Juan Pablo Salgado-Guerrero

An Ecosystem Called University

Universidad Politécnica Salesiana

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ABYA YALA
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The research from which this book derives, won the best dissertation award in 2017 at the Università degli Studi di Ferrara in Italy and its publication has been recommended by the Instituto Universitario di Studi Supeiori (IUSS Ferrara) and the Dipartimento di Economía & Management from the same university.

In an Andean spiral I'm wrapped,
rejecting traditional ways of looking at the future,
detaching myself from a projected present.
Because the tenderness and courage of Rodrigo and Eliana precede me in the future,
because Mariangela is the future of my past and the past of my future,
because Martina, Francisco and Lucia are my eternal present,
because Bernardo, Xavier, Mariuxi and Maria Gracia inhabit my interior.
To you who have permeated me with a love that does not tire or grow weary,
to you who endure my desire to create in all my indisciplines.

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Note to the reader

The question of what the university is requires various answers, but almost always with visions from what the university *should be* rather than from what it is. It is fundamental to turn to the experience and activities of the basic communities that *make up* the university on a daily basis, take into account people's efficiency and courage at a personal and community level, as well as their determination and attitude to serve superior needs and best possible coexistence.

Far from seeking the ultimate truth, this book interweaves its suggestions with the requirements the university identifies day after day, thus helping to reach genuine liberty that truth confers to anyone who looks for it.

The structure of the book follows three aspects: the living organization of the university illuminated by nature; the search for answers to the meaning of the university understood as direction and raison d'être; and reflection based on action that implies a spiral movement in which practice establishes a new synthesis that promotes a qualitative change in what is understood. As you read through the book, you will notice that certain ideas, concepts and definitions are repeated literally or paraphrased. The idea is to give you the freedom to start at any page. The Epilogue and the Inconclusions are the only exceptions as these will make sense only once you have absorbed most of the book. These lines are meant to encourage you to find more than what you imagined and also to challenge you more than you thought.

Consistent with this approach, you can read the book in multiple ways and choose your strategy to decode it. A *glossary of terms* briefly describes the key concepts and allows you to navigate through the pages in a rhizome fashion and in a multidimensional rather than linear order.

Although the book imposes a certain order, every new concept requires a recursive connection with other topics listed in the index. Guided by your intuition and interest, you, the reader, can build your own spiral that will allow you to return to the starting point or any other point, but with a *hologrammatic* vision, enriched with new criteria, points of view and questions, in a continuous dialogue with the text and with yourself.

The text evokes *dialogue* as a method shared with writing that is nourished by diverse opinions and, therefore, offers you the option to make comments in the margins and become a co-author. Everything is legitimate and admissible except submitting yourself to the yoke of moral rigidity that inhibits freedom. That way, the reflective cycles permit you to change your route as you please, living in the present and writing history in the very moment of living it.

We only learn what we do together as an act and fundamental process of *social coexistence*. That way we will manage to grow as people while modestly transforming the local space, reaching those around us in expansive waves in search of possible forms of fulfillment, creativity and beauty.

The book does not support a utopian and unique university, but rather calls for the emergence of many universities that abandon the sterile concept of a "unique thought" and never reach their full potential, because they are always changing.

As chance would have it, this book is published in the midst of a pandemic, a time when enforced quarantine brutally clashes with the forms of economic development and people's health. This highlights one of the proposals of this book: the urgent need to conceive *new forms of social life* that not only harmonize these aspects, but also narrow the gaps of inequality. At the time of an authentic liberation towards truth and justice, the university needs to provide, maintain, and strengthen comprehensive education.

This pandemic shows how useless university campuses are when they are closed and isolated spaces, like ivory towers guarded by the gatekeepers of knowledge. Now, more than ever, the university needs to open up to society. The book encourages the university to discover its capacity to provide *meeting places* that can recreate knowledge, apply it, and discover with astonishment that university is to be found in people's knowledge and knowhow. *University curricula* must integrate intuition and wisdom, values of humanity that are essential for a university.

The ideas and concepts presented in this book are based on practical experience enriched by reflection, since the creation of synergies that transform the same action into a spiral-virtuous cycle are stimulated by community action. As a reader, you have in your hands an unfinished book that requests your input from new spiral cycles and turns all of us into collective authors. Nourished by restlessness and social dynamics, this book is an invitation to learn together, to reflect and debate, and continue to experiment with new ways of doing and learning things. University, this is your moment: knowledge is well worth a matriculation!

