruptions caused by innovation-related changes. For example, if we want to transform the pedagogical experience of the classroom, we need to point out that any innovation that seeks to start from scratch, will threaten the source that sustains such innovation. As could be seen before, change must be gradual (McMillan, 2004) and simple to ensure that it generates as little inertia as possible and, at the same time, closes an action-communication-knowledge cycle that provides feedback to the point of departure.
- *To what extent can actors be multifunctional for projects?* Each project has a specific objective to which actors can contribute. However, some will contribute more than others depending on their relation with the objective or their field of knowledge. This means that they can optimize their energies by contributing to several projects without necessarily having the absolute expertise for the groups that carry them out or for the actual project.
- *How important is the speed of transformation?* If innovations or projects require fast action, then one can take advantage of the subjectivity of research management, as this will favor the rapid resolution of conflicts and the efficient coordination of activities by actors from different teaching functions. The time for transferring knowledge (Handy, 1995), assigning responsibilities and coordinating tasks is relatively short.

An Unstructured Order

The organization of the Research and Innovation Ecosystem maintains multiple relationships of interdependence between *producers*, *consumers* and *decomposers*. The flows and relationships are based on the production of knowledge with non-linear results and multiple purposes. Decomposers must absorb the information from *producers* and *consumers* by identifying the system's potentialities and illuminating mechanisms to manage the tacit-explicit continuum of knowledge production, based on the information it contributes to entropy analysis.

The multiple interactions increase entropy, of which we spoke before. The analysis of entropy delivers the keys to understanding the phenomenon

of an order that is dynamic, multiple and therefore unstructured, in other words, an order that is always in a condition of non-equilibrium.

The organization of the ecosystem is dynamic and variable in time and the *vital* condition for the production of knowledge through research and innovation. The eco-systemic vision and its entropy renders obsolete the way in which the functions of the administration were traditionally understood: planning, organization, direction and control.¹⁵¹

To respond to the dynamics that resembles nature rather than a machine (Burns & Stalker, 1961), this book proposes a shift of focus of the following principles:

- From linear planning to Voluntary Guidelines of communication-action.
- From order-organization to eco-systemic.
- From hierarchical management to heterarchical leadership
- From Control to Management of Knowledge.

Zones of Development and Behavior

When we speak of entropy we refer to uncertainty and the potential to produce novelty; but entropy also relates to the tendency of disorder, *the variable heterarchy and the variable cooperation*.

Figure 27 shows the entropy curve of the Ecosystem, point A is at minimum entropy and the organization of groups in the vicinity is rigid. The interactions and degrees of freedom of the actors and groups are practically zero, which is why their individualized organization depends on who exercises maximum command. This implies that the organizational is above individual interest, reducing the orientation toward *individual behavior* (IB), compensated by strong *corporate behavior* (CB). With respect to the heterarchy variable, there is a high degree of hierarchy, which produces little capacity for innovation and networking compared with cooperation variable. Although the probability p_i is minimal and therefore the Information or expectation of novelty is maximum, the same low probability makes it unlikely that the event will occur, and thus entropy is minimal.

151 Fayol outlines five functions for the administration of industries: planning, organization, direction, control, coordination (Fayol, 2016).

Point *B* also shows minimum entropy levels, there is zero interaction between actors because they are in a highly diffuse structure, individuality is high due to prevalence of behavior centered in the person and not in the organization or *corporate behavior* (CB). In this case the potential for information or novelty is minimal due to the high probability p_i ; despite the highest probability for this to happen, the potential of the group or actors at this point is too low due to their lack of cooperation.

C is another maximum point in the graph. Here we find maximum entropy, it is a transition point of behavior either centered in the corporation (CB) or in the individual (IB). On the one hand, the possibilities of novelty are high as is the capacity of interaction, and, thus also its potential for innovation. However, the transition zone has high consumption of resources based on productivity, which diminishes the efficiency of the groups or actors. *Equity* is the other concept that takes on meaning at this transition point and counterbalances the *efficiency* criterion. If, on the one hand, the maximization of efficiency implies the minimization of costs with the simultaneous maximization of production and the preference for results that reflect growth, on the other hand, *equity* seeks to allocate resources to improve the well-being and quality of life of the community, that is, to minimize internal and external inequalities among groups (Richardson, 1973).

Efficiency and equity are related to entropy. When the value of entropy is too high, the community has more possible states or behavioral trends, i.e., more disorder, but at the same time it increases its capacity to satisfy needs and develop potential.

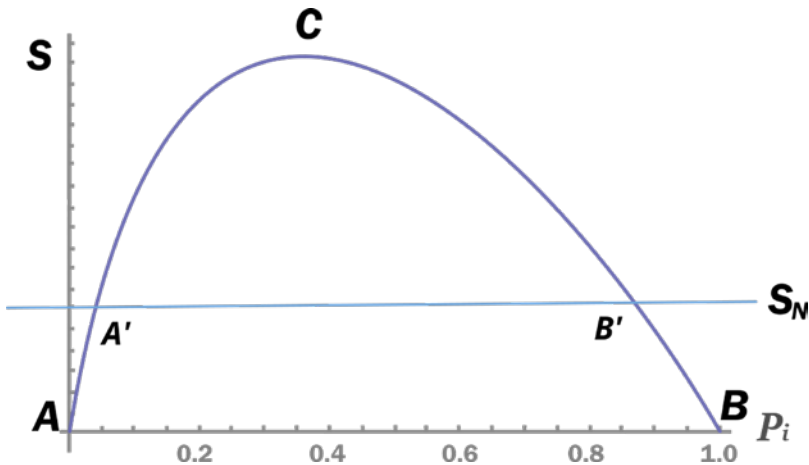
Figure 27 shows how entropy increases between *A* and *C* as the number of interactions. It has a high potential to produce novelty because it is proportional to Information. Structures are de-hierarchized and the tendency toward individuality increases despite a prevalence of strong corporate behavior (CB). From the point of view of efficiency, CB decreases as entropy increases, since the number of connections increases the possibilities of interaction. Yet, this does not mean that all meetings will have a positive outcome. The positive results become more concrete, the need for more connections decreases and the curve stabilizes until reaching a point in *C*.

From point *C* to point *B*, entropy decreases as the number of connections required to produce positive results goes up; certainty about results also translates into a lower potential for novelty. Efficiency increases as one ap-

proaches point *B*. Behavior is becoming more individual (IB) than corporate (CB) and there is an increase in de-hierarchization and the structure is becoming flatter, although more diffuse.

The need for balance between equity and efficiency becomes obvious, since *resilience* emerges as a new concept of from this encounter. With respect to the states of knowledge production, the *resilience* is based on *redundancy*, which implies the relative distribution of entropy. As mentioned above, any evolutionary leap requires heterogeneity; otherwise the system would face collapse. In Figure 27 the S_N line represents the index of relative equity or entropy, and will be lower the higher the number of states. The groups that remain below this level – i.e. have an entropy that is lower than the relative entropy of the system - are highly conditioned by dependency if they are close to point *A* or, due to lack of interaction, have a diffuse organization and a low probability of producing novelty.

Figure 27
Ecosystem entropy



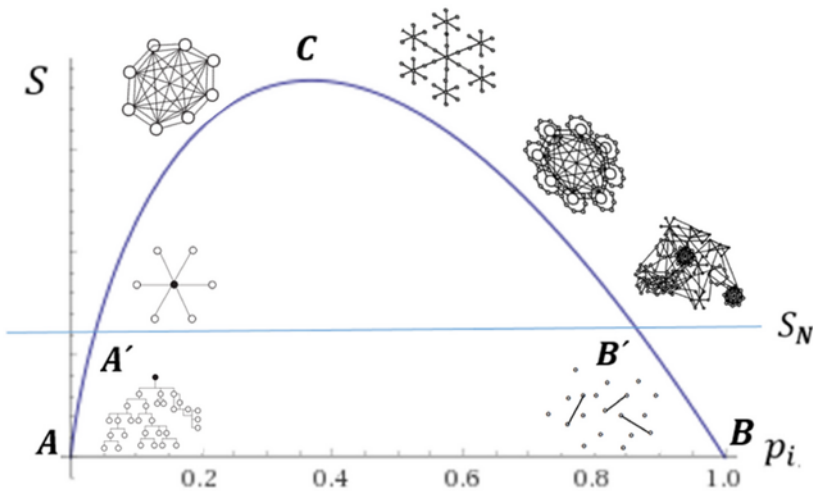
Elaboration: Salgado-Guerrero, J. P.

The crossing of the two graphs produces the points *A'* and *B'*. In this first approach we will examine organizational changes according to the concepts of *entropy*, *efficiency* and *resilience*. It should be noted that this is an

Ecosystem, and that it is therefore necessary to read the graph from the perspective of the constant dynamics to which it is subjected. Moreover, the view from complexity not only establishes antagonisms but also complementarity between concepts (Edgar Morin, 1984).

Depending on the entropy variation of the groups, they will be located along the entropy curve. The organizational structure tends to modify in relation to the increase in entropy. Figure 25 analyzes a classification of classical, hybrid and complex organizational topologies according to Mezza-Garcia (Mezza-Garcia & Maldonado, 2015). Figure 28 shows the change of structures as they advance along the entropy curve. Note the complementary dual trend from point *A* to *B*; as it moves away from the *A*, *corporate behavior* (CB) shrinks while the trend towards individual behavior (IB) goes up. Similarly, as entropy increases, teamwork increases and generates productive relationships between actors.

Figure 28
Entropy curve and organizational topologies

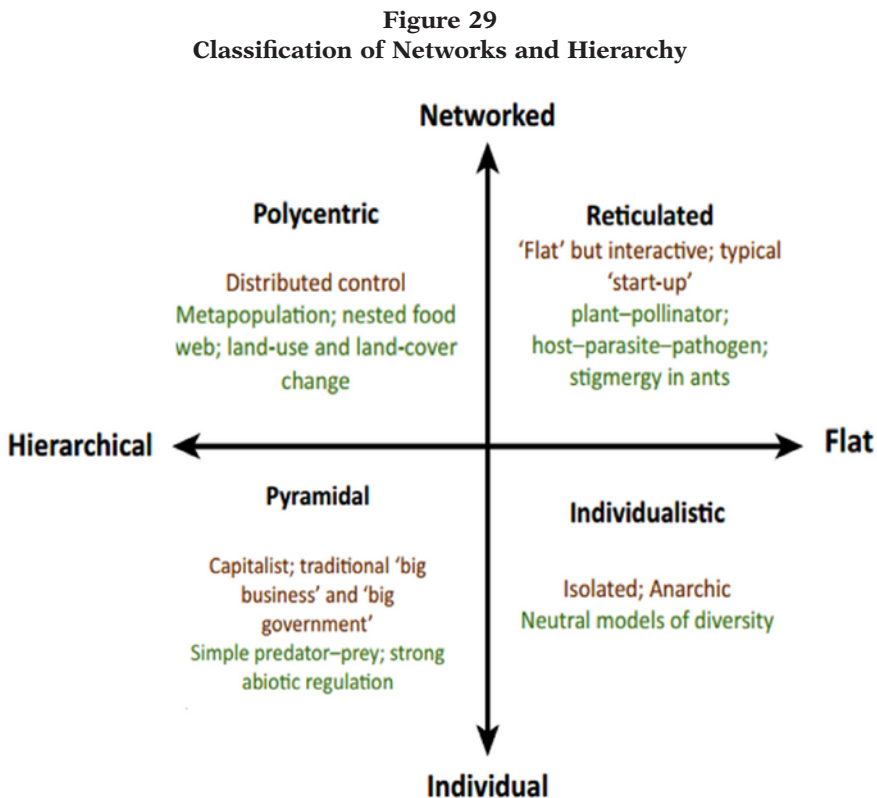


Elaboration: Salgado-Guerrero, J. P.

In order to analyze the behavior of the organization of the Ecosystem and understand its complex nature, we will use the definition of *Heterarchies* as the reconciliation between Networks and Hierarchies as suggested by Cumming (G. S. Cumming, 2016), who proposes a classification into four groups as shown in Figure 29: Reticulated, Polycentric, Individualistic and Pyramidal.

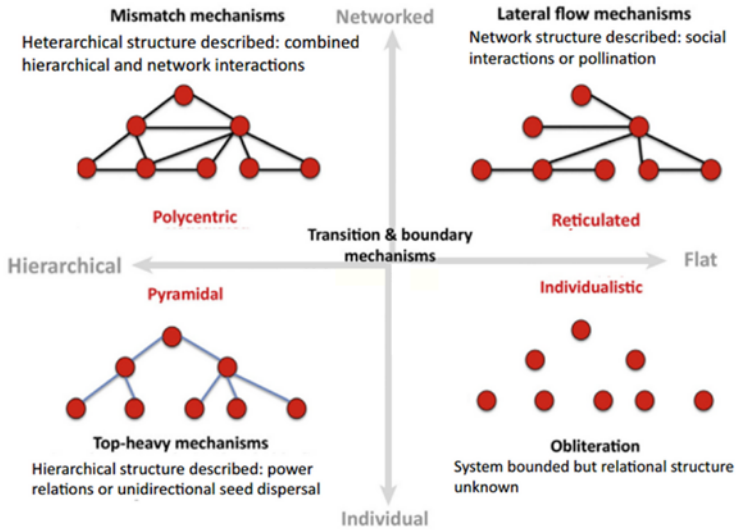
Cumming defines four basic types of heterarchies that can be seen in Figure 29. He assigned a name to each quadrant and below describes an example of social structures and an example of nature.

Figure 30 shows nodes, relationships and levels of interaction between the organizational structures corresponding to the four Cumming quadrants (G. S. Cumming & Peterson, 2017).



Source: Cumming (G. S. Cumming, 2016), prepared: Salgado-Guerrero, J. P.

Figure 30
Networks and Hierarchy by Cumming



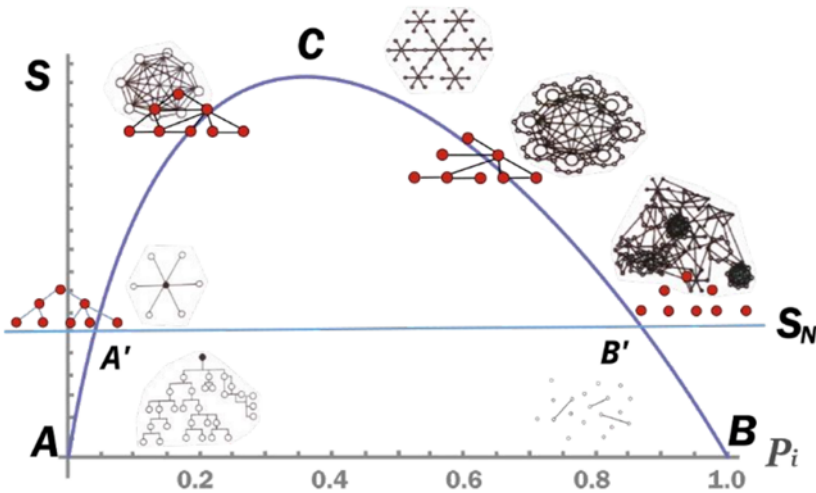
Source: Cumming (G. S. Cumming & Peterson, 2017). Prepared: Salgado-Guerrero, J. P.

Figure 31 shows a distribution of this classification over the entropy curve. A range of possibilities exists between the *reticulated* and *polycentric* structures, which converge close to point *C* of the entropy graph. Note that in this area there is a trade-off between corporate behavior (CB) and individual behavior (IB), which implies that the ecosystem receives and provides at the same time. This area is close to Ostrom's approach to governing the commons (E Ostrom, 2008)

On the other hand, *pyramidal* structures correspond to the coercive hegemonic ones. In *individualistic* structures, competitive relations are greater and, therefore, cooperative connections diminish. Points *A* are *B* extreme, but as one could see above, to maintain the redundancy necessary to ensure resilience the lower limit is line *A*, which is why at points *A'* and *B'*, complex star and network topology structures have been placed as boundaries of the *development cycle* (cf. figure 26). The *fractal* topology and *pseudo-random networks* correspond to paths *A'-C* and *C-B'*, respectively. Pure networks and pure hierarchies only exist in the upper right and lower left parts of this fig-

ure. More complex systems include elements of both hierarchical arrangement and creation of networks.

Figure 31
Organizational topologies and characteristics
of heterarchic networks on the entropy graph



Source: Cumming and Mezza-García (mezza-Garcia, 2013). Prepared: Salgado-Guerrero, J. P.)

With respect to the above-mentioned corporate behavior CB, the compensatory form varies, i.e. the higher IB, the lower CB and vice versa, always between the limits of points *A* and *B*. Beer (Beer et al., 2009) addresses the relationship of three variables in an organization: alignment with organizational efficiency (occurs when the organization as a whole, structure, systems and people, sets out to meet organizational objectives), psychological alignment (is the emotional attachment of people at all levels, particularly leaders, to the purpose, mission and values of the company), and the ability to learn and change (this only occurs when the other two variables exist).

The success of the organization depends on the strength or weakness of these variables, which, in turn, depend on hierarchy, incentives, emotional attachment and commitment. Beer argues that when there is strong efficiency

alignment in the organization, people will want to do things right (following rules and procedures) but will likely not do the right thing when problems arise. In the case of high psychological alignment and lack of efficiency alignment, people will like to do the right things, but are stopped by lack of synergies, structures and common strategies.

Elinor Ostrom (E Ostrom, 2008) analyzes the behavior of the actors who participate in a *Common Pool Resource (CPR)*, and whom she calls *appropriators* and *providers*. In her study she seeks to understand how a group of actors in an independent context can organize and govern themselves to obtain common benefits, even though they are tempted to live at the expense of others or act opportunistically. She argues that the behavior of stakeholders depends on how they know, consider and evaluate the costs and benefits of their actions; and on their perception of the relationship between these actions and the results, since the latter also establish a cost-benefit relationship.