Preface

P. Javier Herrán Gómez

This book is dedicated to the institution of university as a protagonist of change, an issue that has inspired a debate since the beginning of the institution of university itself. Yet today, the questions have changed: does the university retain its capacity to give meaning to its environment, or is the university now subordinated to instrumental reason (professionalization)?

From the very beginning, the author takes a clear stance: for him the university is in a constant conflict between critical sense and instrumental reason. This relationship is no longer linear, as it now acts in the shape of forces that come and go, not negating but needing each other, and producing a "spiral movement", that uses the before and lives the present with new elements that it takes from the environment. That movement not only produces knowledge but also transforms society and seeks meaning in this very transformation.

The book allows us to understand the university as a setting of the indivisible relationship between organization and system, where the whole is more than the sum of its parts, and the product is knowledge as an end, a means and a foundation for the development of the person (critical sense) and the response to the environment (instrumental reason).

The book gradually builds the vision of the *ecosystem university* as producing novelty, where uncertainty is the only certainty. A new element shatters the certainties, which are neither denied nor consolidated. It is an entropy of knowledge that the university produces, and leaving space for interdisciplinary dialogue that nurtures the novelty of the unstructured order.

The author aims to share his vision of the university that produces society and is also a product of it. The book focuses on the ecosystem university, which undergoes constant growth and transforms its environment, aiming at the construction of responsible citizens and the free individual; a spiral of knowledge without control of causality.

The reader encounters a text about a university model that is compatible with life, and how this uncharted path winds from a controlled and organized one to a utopian, ecosystemic, natural and spontaneous product of life. In this undertaking, the ecosystem university appears as a "common house", where life takes place in something like a "commune".[1]

The university of today revolves, for the most part, around a centralized scheme of efficacy and efficiency. As a consequence, the complexity and uncertainty of reality is subordinated to the paradigm of control. The Ecosystem University that the author envisions, builds on life and the chaos from which it emerges, it is a sphere of communal management for the production of knowledge. This university is compatible with life because it is *ecosystemic* and the responsibility of everyone; it evolves as a lifelong project of human individuals as citizens, all of whom are different; it understands the environment through growing with it.

This book will challenge its readers not only because of its theoretical but also its hands-on approach at the Universidad Politécnica Salesiana. Life finds its path in each paragraph that we read, and the book lets us discover the social values of the university community.

Let me end my contribution with a passage taken from this book: "We must all stay committed to a revitalized university in a society that battles with old pains and new hopes. May creativity without discipline live in us forever!"

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

Introduction

Even today one could say that the topic of nature and its dignity is relatively new. As Kant notes in *Morality*, an anthropocentric sense still predominates in the activity of man as the sole bearer of conscience and intelligence. We often forget that we are part of a larger whole, our short existence seems to ignore that the world is a living *Gaia progressivism* (Lovelock, 1983) that organizes and regulates itself to facilitate the continuation of life, a life that forges its way among living beings from generation to generation, even if our perspective makes us believe that it belongs to us.

To think that the earth is but a moment in the evolution of the universe, that life is but a moment in the evolution of the earth and that our life is but a moment in the evolution of life, opens our minds to a new perspective and instills in us respect for what precedes us and has taken millions of years to organize a biosphere, a suitable habitat for life, the result of synergies between multiple living organisms. At the same time this perspective instills in us the responsibility that comes from understanding that we humans have a conscience, feel and love.

The oneness of human beings with life, the same life that animates the planet, makes us participants of its very dignity, and therefore makes us reject the logics of exploitation, depredation and control that have marked the development of our civilization, which denies the intrinsic value of the dignity of the planet, which is our dignity, through the accumulation of material goods.

To understand that the earth has dignity and that this dignity corresponds to ours is one of the central messages in Pope Francis' encyclical *Laudato Si': On Care for Our Common Home*, beyond "sustainable development"[2], which obeys the maximization of the accumulation of wealth. It is a matter of "a way of life" which, in the face of the sustainability of the planet - our common resource - motivates us to interact with Earth in a kind of synergy, in

2 Which originates in an economy of politics rather than a policy of economics.

which we appropriate and provide, and where our *we-ness*[3] constitutes the supreme value.

We want to move toward a culture that recognizes and encourages "otherness" as the beginning of community commitment, which follows the individual. This process of *we-ness* dismisses - without the need for laws and regulations - corruptive immorality and cowardly indetermination, and exalts the human potential that promotes, unifies and liberates the integral development of a person in a community.

One cannot speak of *we-ness* as long as human beings do not communicate with the logic with which nature works. That is to say, it is impossible to try to take care of the common home from outside; it is as if we sought to control the way in which nature works.

Only by understanding how nature organizes itself and generates synergies in the form of biocenosis that sustains life, will we be able to share the dignity that makes us one with nature. Paradoxically, the forms of organization that we human beings have developed, marked by control for efficiency and effectiveness based on the accumulation of wealth, have transversalized our organizations, causing asymmetries governed by the control of those who hold power over others or over nature.

Over its 4.5 million years of existence, the Earth has built memory through a myriad of synergies that have produced not only an orderly system– i.e. all are interconnected - but also an organized order, each in their own way. We share with the planet a common origin and destiny that urges us to leave aside the anthropocentric arrogance from which we judge and act in order to move on and learn from the subjectivity and history of nature that precedes and encompasses us.

If the history of the Earth could be condensed into one year, the human race would exist for 30 minutes, and yet we dare to judge what surrounds us from the few milliseconds that would correspond to our existence. Our human nature is the same that has been developing over millions of years, and from it we must reflect on human action in its environment.

3 Term coined by Monsignore Luis Alberto Luna Tobar, archbishop of Cuenca, Ecuador, who uses the term to highlight communitarian essence as a focal point of encounter for the development of the individual and his liberation as a human being.

We cannot deny that human action goes against anything ecosystemic, perhaps because of our limited capacity to understand the history and subjectivity that precedes us on our planet. Still, neither can it be denied that many groups of humans have demonstrated - with results of public knowledge and valuable experience - that *we-ness* is extremely contagious and penetrates people's consciences until it builds an irreversible base. This *we-ness* leaves us with a palpable sense of freedom, of a shared path, of rigorous equality, and an association of fundamental values, a sense of unity between humanity and the nature of which we are an integral part.

That is why this book proposes to move from the *controlled* and *anesthetic,* which we have *humanly* constructed in the organization and management of the university, to the *utopian* and *ecosystemic,* to the *natural* and *spontaneous* that derives from the logics to allow nature to produce life and enable the university to also accommodate new forms of life.

The organizational model that originates in the industrial age and has been fashioned to respond to a type of machine organization traverses the universities ignorant of their nature. The dilemma does not originate in how to improve production to satisfy the needs of knowledge transmission imposed by the market through the control of the internal labor force, but in how to promote the development of the socially responsible life project of those people who make it up and how this project results in the production of relevant, pertinent knowledge that will transform society.

The university of today continues to be tempted and manipulated to sustain a centralized scheme of efficacy and efficiency corresponding to a Taylorian paradigm of management and control, befitting instrumental rationality. This leads to a bureaucratization and regularization of university action subordinated to rankings that eventually damages human capacities. The university organization is often unaware of the many and diverse capacities inside the institution, withdrawing itself to creativity and the possibility of understanding and responding to the complexity of reality.

Although we are witnesses to the constant transformation of our world, people are still fascinated by the model of the machine organization that gives them a feeling of control. Decision-makers still believe that being at the top of the hierarchy endows them with power, control and a position of comfortable warmth over their devoted corporate staff.

As new initiatives such as coworking spaces are emerging (J. P. Salgado et al., 2017), the approach to work as being of social value[4] (Juncosa Blasco et al., 2019, p. 124), or the imperative need for the organization to produce knowledge and novelty in order to remain in the market, autocratic command and control pyramids are becoming increasingly useless. This is substantiated by the fact that organizations, whether business or social, increasingly seek to replace their structures with more democratic, innovative and entrepreneurial networks, autonomous units united by a vision, values and the management of a common good (Elinor Ostrom, 2011).

The paradigm of the machine that exercises control is being replaced by another one that offers autonomy and work, where the concepts of the ecosystem provide robustness to the new primary concern, namely the capacity of organizational resilience to meet intermittent discontinuous change (Bak, 2013).

It seems that the problem is not the administrative management as such, but in how the management of organizations is interconnected with the vitality provided by the knowledge that these can produce, i.e., to promote the human development of those who conform to it and that this contributes to the objective of the organization. This is the exact opposite of the machine organization that seeks interactions based on instruction and results through the stick-and-carrot approach, where the mistake, which constitutes a potential for learning and an opportunity to produce innovation, is seen as inefficient.