In an Ecosystem the groups of actors share interests with regard to the University (CPR). Individual action alone cannot defend or promote a common interest or resolve (M. Olson, 1965). Ostrom maintains that overall benefits are generally smaller when actors act independently rather than on the basis of a joint strategy. This is why they feel compelled to establish an organizational mechanism. However, this does not necessarily imply creating some kind of organization, but actors will rather organize themselves on the basis of systemic, interdependent, circumstantial behaviors; and on the basis of the frequency with which these can occur, that is, combining and coordinating activities without changing a shared culture (Kreps et al., 1982).

Over time, the actors of the Ecosystem will increase their knowledge through trial and error. Establishing standards about interaction and limits will also depend on the valuation that the actors attach to the actions or strategies themselves and not only with an eye on the consequences (Coleman, 1990).

Even though she refers to the works of many other researchers, Ostrom's approach is particularly important for this book because she proposes approaching the problem of *governing the commons* not only from the classic paradigms of *the Prisoner's Dilemma*,¹⁵² but argues that the problems of

152 (Dawes, 1973) (Luce & Raiffa, 1957) describe it as follows: "Two suspects are arrested and separated, the prosecutor is sure they are guilty of the crime, but does not have the evidence necessary to convict them. He points out to each prisoner that he has a choice: to confess to

managing the commons are characterized by collective action and therefore, by the problem related to *appropriation-provision*. Thus, she establishes two initial assumptions:

- The appropriators in CPR situations face a diversity of appropriation and provision problems whose structures vary from one situation to another, depending on the values of the underlying parameters.
- The appropriators move continuously between different fields and levels of analysis (E Ostrom, 2008). These assumptions are consistent with what this book describes in relation to an Ecosystem. Hence their importance for this analysis.

The congruence between *appropriation-provision* implies the constant search for a balance between:

The adjudication of the flow of appropriate resources to diminish the conflict regarding the assignment of rights and the destruction of resources, which occurs when too many actors appropriate the common resource¹⁵³ or when actors appropriate greater amounts of the resource because they have greater capacity to use it. The actors' dependence on the University (CPR of limited access) to access the resources according to the rules generated in the community, as well as the mechanisms for supervising compliance, turns the University into a structure that differs from the *Prisoner's Dilemma*. However, a decompensation of the balance favoring appropriation will allow actors to

the crime which the police are sure they committed, or not to confess. If neither confesses, then the prosecutor holds that he will bring against them minor false charges, such as petty theft and illegal possession of weapons, and that both will receive a lesser punishment; if both confess, they will be prosecuted, although he would recommend lesser penalties than the more severe sentence; but if one confesses and the other does not, then the confessed will receive lenient treatment for offering evidence to the State, while the latter will be treated with the full force of the law."

Prisoner 1	Prisoner 2	
	Does not confess	Confesses
Does not confess	1 year each	10 years for prisoner 1 year and 3 months for prisoner 2
Confesses	3 months for prisoner 1 and 10 years for prisoner 2	8 years each

153 The term common property resources is used in relation to a limited access resource, i.e. where a group of appropriators are jointly dependent on the system to access the resources.

survive in any factor of production outside the current rules (Townsend & Wilson, 1987).

Another problem with appropriation is temporary access to resources due to heterogeneity and uncertainty, which can put certain actors in privileged positions over others. If actors perceive that access to resources is unfairly distributed, it may affect their willingness to invest in activities to provide to the provision the stock.

The problem of appropriation and its regulation interacts with the organization for supervision and control, which implies a modification of the organizational structures and the normalization of the entire university, and the establishment relations of strategic behavior between the appropriator and the monitoring boards.¹⁵⁴

The effects of the very different ways of assigning responsibility for building, restoring or maintaining the Ecosystem University (Common Pool Resource) that supplies resources. If the actors provide independently, they may feel tempted to deliver less than optimal efforts for the construction and maintenance of the Ecosystem.

The problems of provision not only have to do with the construction of the Commons (CPR), but also with the extraction of resources, i.e. instituting limits to avoid the degradation of the resource. It is essential to establish the relationship between the choice of an individual strategy and the choices made by other stakeholders; in addition, it is also necessary to establish the dependence between the solution of provision problems and the solutions to appropriation problems.

There is no single way to solve these problems. The only agreement is that the models for producing collective action (Oliver, 1980) involve different assumptions and conclusions. For these reasons, this paper proposes the formation of a *Collective Action Council*¹⁵⁵ among the actors to ensure congruence between *appropriation-provision*.

154 Gardner defines this interaction as the play between detection and deterrence (Gardner et al., 1990).

155 The Collective Action Council is made up of representatives of the grassroots groups and is in charge of establishing rules for the use of resources that structurally affect action on common goods, in which the actors have property rights, guaranteeing congruence between appropriation and provision. This dynamic depends on the consensus of the interests

These *Collective Action Councils* establish rules for the use of resources that are approved by consensus. Actors accept that the Council applies and supervises compliance with the rules.

The main concern in establishing the rules is the dynamics and constant change of the organization of the groups and therefore of the University. Therefore, the rules of the game must be flexible and agreed with the actors. Ostrom establishes changing and flexible organizations that contrast with restricted and rigid institutions (E Ostrom, 2008):

- Changes in the rules used to regulate actions at one level occur within a generally “fixed” set of rules at a broader level.
- Changes in the rules at higher levels are generally more difficult and costly to carry out, which increases the stability of mutual expectations between individuals who interact according to specific rules.

Universities are multi-component systems built to provide the best conditions for learning and human development. However, delimiting the space of influence of the university is not simple, since the university cannot be limited to a geographical area. In this paper we limit ourselves to the components that are linked to research management, where the university should comply with two requirements:

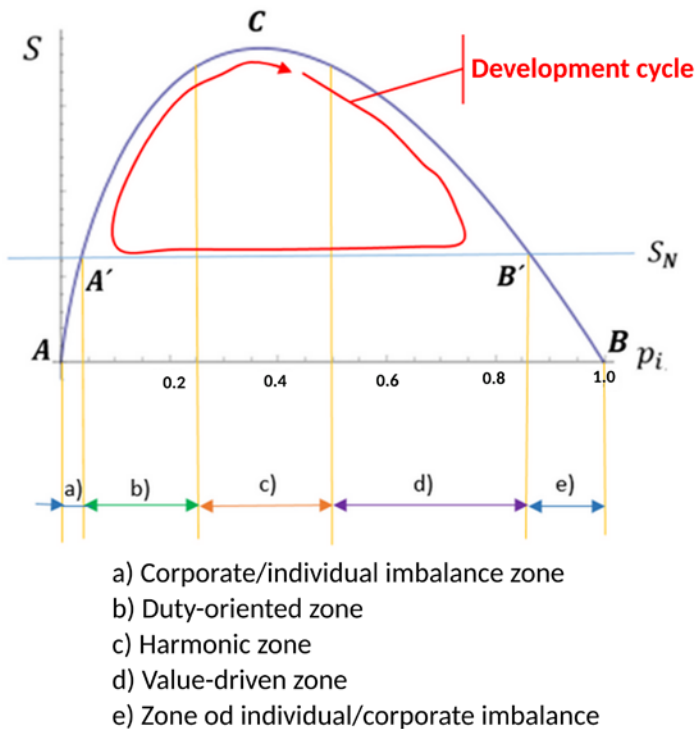
- To efficiently deliver the resources and relationships that allow each of the states to develop effectively;
- To shape the Ecosystem with enough flexibility to adapt to evolutionary changes and external and internal constraints.

The former requires a certain amount of order and organization; as we could see before, this requires low entropy and a certain level of regulation and enforcement. However, the second requires *redundancy and diversity* or entropy to prepare the University to resist adversity. Hence, entropy is tolerable as long as it does not compromise *efficiency and resilience*. The complexity of the Ecosystem University makes it resemble more a biological organism, in which the topology of groups and their evolution depend on multiple interactions.

of the actors in the university. These consensual rules defend the actors, they are flexible since they can be easily modified, but without concessions to accomplishment.

Figure 32 shows the various *behavioral zones* along the entropy graph. Note that as the point of analysis approaches *A*, it moves toward uniformity and as it approaches *B*, it moves toward dispersion. We can also observe the development cycle and conclude that the roaming of a group crosses at least three of the behavioral zones. The central zone denotes a balance between corporate behavior *CB* and individual behavior *IB*. The increase in equity (Theil Index) diminishes S_N and, therefore, widens the central zones; between A' and B' , the extreme points of the curve, the *resilient* capacity of the groups gets compromised and limits its response to the multiple changes imposed by the environment. Below we shall explain the characteristics of the behavioral zones:

Figure 32
Trends of IB and CB and characteristics of behavioral zones



Source: Ostrom, Beer and Cumming. Prepared: Salgado-Guerrero, J. P.