If the primary concern is the living organization and its management for the production of knowledge, autonomy, self-organization and self-regulation find a place in the desired definition from within as well as the affirmation of the identity of the university. These concepts are only possible far from a culture that invites the denial of the other and legitimizes the inferiority of the loser and the superiority of the winner. We need to build mechanisms and non-market relations for the organization. Failure to do so will invariably obstruct the way toward building an ecosystem, which in turn discards instrumental reason as an option to control the other.

An ecosystemic organization will not be built with subordination to the demands of the other, but with the freedom granted by the coincidence of purposes and desires based on a common good. Applying the ecosystemic principles to an organization such as the university must focus on the individual and

4 The social value of work comes from how much people consider someone's work to be good for society. One does not only work for oneself but for others.

the development of his or her life project that is socially responsible with the common good. Besides, these principles are not incompatible with our way of life. Although we may live by other anthropo-referenced rules, those principles are related to our biological being, and make us who we are. Hence, the ecosystemic organization becomes a utopia that in itself is not utopian.

Uncertainty is the only certainty of the Ecosystem University, its capacity to surprise and produce novelty by breaking the cruel anesthesia of the known. Novelty is the basis for questioning and modifying knowledge, without fear of error, not exclusive without submitting to a positivist reason, but rather leaving space for the dialogue of knowledge between what can be considered as true or also as real. It leaves room for emotion as the fundamental driving force for learning knowledge that is not taught but explained by itself when it is produced; an Ecosystem University where people learn science hands-on, where research acts as an engine that specializes in science but at the same time makes it more complex in trans- and interdisciplinary terms.

Independent of the program and the process, the students and professors of the Ecosystem University can respond not only to issues of their special fields, but will manage to develop themselves in the midst of associativity, antagonisms, uncertainties and the multiplicity of forms of knowledge, but most importantly, in their formation as human beings. The Ecosystem University has the potential not to shun life because its methods are compatible, it breaks the logic of stimulus and reward to re-signify the value of work in the dignity of human development; therefore, it leaves the comfort zone that kills people´s initiative, to explore the infinite universe of knowledge that enhances human existence outside the Cartesian dualism.

The whole is more than the sum of its parts, and the Ecosystem University responds to a living organism in which the production of knowledge is an end, a means and the basis for the development of the individual. This university is closely related to the context, which it nurtures and on which it feeds.

The need to resort to nature in order to understand this living organization, the biomimetics[5] (Benyus, 2002) of ecosystems, combines not only the

5 Biomimetics (from bio=life and mimesis=imitate) studies nature as a source of inspiration for the development of technology or for resolving human problems drawing on knowledge of millions of years. For the case of university organization, this text discusses various perspectives, metaphors and analogies inspired by nature with the intention to understand a model of organization more in line with the human condition.

elements that make up the university from the perspective of complexity, but also allows us to understand the non-linear cyclical relationships, the sometimes even contradictory interdependencies, the synergies that constitute the foundation of university autonomy when mixed with its self-organizing capacity; in short, the indivisible relationship between organization and system (Edgar Morin, 1984).

Plagued by old pains and nourished by new hopes, today's university will be overturned by the transformations of the Ecosystem University. The ecosystem logic will renew the anachronistic organizational modes and useless practices of control.

The Ecosystem University encourages an environment that enhances the capacities of the people who live in it, form multiple rhizomes with infinite knowledge, based on the synergy resulting from a number of meeting places for personal and collective interest. This environment is not a bubble within the university campus, but will take over the territory, the cities, the social realities and turn them into a supportive context. Students and teachers are therefore no longer convicts or inmates[6], but become involved in collective work, community action and the transformation of society from within and for its benefit.

There will still be university chairs in the Ecosystem University; scholar, expert or master will remain necessary terms, albeit moved to a back burner, since the creation of knowledge requires significantly more than to immerse oneself into the experience of a professor.

The meeting places,[7] developers of rhizome networks, consist of a democratic space that assembles all interests that one can include in the concept of the common good (Elinor Ostrom, 2011). They can, therefore, be a physical place; virtual, symbolic, stable or transitory. Such places provide room for emotions and affections of the university actors, mix technique and reason with inspiration and sensibility, and produce affection resulting from the time of coexistence at work. People will eventually appreciate a concrete university, a common good that they are familiar with.