1. **Corporate/Individual Imbalance Zone.** This area is characterized by a strongly hierarchical (pyramidal) topology, which can mean strength in a certain way. For example, orders are quickly obeyed and effectively executed thanks to a high level of control, these systems can execute different tasks simultaneously (Herbert A Simon, 1962). The rigidity of these systems avoids redundancy and therefore increases efficiency (Scheffer & Westley, 2007) Yet, this rigidity impedes *learning capacity* (Pahl-Wostl, 2009) and considerably reduces *resilience* (Scheffer & Westley, 2007), slowing down responses, disconnecting the system from environmental concerns, and exposing it to problems of justice and equity (Duit & Galaz, 2008). Si Although its efficiency may be high, this does not imply robustness. Beer (Beer et al., 2009) explains that psychological alignment in these circumstances is motivated by internal uniqueness and by objectives regulated by rules.

With respect to *appropriation-provision*, hierarchization privileges certain actors. If actors perceive that access to resources is unfairly distributed, they will become unwilling to invest in activities to provide for the Commons. The rigidity will also alter the functioning of control and supervision. In the absence of a monitoring council, the distribution of resources is imposed by a few, which means that only few have appropriation rights but many the obligation to provide.

According to Cumming (G. S. Cumming & Peterson, 2017), such systems can collapse because of:

- *The degradation of their self-organizing systems* due to extreme rigidity, excessive consumption of their resources that alters fragile efficiency (Meadows et al., 1972), collapse due to a sudden change in environmental demands or an impact felt in some part of the production process.
- *Exceeding the complexity threshold*: the complexity of ecosystems generates problems that only greater complexity can solve. Higher complexity constitutes an excessive burden for an organization and might fold it.
- *Elite formation*: common resources are appropriated by a few individuals of higher status. It produces what Ostrom (E Ostrom, 2008) calls *parasitism* by those with power at the top of the pyramid. Resentment, revolution or technological change can cause collapse (Armit et al., 2014).

- *Over-specialization*: specialization in a particular resource prevents adaptability and trans-disciplinarity, the vulnerable effects of unrecoverable costs (Janssen et al., 2003), as well as lack of diversity (Crawford S Holling & Meffe, 1996).
 - *Inability to adapt*: the rigid structure makes it impossible to maintain the integrity of the system, which will be unable to resist or absorb a major impact. Those at the top of the hierarchy will obstruct necessary self-organization to accommodate the imposed changes, and also the ability to learn from the crisis and use it as an opportunity for self-improvement (Folke, 2006).
2. **Duty-driven zone.** The topology in this area belongs to the range of *fractals* and *pseudo-random networks*, which implies polycentric governance, and, according to Ostrom, offers an alternative to pyramidal and reticulated structures (Elinor Ostrom, 2010a). Pyramidal efficiency can be combined with reticulated flexibility; polycentric socio-economic and socio-ecological systems are closer to a bio-organization. Paradoxically, one could also combine the worst of the two types of structures, which would imply elites with excessive power and internal struggles over problems of appropriation, or due to the transition, even little decision-making capacity (Elinor Ostrom, 2010b). Therefore, in this area one must take care of the interactions between the different groups, particularly if they are cooperative or antagonistic, since it determines success. Corporate behavior creates the formal conditions for efficiency and effectiveness; yet, without individual commitment, structures and rules become fragile in the face of continuous change and potential problems. Although individual interest (IB) offers more freedom to grow, in this area the organization as a whole, structure, systems and people, will aim to meet the organizational objectives, which produces an imbalance in favor of organizational efficiency. Beer (Beer et al., 2009) argues that when there is strong efficiency alignment (CB) in the organization, people will want to do things right (following rules and procedures) but do not tend to do the right thing when problems arise. Cumming (G. S. Cumming & Peterson, 2017) argues that these systems can collapse because of:
- *A mismatch of scales*: which produces a dysfunction of the system when the scales of ownership and provision, as well as those of governance and self-governance lose balance (G. Cumming et al., 2006).

- *Over-scaling*: the search for opportunity and the increase in entropy with the respective proliferation of relationships in search of results that are not always achieved, can de-motivate people and create a reaction of overconsumption (G. S. Cumming et al., 2014).
 - *Speculation*: gradual increase of individual interest. If the actors act independently, the total benefits are generally smaller than those achieved by a joint strategy. Actors therefore feel compelled to establish a self-organizing mechanism [377] that reduces regulation. They speculate on potential for growth possibilities, but in the face of threats to expected future growth, the imbalance between investment and results may cause problems (Bems et al., 2013).
3. **Harmonic Zone.** This zone combines polycentric and reticulated governing systems, i.e. topologies ranging from ring, connected, and fractals. One must also note that this one is characterized by a high level of networking and heterarchical governance, the deliberate creation of “flatter” and less hierarchical organizational structures (Guy & Rubin, 2015); hierarchical control may inhibit some forms of self-organization, facilitated by more flexible decision-making that may be minor for the university but important for the groups (May, 1999). Therefore, flexibility and adaptability are expected to be highest in a less pyramidal and more reticulated heterarchy. Excessive connectivity can reduce efficiency and thus diminish entropy.
- Cumming suggests that “hierarchy versus heterarchy” or “hierarchy versus network” are false dichotomies. His study, which condenses the works of some other authors (Bodin & Crona, 2009) (Wilson & Hölldobler, 1988) (Bell & Hindmoor, 2009) suggests vision of a *Network vs. Hierarchy* dichotomy that is non-linear (Herbert A Simon, 1962), but rather proposes a reconciliation, marking a clear distinction between two fundamentally different types of complex systems. Governance problems often arise from the lack of understanding of this double complexity and are sometimes weakened by the emergence of social networks. It is therefore necessary to apply a polycentric type of governance (Elinor Ostrom, 2010a) (Elinor Ostrom, 2010b) in this zone that combines heterarchies and networks in a new way (Brondizio et al., 2009).
- Beer (Beer et al., 2009) argues that a high degree of psychological and organizational alignment will require fostering relationships for an *honest dialogue* about the changes that are taking place in the organization. Without it, people will have difficulties understanding the

necessary changes in organizational culture to improve production. The personal orientation (IB) combined with the organizational orientation (CB) creates a balance between the fulfillment of tasks and the vocation to work by values, which raises the commitment and motivation to belong to a proactive community. The balance between appropriation and provision activates the Collective Action Councils and the establishment of rules regarding reciprocity and efficiency. In Beer's words: "*people will not only do the right things but do them well*" (Beer et al., 2009).

This zone offers a greater possibility for establishing congruence between the *appropriation-provision* (Elinor Ostrom, 2011) mentioned above.

This zone also corresponds to the maximum entropy of the Ecosystem, i.e., greater uncertainty and therefore greater potential to produce novelty. The growing complexity demands strategies of self-organization from its actors. According to Ostrom (Elinor Ostrom, 2010b), Kauffman (S. Kauffman, 1995), Holland and others, this self-organization is based on nodes produced either by communication or by alliances with common and interdependent interests. Its dynamics and interrelations help this complex system to evolve and adapt to the conditions of the environment, which implies transitions between the *zones of development* (Friedmann & others, 2001) and *zones of behavior* (figure 26).

Self-organization helps to identify problems and solve them from the bottom up (Friedmann & others, 2001). This is made possible by positive and negative feedback interactions for self-construction, self-correction, and self-diagnosis. Self-organization seeks order, but not through non-linear interactions and possible configurations that reduce entropy. One of the complex features is the tendency to produce emergent behaviors, which impedes predictability (John H Holland, 2000). Therefore, the whole is more than the sum of its parts (Edgar Morin et al., 1994) (John Henry Holland, 1995). It is precisely because of non-linearity that complex systems are self-organizing and produce patterns without the intervention of external orders and adapt to circumstances.

With a low Theil index line, i.e. high redundancy, this zone shows maximum resilience and the resources of the groups will be used to self-or-

ganize. As there is no single node, failure of one of them will less likely cause the organization to collapse (Estrada, 2012).

The capacity to learn and change is directly related to the openness of leaders and members of the organization to investigation, and to accepting challenges by concrete facts of the context; and also to facilitating transparent internal realities of the organization, thus allowing people to be frank with their superiors.

4. **Value-Driven Zone.** This area is characterized by reticulated structures that vary between fractal and complex network topologies. Commons systems may be seen somewhere between reticulated and polycentric structures (G. S. Cumming, 2016). In business, for example, companies will shift from the networked to a top-down organization as they become bigger and bigger.

The rapid mutations between different structures - both hierarchical and networked - can be explained from the perspective of Holling's anarchical cycles¹⁵⁶. The reticulated dynamics suggests that the diversity and networking of groups are limited by dispersion, which increases as they move away from the center of the curve. That is where we locate the groups that have established successful states of knowledge production. Their specialization reduces interactions and complex networks feel tempted to stop cooperating; individualization increases gradually and the groups threaten to collapse due to fragmentation (G. S. Cumming & Peterson, 2017).

Polycentric governance is still an alternative to reticulated structures (Elinor Ostrom, 2010a). Their success depends on the nature of the interactions between the different groups, particularly when they are cooperative or antagonistic.