6 In classrooms separated along corridors in the way of prison cells, observed by a kind of education officers with the risk of being taken to the *Panopticon* (Michel Foucault, 1982).

7 A meeting place is a space without dimensions or ubiquity but the convergence of interests and hopes of a group of people or groups that converge and organize themselves as complex systems adapting to diversity and developing capacities in an intentional environment, interacting and recreating dynamic learning spaces.

Thinking of dispersed and interconnected rhizomes in the new Ecosystem University threatens the paradigms of organization and regulation that do not coincide with the natural behavior of people and their communities. Yet, at the same time it creates hope for renewal, room for a new order, albeit not necessarily ordered but more organized. The rules of the game will be new and at the same time ancestral, as this is how nature, of which we are a part, has worked for millions of years.

Changing the rules of the game also changes the board, and the players will act with dialogical strategies, following the paradigm of complex collective knowledge, combining the individual life project with the identity and sustainability of the Ecosystem University, understood as a common good on which we all depend.

Every person's life project integrates a multitude of opportunities, problems, knowledge, capacities and creativities that are possible in meeting places that form networks different from the departmentalization coming from the "school" or "university". Without it, the personal life project is combined with the specific group project, which brings together more flexible and open ideas in the Ecosystem University, in groups that can do without tutors or supervisors to meet and cooperate.

The project includes the power of transformation, but not the project understood from the classic vision of utilitarian and controlled planning. Instead, it will involve a socially responsible life project that turns the individual into BEING the main actor who is able to ask questions and offer critical solutions based on ideas and knowledge, recognizing new projects in the community that mean life and articulate knowledge through practical transforming exercises.

The Ecosystem University is independent, it does not subordinate itself to the concept of the classroom, its way of life shows that school is not necessarily equal to education. The human quality of this type of university implies questioning the concept of school in order to create an environment that will seek to form and potentiate human capacities. This curriculum may be picked up in the street, it is something that "completes" education, a street that puts to the test any capacity to produce values, and that the school can influence, but, luckily, not control.

The curriculum of the street deals with the experience, builds society and enables it to produce university. Yet, it is not about studying the street to turn it into data or multiple choice exams. The ecosystem perspective does not cancel out or deform formality, but simply opens the doors to new ways in which learning about life enables us to respond to rather than disallow uncertainty, complexity and diversity. Note that traditional schools wrongly denounce these realities of society as nonsystemic, when in fact their antagonism embraces potential for the development of hope, trust and love.

Non-school education involves values and valorizations not controlled by the school; these are produced only in the street, in life, and are a source of autonomy and liberation. Learning with a street curriculum that combines reality does not imply submitting to it but acting upon it.

The university has always been a product as well as a producer of society. Yet, in recent centuries this dynamic has become more complicated, not only because it has inherited the professionalization of the Napoleonic model, the scientific rationality of the Humboldt model, or because it is marked by a constant struggle for autonomy from the state. Today we also need to take into account other social forces produced by the market and globalization that orientate it towards new tendencies such as quality, the knowledge society and the economic system. Looking at these tendencies raises, once again, the question of whether the university still preserves its capacity to give critical sense (direction and reason for being) to its surroundings or whether it has simply subordinated itself to instrumental reason.

The relationship between critical thinking and instrumental reason is conflictive but it is also the foundation for the university's fertility; submitting it to mere utilitarianism would distort its reason for being.

The modern tendencies that originate in the frenzy of the market, force the university to be efficient and effective, and it seems that the organizational model inherited from the Industrial Age dominates in universities. Yet, this model was created for a machine organization very different from the nature of the university. The dilemma does not lie in forming professionals who will easily adapt to the mercantile logics and be able to produce and serve, but in being critical enough to understand to what extent these products build or destroy nature or to what extent these services build or destroy culture. In other words, we need to be able to formulate a socially responsible life project.

The development of this life project requires not only an environment that strengthens it, but also an organizational structure characterized by community mechanisms that combine the economic, political and social role of each university actor, builds values and valorizations that are more human and less mercantile without ignoring the market and subordinating the common good of the university community. We need to mark a distance from the obsessive notions centered on the economy and understand that these reflect conditions that are rooted in the past.

We cannot have an environment that enhances human capacities without truly appreciating the effects of social exchanges. This opposes the concept of individualism according to Charles Taylor (Taylor, 1994), which dates back to the Industrial Age, but offers exchanges that are based on the sustainability of the university as a common good.

The common good is not a quality of the Ecosystem University but a socio-political construct, the result of the action of each individual, which turns into a collective interaction. Such action aims to sustain a tangible good that is common because everyone depends on it and appropriates it. However, what the common good and the environment that potentiates capacities have in common is action. This makes them complementary, since one is about tangible goods and the second is about the environment.

We need to recover the sense (understood as meaning and direction) of work and not submit it to the mercantilist logics, recovering its social, moral and cultural values. Likewise, we need to recuperate the supremacy of the individual over capital, and of society over the market, without negating capital and the market. We have to start from cultural sustainability and the crucial qualities of communal action which focus on *being* rather than *having*.

That individual and collective action aim at providing the university with sustainability and self-sufficiency as a common good does not mean isolating from the market, because it depends directly on it. We rather need to understand that its self-sufficiency depends on the existence of a flow of internal exchange, relatively independent of the changes from the outside that facilitate the reproduction of the community and the possibilities of appropriation-provision by its members.

In both cases, human action must reinforce the interactions and synergies of the rhizomes we mentioned earlier. We must reinvent mechanisms and non-market consensual policies, rediscover new values beyond monetary transactions. Otherwise, the Ecosystem University will not find the biotope[8] necessary for its development, and will be doomed to become an anachronistic community by endangering all social ties and reinforcing individualism.

We must keep in mind that we cannot generate liberating knowledge unless it relates to everything else. Imposing truth and denying dialogue is nothing more than an epistemic colonization. As said before, the Ecosystem University is far from seeking control by rationalizing the various actions, but rather favors autopoiesis[9], self-organization, the community fabric.

Knowledge is the result of living interactions, which is why the Ecosystem University connects emotion and learning, the mind and the body. The current university, deprived of any knowledge that does not engage in positivist reason, will be emancipated by the ecosystem paradigm that goes beyond instrumental reason (focused on the ends) to open itself to critical thinking (direction and raison d´être, focused on the means) to examine, select, classify, interpret, and transmit content according to the circumstances of those who produce knowledge.

The knowledge of the Ecosystem University is alive and exceeds the limits of the disciplines, it escapes the Cartesian linearity to recreate itself in a continuous spiral; its references are the experience and validation of a complex society rather than the rules of science.

This is why I would like to maintain that education must be a challenge for the university since it is much more than rational knowledge; it has to do with many other dimensions of the spirit, emotions, and intellectual motivations. Therefore, the formation of the BEING must be based much more on

8 A geographical space with certain environmental conditions for the development of the species is known as a biotope. Further down, the book makes an analogy between a biotope and the conditions of necessary exchange of resources that can mean reciprocity and are the basis of ethical development.

9 *Auto-poiesis* is a Greek word made up of the prefix *auto* (for itself) and *poiesis* (creation, production) and was proposed as a concept to define life (Maturana & Varela, 1980). 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 and have 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 (Luisi, 2003) (Seidl, 2004) (Froese & others, 2010), although no formal measures have been proposed so far. Plato's conception of the term poiesis might be of interest, namely "the creation or passage of non-being into being" (Crespo Güemes, 2007).

non-rationality, symbolic acts, dignity, fundamental virtues such as respect for life and others to encounter meaning, otherness, the potential of transcendence.

The university faces the challenge of organizing itself in a way that is compatible with life, the ecosystem, our nature; everybody must take advantage of this potential to dignify the human person through a socially committed life project and the production of knowledge that liberates the individual and society. Perhaps this is what Don Bosco, the educator par excellence, was referring to when he made reason the pillar of his educational system, the BEING *as an expression of freedom, recovered by the action of reasoning, matured by the love manifested and sweetened by the divine of religion* (Sáenz, 2017). Such reasoning has a critical sense because it is based on the principle of the conscience and understanding of what is good, and the need for self-analysis of reflection. Any action in the light of this type of reason is undoubtedly "an act of love."

So what is the ultimate goal of the university? Compatibility with the life of the Ecosystem University liberates the person and therefore transforms action in society. This leads us to reflect on two aspects: first, how the university responds instrumentally to the demands of society and second, how generating knowledge can be based on critical thinking and thus envisage society.

From the perspective of the centrality of the person, the university must be capable of combining critical thinking and instrumental reason, where the production of knowledge is a transforming axis. In turn, the university community can create, criticize, transmit and feedback the scientific agendas, and co-construct knowledge for and with society (UPS, 2007).