Beer (Beer et al., 2009) argues that high psychological alignment with the organization implies joining a tacit - "psychological" - contract with the members of the organization, i.e. meeting their expectations to make them "fall in love with the organization." Combining their inter-

156 According to Holling, ecosystems are subject to a number of dynamics along four phases: one of growth or explosion, another of conservation or consolidation, another of release, catharsis or collapse, and a phase of reorganization or renewal. He describes these stages of the adaptive cycle from the concept of panarchy, i.e. a network of adaptive cycles, each of which is situated in a specific time and space. That way, any cycle can be influenced by cycles situated at higher or lower scales, i.e. by influences from above (top-down) and from below (bottom-up) (Crawford S Holling, 2001).

ests with those of the organization turns its members into stakeholders. This might even lead to a situation where mutual expectations and obligations generate *high value* between the parties. These *shared agreements* (Herrán Gómez et al., 2014) are people's positive assumptions, their aspirations, and what they are capable of doing.

Most organizations expect their members to perform tasks effectively because of the hierarchical and networking characteristics that were addressed under *task-oriented zone*. In contrast, eco-systemic organizations with strategies based on heterarchies that enhance the morphological changes of their structures according to people's development, expect their members to: (i) take initiative, (ii) work in teams, (iii) control themselves, (iv) continuously adapt to change, (v) contribute to the mission and strategy, (vi) act in a way that is consistent with their values, (vii) learn and provide feedback.

Members tend to expect (i) a non-political culture that does the right things, (ii) opportunities their managers what they think, (iii) to participate in the definition of goals, (iv) to have a say in the rules of ownership-provision, (v) delegation of authority, (vi) to be able to choose their work groups, (vii) autonomy to establish their own strategies according to the objectives that correspond to them, (viii) flexibility of structures to be able to adapt to changes.

This tacit contract is not an easy undertaking as members of the organization will have to sacrifice their egos and accept community values. Reticulated and polycentric structures are at risk of collapse because of (G. S. Cumming & Peterson, 2017):

- *Contagion*: refers to a disruption or negative impact that is transmitted via lateral connections. If tacit contractual commitments are broken through to the autonomy of groups, people will ignore the agreed rules when accessing resources. Thus, like the mechanisms for supervising compliance, we have an imbalance that favors appropriation, which will induce actors to survive in any production factor beyond applicable rules (Townsend & Wilson, 1987) (Elinor Ostrom, 2011) and establish relations of competition rather than collaboration.
- *Fragmentation*: loss of group cohesion and the interdependence of connections may produce a collapse due to high competitiveness and individualistic tendencies. Breaking connections and mounting competition for the flow of resource appropriation will fuel

conflicts over the allocation of rights and the ensuing destruction of resources; this occurs when too many actors appropriate the common resource¹⁵⁷ or larger amounts because they have a greater capacity to use it. If there is competition for appropriation and actors provide independently, they may feel encouraged to deliver less than would be ideal for establishing and maintaining the Ecosystem.

5. **Zone of Individual/Corporate Imbalance.** This zone is characterized by a type of topology that works with complex networks that gradually disperse, i.e. due to competition, individualism (in which neither hierarchical nor network interactions are consistent) has broken most interactions between groups. This occurs if we take to the extreme the tendency explained in the previous zone, where value orientation is the strength of the system, but, nevertheless the object that receives such value can cause inconsistency. McCulloch (McCulloch, 1945) studied the variation of individual preferences and identified this inconsistency in the hierarchy, which he explains as follows: someone may prefer *A* to *B*, *B* to *C* and *C* to *A*. This cannot be explained by a theory that assumes a simple hierarchy of values. However, it is consistent with a more complex system structure that follows higher orders but does not permit the construction of a scale of values.

It should be noted that both the pyramidal structure and the diffuse structure are extremely individualistic, i.e. they strongly compromise the spirit of teamwork by imposition or the lack of connection between nodes, actors or individuals acting alone or almost isolated.

Reticular dynamics strengthen groups, pyramids classify people in functions, polycentric dynamics lump actors together, and individualistic dynamics are neutral (Hubbell, 2004). They neither add to nor take away anything from the Ecosystem, but create imbalances since the organization would lack the capacity to recover from an external phenomenon if the majority of actors were leaning toward this zone. Therefore, the dynamics of the Ecosystem is conditioned by the dispersion of the groups and the number of interactions between them.

157 The term *communal tenure resources* is used in relation to resources with limited access, i.e. where a group of appropriators are jointly dependent on the system, to have access to the resources.

Groups can be spared competitive exclusion by forcing an evolutionary leap; reorganizing and forming new communities that transform repulsion between actors resulting from excessive competition, into potentials for the production of new positive interactions, even though this may create new power relations that dominate polycentric systems.

The above requires a trade-off between efficiency and flexibility, with different results for effectiveness [199]. Although self-organization and innovation constitute a potential for problem solving, excessive individualism leads to a lack of consensus or zero-orientation towards challenges. Cumming explains how an individualistic nature complicates the challenge of avoiding collapse by over-exploitation of the commons (Bascompte et al., 2006), and defines two risks for these organizational structures:

- *External disruption*: an external situation destroys or damages the ecosystem (Nur & Burgess, 2008), due to its weak and fragmented culture (Beer et al., 2009).
- *Fatigue*: there is a gap in the *appropriation-provision* relationship because people are tempted to act selfishly and live at the expense of others (E Ostrom, 2008). The lack of consistency in this relationship wears down the common good to the point of devastation through the gradual depletion of key resources, such as diversity or the lack of states of production, which ultimately collapses the system. (Aagaard et al., 2016).

Although the term *heterarchy* has been used in various ways, Cumming manages to interweave the elements of networks and hierarchies as an organizational/structural continuum; relating these concepts in a linear fashion and accepting the network as a flat and not a vertical hierarchy would limit the complexity perspective. The relationships between patterns-processes or structure-functions can be defined more clearly and more closely within the context of the perspectives of the heterarchies.

Although it is clear that this is not the only way to understand the functions and dynamics of an Ecosystem, polycentric governance does not have the last word. None of the structures holds supremacy over others but they are simply necessary to address specific circumstances or time-contexts; hence the importance of resilience as a force for transformation and adaptation with its own response.

Some groups are more capable than others of adapting to new circumstances. The challenge for maintaining sustainability lies in finding mechanisms to enable evolutionary leaps between different topologies and hierarchical structures, but avoiding that groups become static and maladjusted to any external environmental changes.

In her study "*The Governance of the Commons*," Ostrom (E Ostrom, 2008) criticizes Smith (Smith & McCulloch, 1838), saying that he does not take into account that in a changing and complex context the decision between exploiting or sustaining the shared pastures,¹⁵⁸ depends considerably on the *discount rates* the independent owners have. Therefore, if the rate is high, the common good will be abused in a disorganized manner. The second challenge is to find mechanisms to constructively address the conflict (Beer et al., 2009) between the profit motive and the sustainable use of the common good resources against the background of the significant eco-systemic dynamics and complexity. If this decision is based exclusively on the benefit of the actors, it will negatively affect the rate of sustainability and destroy the common good even in the long term.

Zones of Development and Entropy

Given the entropic variation, two conditions occur:

- *A relative lower limit of entropy*, under which the organization becomes rigid or homogenized and *loses its potential and the ability* to reconstruct itself to evolve. The uniformity that this area produces makes the organization too susceptible to changes demanded from the inside or outside and,
- The increasing entropy affects efficiency because of the relationship between the *amount of resources* needed to produce results.

In Figure 33, C represents maximum entropy. There is a high possibility of novelty and interactions and relationships between actors and groups, which also creates a high potential for innovation. However, in the transition zone the consumption of resources rises in accordance with their productivity, which reduces the *efficiency* of the groups or actors. The maximization of efficiency implies the minimization of resources for the simultaneous maximization of production and the preference for results that reflect growth. On

158 This would be the worst scenario in the *Prisoners' Dilemma* game (Luce & Raiffa, 1957).

the other hand, *equity* seeks to allocate resources to improve the well-being and quality of life of the community, that is, to minimize internal and external inequalities among groups (Richardson, 1973).

These two concepts, *efficiency and equity*, are related to *entropy*. When the value of entropy is too high, the community has more possible states or behavioral trends, i.e., more disorder; however, its capacity to meet needs and develop potential also goes up.

If we are dealing with an organization with a focus on Knowledge Management (as we saw before), we need to understand the term *efficiency* from this perspective. Knowledge production is constructivist and based on the flow of information and joint actions among groups and individuals in the Ecosystem. Therefore, *efficiency* could be understood as the rate between connections and shared information and the number of concretions of the cooperating groups.

Figure 33 shows how entropy increases between points A and C as the number of interactions increases. One should bear in mind that its potential is high because it is proportional to Information. As for efficiency, the latter decreases as entropy increases because the number of connections increases, but this does not mean that all the meetings have a positive outcome. As the positive results become more concrete, the need for more connections decreases, and the curve stabilizes until it reaches a point of zero efficiency in C.

From point C to point B, entropy decreases, and efficiency goes up as fewer connections are needed to produce positive results. In other words, the established relationships produce results which makes it unnecessary to explore further possibilities. Hence, the certainty of results also translates into a decreased information potential. Efficiency increases the closer it moves to B.

We have to be aware that this is an ecosystem and that there are no fixed departmental functions. The functions are modified depending on time, following eco-systemic patterns and increasing and decreasing their entropy.¹⁵⁹

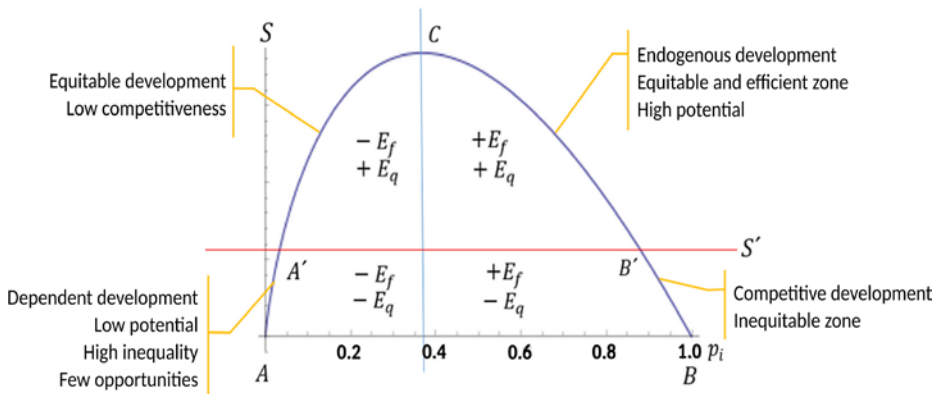
According to Miguel-Velazco [505], the regions of development can be classified as (cf. Figure 27):

159 Decrease of entropy does not imply contradiction with the second law of thermodynamics if it is understood from Candel Rosell's approach. In his review of the concept of Chaos, he states that in the process of evolution the increasing entropy is the result of an *organizational* entropy and a *thermal* entropy. We could assume by analogy and for the purpose of the present work, the *cooperation variable* as *thermal or energetic entropy and the organizational entropy as a variable of heterarchy* (Candel Rosell et al., 1984).

- Regions with low efficiency ($-E_f$): Weaknesses and threats outweigh strengths and opportunities, and the relationship between the positive results of their interactions is inferior to the number of interactions. This implies greater abrasion in the attempt to obtain results, which makes them less competitive and their development dependent.
- Regions with high efficiency ($+E_f$): Strengths and opportunities outweigh weaknesses and threats. The relationships are established according to their results and the attrition to obtain them is lower, and this produces a positive efficiency relationship. Here one can make the most of one's resources and the opportunities for strong connections with the environment, competitiveness goes up and development is endogenous.
- Regions with low equity ($-E_q$): Here inequalities occur through dependence or competition; these regions are inefficient and offer few opportunities.
- Regions with high equity ($+E_q$): These have achieved greater *heterarchy*, and their competitiveness is limited by the interdependence of relations; complementarity between common and individual interests strengthens their cohesion equity.

The entropy graph could then be interpreted as follows:

Figure 33
Entropy - Efficiency – Equity chart



Elaboration: Salgado-Guerrero, J. P.

Groups can be in one of the following development zones:

- **Zone of inequitable development** ($+E_f$, $-E_q$): the strengths and opportunities of the groups surmount weaknesses and threats. Relations are established on the basis of results, and abrasion to obtain them is lower, producing a positive efficiency factor. In this case it is possible to take maximum advantage of the resources but the opportunities that depend on the interactions and relations are weak due to the high competitiveness that ends up polarizing the community. Existing high inequalities caused by the competitiveness, produce high inequity, and opportunities for productive agreements are scarce.
- **Zone of dependent development** ($-E_f$, $-E_q$): here the weaknesses and threats outweigh the strengths and opportunities, i.e. the positive results of interactions are inferior to the number of interactions and connections, which implies greater abrasion in the attempt to obtain results. Therefore, these are not very competitive and their development is dependent. Inequalities caused by dependence produce inequity and offer few opportunities for connections to produce innovations.
- **Equitable development zone** ($-E_f$, $+E_q$): although in this zone the relation between the positive results from their interactions and the number of interactions and connections is negative, the equity resulting from their low hierarchical dependence favors the increase of interactions to produce innovation (heterarchies). Therefore, these zones are dynamic and in constant evolution; their competitiveness is limited either by the interdependence of the relations, the complementarity between the common and individual interests keeps them cohesive and strengthens their equity.
- **Zone of endogenous development** ($+E_f$, $+E_q$): this area has achieved greater heterarchization, and its strengths and opportunities outweigh its weaknesses and threats. The opportunities for strong connections with the environment as well as competitiveness increase, and development is endogenous. This higher competitiveness and the focus on efficiency gradually weakens the balance that results from the interdependence of relationships. In the same way, the complementarity between common and individual interests gradually becomes unbalanced, damaging cohesion and equity as they approach the area of high (in-equitable) competitiveness. However, as long as they remain in the endogenous development zone, they enjoy the positive benefits

of efficiency and equity. Finally, as a preventive measure, it is necessary to manage the resilient capacity to make the evolutionary leap to the equitable zone and start the cycle all over.

From Figure 33 we can deduce the concept of vulnerability of the Ecosystem when the groups are in the zones of *inequitable development* or *dependent development*. These zones occur when the entropy of a group is below the relative entropy S_N , and the ecosystem is highly competitive or dependent subject to the probability that the *state* occurs.

Resilience gets affected by the loss of redundancy because the number of knowledge-producing states is low due to excessive control - in the case of the *dependent development* zone -, and because of the loss of diversity in the case of the *competitive development* zone (Sánchez Parga, 1997).

If the number of states of knowledge production is low (low redundancy), relative entropy increases by reducing the *zones of equitable and endogenous development*.

New Pillars for Ecosystem Organization

People often interpret order as linked to a structure, meaning that organization requires a kind of *skeleton* that sustains the various parts; however, this paper argues:

1. Not to make exclusive value judgments on the different types of structures as their worth may be useful in every space-moment.
2. If they are useful in every space-moment, we must realize that they may change over time.
3. This dynamics of the structure implies that such constant change will require resilience.
4. Dynamic structures are useful for research and innovation groups. The macro-structure of the Ecosystem University is the result of the above-mentioned fabric; otherwise there would be a risk of weakening the institutionality.
5. Due to self-organization, structure and order can exist even in chaos (Fernández et al., 2014). Obviously, this requires non-linear patterns, and it may not be a matter of ordered-order, but one of organized-order.

On the other hand, when we talk about structures, we often think that these range from flat to pyramidal, i.e. from networking to hierarchical. Cumming overcomes this paradigm (G. S. Cumming, 2016) and interweaves the elements of networks and hierarchies as an organizational/structural continuum. Relating these concepts in a linear way, that is, assuming the network as a flat hierarchy and opposed to the vertical hierarchy, would limit the perspective on complexity. The relationships between *patterns-processes* or *structure-functions* can be defined more clearly and more in line with the context from the perspectives of the *heterarchies*.

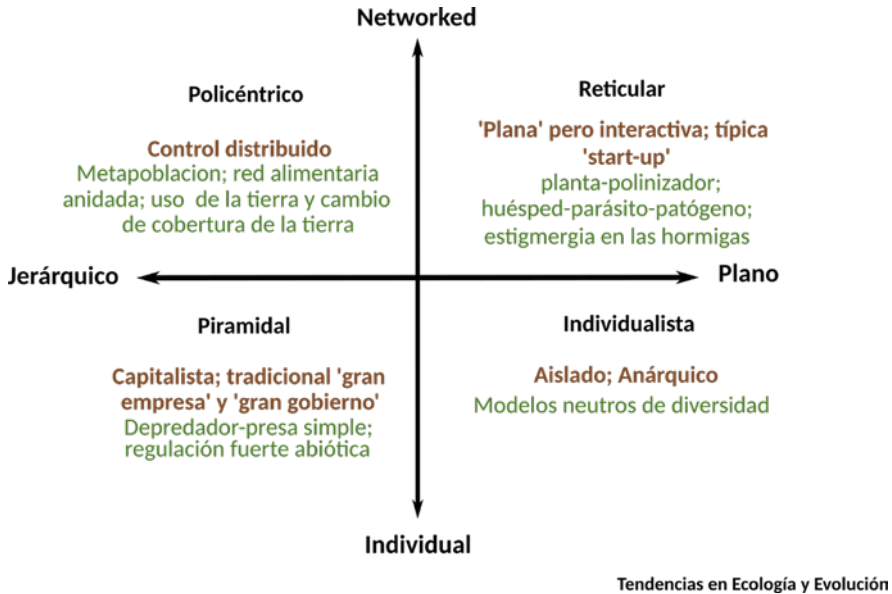
Cumming suggests that “hierarchy versus heterarchy” or “hierarchy versus network” are false dichotomies. His study, which condenses the works of some other authors (Bodin & Crona, 2009) (Bell & Hindmoor, 2009) (Wilson & Hölldobler, 1988) suggests a vision of a *Network vs. Hierarchy* dichotomy that is non-linear (Biomimicry Guild, 2009), but rather proposes a reconciliation, marking a clear distinction between two fundamentally different types of complex systems. Governance problems often arise from a lack of understanding of this double complexity and are sometimes weakened by the emergence of networks, e.g. social media. It is therefore necessary to apply a polycentric type of governance from, 2010b) in this zone, which combines heterarchies and networks in a new way (Brondizio et al., 2009).

This is not the only way to understand the functions and dynamics of an Ecosystem. Polycentric governance does not have the last word, just as none of the structures has supremacy over another. They are simply necessary when specific time-space circumstances arise and underline the importance of resilience as a self-reacting force of transformation and adaptation.

To analyze the behavior of the organization of the Ecosystem and understand its complexity, we will use Cumming’s definition of *Heterarchies* as the reconciliation between Networks and Hierarchies (G. S. Cumming, 2016); he proposes a classification into four groups according to their tendency as we can see in Figure 34: *Reticulated, Polycentric, Individualistic and Pyramidal*¹⁶⁰.

160 Cumming manages to interweave the elements of networks and hierarchies as an organizational/structural continuum. Relating these concepts in a linear manner, assuming the network as a flat hierarchy and opposite to the vertical hierarchy, would limit the perspective on complexity. The relationships between patterns-processes or structure-functions can be defined more clearly and more closely with the context from the perspective of heterar-

Figure 34
Classification of networks according to Cumming



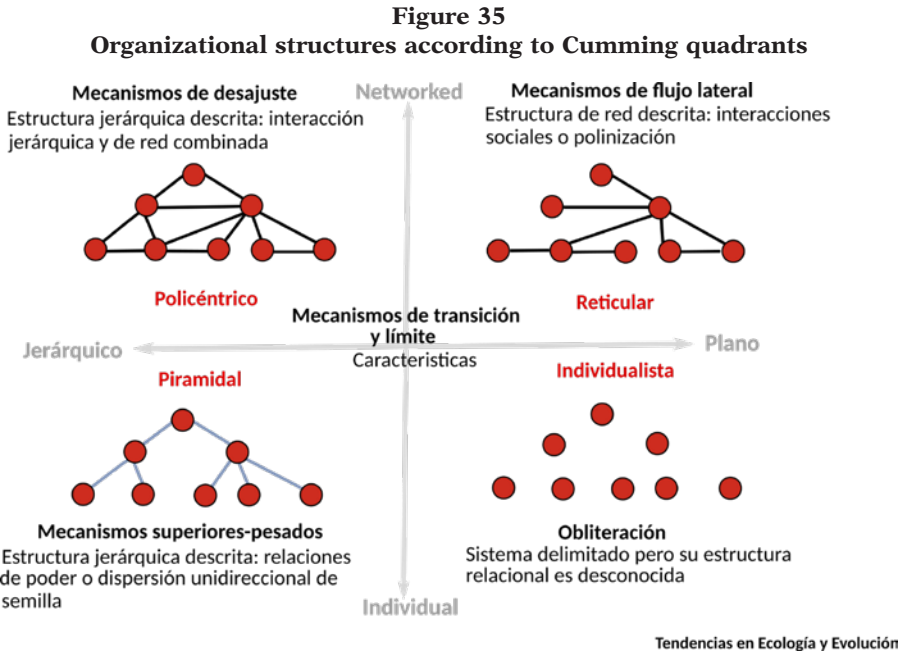
Source: Cumming (G. S. Cumming, 2016). Prepared: Salgado-Guerreo, J. P.)

Cumming describes four basic types of heterarchies that can be seen in Figure 34. The author has assigned a name to each quadrant, and below describes an example of social structures and an example of nature.

Figure 30 shows nodes, relationships and levels of interaction between the organizational structures corresponding to Cumming's four quadrants (G. S. Cumming & Peterson, 2017).

Ecosystem organizations that base their strategies on heterarchies encourage morphological changes in their structures according to people's development, and the members of the organization (Beer et al., 2009) are expected to: (i) take initiative, (ii) work in teams, (iii) set up their own rules, (iv) continuously adapt to change, (v) contribute to the mission and strategy, (vi) behave in a way that is consistent with their values, (vii) study and provide feedback.

chies (G. S. Cumming, 2016). This term will be more appropriately define as "an unstructured order" later on.



Source: Cumming (G. S. Cumming & Peterson, 2017). Prepared: Salgado-Guerreo, J. P.)

Members, in general, expect from the organization: (i) a non-political culture that does the right things, (ii) opportunities to tell their managers the truth, (iii) to participate in the definition of goals, (iv) to have a say in the rules of ownership-provision, (v) delegation of authority, (vi) to be able to choose their work groups, (vii) autonomy to establish their own strategies according to the objectives that correspond to them, (viii) flexibility of structures to be able to adapt to changes.

Facing the complexity of the University from the Ecosystemic perspective and its constant dynamics requires a framework of action different from that of control and focus on efficiency. If we tend towards heterarchies, independence and self-organization, redundancy and diversity, obviously efficiency is affected and will also be subject to such dynamics. As a first step, we shall have to take into account the criteria proposed by Holling in order to understand the complexity of economic, ecological and social systems (Crawford S Holling, 2001):

- Be “as simple as possible but no simpler” than what is required for communication and understanding.
- Be dynamic and prescriptive, not static and descriptive. Monitoring the present and the past is static unless it is connected to policies, actions, and consideration of different futures.
- Accept uncertainty and unpredictability. Surprise and structural change are inevitable in social and natural systems.

On the other hand, the morphological dynamics of structures imply constant change, which is only possible if the organization has a capacity for resilience. Moreover, according to Broekstra (Broekstra, 1998), the synergies that create self-organization depend on the communication among its members.

The organization of the ecosystem is dynamic and variable over time. This is the *vital* condition for the production of knowledge through research and innovation. The ecosystemic vision and inherent entropy supersedes the way in which the functions of the administration were traditionally understood: planning, organization, direction and control¹⁶¹.

In order to respond to a dynamics that resembles more that of nature than that of a machine (Burns & Stalker, 1961), this book proposes the following reorientation of these principles:

- From linear planning to the Voluntary Guidelines of communication-action.
- From order-organization to the ecosystem.
- From hierarchical management to heterarchical leadership
- From Control to Knowledge Management.

From Linear Planning to Voluntary Guidelines

The Ecosystem University faces constant change in policies, programs, budgets, and procedures. It requires planning as a method of governance and, at the same time, as a ductile, flexible and effective tool, as university research emerges from within based on premises of informality and supported in original meeting places.

161 Fayol defines five functions for the administration of industries: planning, organization, direction, control, coordination (Fayol, 2016).

This planning must not be limited to responding to the demands of officials and rating agencies, but should aim to strengthen the University's identity.

This is why it cannot be based on the orthodoxy of design since it runs the risk of creating an illusion of formal accuracy and the prescriptive method. Such planning only draws the university on paper but is unable to approach it through its based on its diffuse, variable and complex nature, and thus, only projects its non-existence.

The vision of an Ecosystem allows us to understand flexible planning, far from reason, conditioned by objective criteria, but such planning rather combines uncertainty and unpredictability of the potential of human action.

The ultimate objective of planning no longer involves quantitative goals, but rather focuses on the directionality of the development process towards the objectives of the common good (Trueba et al., 1995).

We are talking of planning that takes into account the knowledge produced within and that connects it to public action (Friedmann & others, 2001) through Communication-Action.¹⁶² The dynamics in time of human action implies a continuous process of reflection about the action in order to project the basis of the knowledge generated by the community, thus breaking the linear Euclidean logic (Cazorla et al., 2013).

Rigid planning would eventually limit the capacity of groups to produce novelty and therefore knowledge. If we add the fact that groups use organizational structures that vary according to their interaction, then it becomes virtually impossible to anticipate their maturity and dynamics.

The only way to project the current reality without generating a gap between theory and practice is to base planning precisely on the leap from the tacit to the explicit of the University's knowledge; this happens through communication-action with the environment.

On the other hand, continuous improvement and evaluation are perceived from the communication of results and social validation of knowledge that, in turn, produce an internal leap of explicit-tacit knowledge in the university.

162 Herrán, J. Analyzes Communication-action from the perspective of communication for the development, adding concepts to his model that originate in the Andean epistemology, a result from his experience with indigenous communities (Herrán Gómez, 2015).

From Structured Order to Ecosystem Organization

In the Ecosystem University, the greater the hierarchy, departmentalization or delimitation of functions, the greater the infertility of knowledge production and innovation. University organization faces the challenge of imprinting transformation and accompaniment and not submission on decisions, roles or regulations, but rather the task of influencing the community to make changes on the basis of mutual purposes by creating meaning. This organization establishes relationships in the *meeting places*, brings together groups and people with potential common interests and creates environmental factors and interrelations that favor innovative results to produce new organizations with *vulnerable sustainability*.¹⁶³

The conception of the world goes beyond the need to solve a certain number of problems. The organization cannot focus on a myriad of processes that provide solutions to problems that are a consequence of the action of society itself. UN objectives (United Nations, n. d.) for example, are real and global problems that demand a solution, such as fighting poverty, but the global focus is on how to solve them by diverting attention from “the machine that produces those problems in the first place.” The organization must consider the nature of Ecosystems to conceive of itself as an organization that does not make problems worse that threaten the very ecosystem. However, we must not forget that an open ecosystem absorbs energy and delivers products to its environment, i.e. *vulnerable sustainability*.

The organization that this book proposes is based on the potentialities of the ecosystem and the capacity to self-organize in order to produce generational leaps in evolutionary terms. Although complex, this can be achieved by combining collective and individual interests. The organization is based not so much on *communication-action planning* but on the capacity of the Ecosystem to *digest* the information that its actions provide, and to establish

¹⁶³ Sustainability is often linked to efficiency and equity. However in organizations such as Startups, the search for opportunities significantly increases the risk and involves a greater expenditure of resources and therefore lower efficiency. Yet, even with lower efficiency, the possibility for innovation will be greater, even more since a situation of risk may reduce efficiency in global terms of the Startup. Nevertheless, the search for innovation in risk situations always involves maximum efficiency. Hence, while it needs to aim for sustainability, a Startup must always bear in mind its sustainability is vulnerable, but that the context of this type of vulnerability is positive for innovation.

relationships with the production of organizational knowledge, identifying potentialities that are understood in terms of the theory of information as expectation or novelty.

From Hierarchical Direction to Dynamic Heterarchical Leadership

The way in which we produce, conceive and research our own knowledge, the definition of the theoretical objective, the internal epistemological rupture, awakens the questioning of the situations and challenges that arise in the University.

The importance of participatory work, the redimensioning of the University, shared values, leadership based on knowledge, etc., the common task conceived and executed as a whole that is greater than each of the parts, is the *direction* of the Scientific, Academic, Educational Community.

The *policy makers* must guarantee the *direction* by seeing it in a double interaction: as the *sense and the instrumental reason* of the University response to the territory (not only in a geographical sense but also regarding influence) and also as combining the interests of *organizations (therefore, of community) with the interests of individual or personal development*.

This is the only way of leading when it comes to promote innovation. It is a process of influence referred to the management of change; it means mobilizing others not to solve problems they are used to solve, but problems that have not been successfully addressed before. In other words, change requires proper leadership not just guidance.

The *direction* in an Ecosystem takes the *sense* (direction and *raison d'être*) that the evolution of the system adopts. The decision-making and integration roles are not very effective because of the complexity of the system. In the *direction* of an ecosystem, *directive positions* have little weight as *leaderships* acquires greater significance and also its relationships with respect to innovation and innovative culture. People tend to understand leadership from the perspective of organizational culture, where leaders remain “entrenched” in their offices, and use official channels to communicate in an almost always unidirectional way. Obviously, this type of leadership is rather detrimental for complex systems and will eventually be harmful because, at best, it will create an absolutely dependent group.

A leadership that imprints direction and meaning is capable of fostering dialogue based on the values of the Ecosystem; capable of creating

a shared *internalized* vision with a view to creating *conceptual and systemic knowledge*, combining, as has been said, organizational interests with individual interests. In other words, it is not a question of guiding but rather of leading to encourage innovation and creativity.

The sense and *raison d'être* of the organization are validated through leaderships that contribute to constructing the Ecosystem's identity. Its identity helps the Ecosystem to shield itself against external risks. In the ecosystem view, the relationships between organizational knowledge and the phenomenological framework build an *autopoietic*¹⁶⁴ system of ideas and concepts achieved through communication/action (Herrán Gómez, 2015). Society builds the very society.

We are talking about understanding the dynamics of the organizational structures of groups, necessary for each phase of knowledge production. These structures have an intimate relationship with corporate behavior (CB) as well as with the tacit-explicit continuum of knowledge production, as we will see later on.

From Control to Knowledge Management

Perhaps this is the “pillar of administration” that experiences the greatest transformation from the logic of an Ecosystem, since, traditionally, it is based on the *identification of standards*. In an ecosystem, standards *immobilize and hierarchize, producing segregation and inequity and suffocating the capacity to innovate*. So we are starting from a clean slate. Thinking of the *organization as a conversation* (Broekstra, 1998) will create the possibility of *dialogue, shared responsibilities and the provision and appropriation of the ecosystem*; more than an intent to control, we are facing a paradigm of a *knowledge-based organization* that combines *values, visions, concepts and ecosystem knowledge*.¹⁶⁵

164 *Poiesis* is a Greek term that comes from the verb *do* (ποιέω) but means ‘creation’ or ‘production’. For Aristotle: *productive action* (*poiesis*) focuses on results and *practical action* (*praxis*) focuses on means (Aristotle et al., 1970). Plato defines the term *poiesis* as “the cause that converts anything we consider not to be into being”. Cerrit Broekstra, uses the term in his work “*Organization as Conversation*” (Broekstra, 1998), which is of singular interest in this work to define the epistemological dimension. Also, review in (Maturana & Varela, 1980).

165 The first three terms are taken from Broekstra and coincide with the first three phases of Internalization, Socialization and Externalization of Nonaka-Takeuchi's approach. Yet, the last phase of the Knowledge Creation Spiral is of vital importance for the Ecosystem Organization and is therefore included (Ikujiro Nonaka & Takeuchi, 1995).

Michael Polanyi (M. Polanyi, 2009) describes the differences between tacit and explicit knowledge in the simple phrase that “*we know more than we can say*”. In Japanese culture, Nonaka and Takeuchi (Ikujiro Nonaka & Takeuchi, 1995) identify the notion of the explicit and tacit, and quantify the value of tacit knowledge regarding the capacity of innovation and creativity. Therefore, the production of a university is based on the continuous relationship between tacit and explicit knowledge. This correlation is achieved through processes of communication/action with the environment and far from control. What remains for the administration is to monitor and stimulate the development of people, their groups, and to look after agreements and shared responsibilities.

Bratianu (Bratianu, 2011) establishes an analogy between organizational knowledge and energy, where the exchanges, acquisitions and external flows of knowledge with the environment are constant; thus:

- An elaborated semantic construction inside the University allows us to partially understand the fields of knowledge in the groups and the knowledge codified in the organizational culture, and to use the information of the states of knowledge production, as well as the products and results of those states (Davenport & Prusak, 1998),
- Yet, the University itself must also maintain a *dynamic balance* (which does not imply order) with its context, so it can respond to changes and also assimilate the knowledge it receives from the environment.

In other words, the knowledge of the University depends on the flow of knowledge from society to its interior and the creation of relevant knowledge and the flows of shared knowledge with the outside.

According to Nonaka-Takeuchi, knowledge is created at the individual level and then amplified and structured until it is systematized into a culture. Then the cycle recurs spiral-shaped, always increasing the level of knowledge. Schiuma (Schiuma, 2009) argues that every organization can be analyzed as a system made up of knowledge elements that are somehow interdependent.

In his book “*Developing a Knowledge Strategy*”, Michael H. Zack (Zack, 1999) talks about the gap between the company and the demands of the market, defined by what the company must and can do, or what the company must know and what it actually knows, keeping the distance between the company and the University. This concept suggests that an organization can-

not be separated from its context and lacks interaction and interdependence with its environment. That is, the absence of knowledge-energy flows would produce what in the university world is called endogamy. From the ecosystem point of view, this would be harmful, since we would be talking about the university of becoming a closed system by preventing the entry of energy and making it as vulnerable as glass - hard but also fragile. To guarantee the sustainability of an Ecosystem, we must bear in mind that it is an open and dissipative system where the exchanges of energy resulting from its dynamics, also create it. Knowledge Management strategies act in two ways: while they aim to close the gap with society by seeking to produce relevant and transformative knowledge, they also enhance the dynamics of the tacit-explicit continuum within to ensure the spiral of organizational knowledge and personal development of research groups and individuals in Academia.

Knowledge Management in the organization experiences multiple evolutionary transformations: (i) the transformation of knowledge in the spiral of the tacit-explicit continuum, (ii) those that depend on combining individual and corporate interests, which in turn conditions the behavior of the actors, which is also dynamic, and (iii) the dynamic and heterarchic metamorphosis of the structural topology of the groups.

According to Broekstra (Broekstra, 1998), these transformation processes are effective as long as they meet the following conditions:

- *Understand the context* (transformation, renewal, creation, shared ideals, energy exchange)
- *Open systems with authentic values* (dialogue, reason for existence and what it represents, inspiration, psychic energy, critical thinking)
- *Values-based vision* (values and assessments that promote identities; the center of mass of a ship that guarantees its relative stability and buoyancy).
- *Conceptual knowledge* (codes, agreements, systemic flows, concepts, consistency, strategies, non-linearity)
- *Project orientation* (innovation, networking, new roles, new relationships, shared responsibilities, willingness to lose something in order to gain even more collectively, new social patterns, new organizational capabilities).
- *Closing cycles* (when we make new experiences, become aware of new things, mobilize energy, action and contact, it is important to close that cycle so that we can move forward).