Although the purist idea of science establishes as "true" only what can be reasonably justified, this rationality of scientific thought itself is not enough to explain meaning. For example, biology describes all the functions of a living organism, but it cannot explain the meaning of life; thus, it can also explain many circumstances that accompany a person's life, but not its meaning.

We have to repeal the disciplinary value of the university structure, go beyond science understood as "normal," since this only domesticates and puts down the capacity for reflection. The Ecosystem University opens up to society to co-produce transformative and pertinent knowledge from common experience. Only from action with and from society can it produce a virtuous cycle that feeds back its own practices and knowledge.

We understand that university action can take forms other than Napoleonic massification or the positivism of Humboldt. However, we always need to bear in mind that unless it produces knowledge with a critical and useful sense for society, we cannot speak of a university.

Entering into dialogue with others and leaving one´s shell entails an enormous power, illuminating the sense of knowing how to BE without pretending to "be someone," as imposed by the environment. From this context, from this awareness and this way of seeing the world, the university ecosystem promotes everything that can be called education. It is all about educating people to live their life with a view to not only make a career, let alone "civilize" others.

The Ecosystem University is committed to the human being and not to productivity or working hours, because only the person can be the architect of his or her own development and liberation. Being committed to the human being implies establishing the structural bases for non-commercial coexistence, where people find the surroundings that strengthen their capacities without regulating them - a university that is open to the process of individual formation and that will, fortunately, remain forever incomplete.

The Ecosystem University faces the challenge of being flexible in its support of people´s multiple learning strategies; to offer and facilitate multiple learning scenarios, and go beyond the artificial classroom situation course program. We need to take chances, understand that contradiction is not only antagonism but also complementarity, navigate complexity and accept all bifurcations regarding learning strategies as an opportunity.

Motivating people when they are irritated by uncertainty requires energy to produce knowledge that goes beyond what the curriculum prescribes or a simple transfer of information. Learning is based on strategy and not on a swathe of subjects and content.

The Ecosystem University opens itself to a new space and the time has come to tear down the walls of the instituted truth and give human groups the opportunity to draw upon their own knowledge based on their dialogue with their surroundings and their relationships in life. As human beings we can only exist in society, and from society we build the sense of identity and our life project; our lives are based on what we experience in dialogue with others.

The university must open itself to life because only there will it find the meaning of human knowledge. Everything alien to life can be written in books, scientific papers, but will neither impact on nor become life. Opening ourselves to life requires a university organization that does not start from a curriculum or program, but from building a community and is based on its identity values that act on social behaviors; therefore, we are talking of sociological, ontological, pedagogical and cultural factors.

Consistent with the above, this book does not pretend to contain the supreme truth, but it will seek to provoke the reader not only from a theoretical standpoint but from the practical experience in the UPS, an infinite praxis to continue experimenting with new ways of doing and knowing.

The most probable scenario is that of multiple paths, although all will lead in the same direction, namely to defend the preeminence of the dignity of the human being and his value above all unequal and individualistic systems; to create a break in the rigid and normative technicist processes to allow for imagination, hope and understanding; to propose new forms of structures and non-structures, where the actors are not doomed to meritocratic exclusion but are capable of building autonomy and freedom.

While our proposals will obviously not take us to the divine heavens of knowledge, but at least we will not remain hostages to the supermarket of knowledge consumption; we will be committed to an Ecosystem University or another type of university that learns to focus more on *we-ness* through being capable of acting in everyday life.

A university for *we-ness* that penetrates people's consciences, follows a shared path, lives rigid equity and is geared more toward humanity and less to the palace of "the anesthesia of the known," that simply "passes the time" and irresponsibly mortgages action.

"We must all stay committed to a revitalized university in a society that battles with old pains and new hopes. May creativity without discipline live in us forever!"

PART I

Toward an Organization Compatible With Life

Chapter 1

Why Ecosystem?

From an ecological point of view, an ecosystem is a collection of organisms that live in a given environment, share the resources they use, and the environmental conditions to which they are exposed; it works like an integrated system with flows and cycles of energy and matter. An environmental unit made up of biological components or biocenosis, and non-biological components, a biotope, that interact with each other to sustain the flow of energy and matter cycles in a structurally structured and functionally integrated way. Put simply, an ecosystem is a biological system built by a community of living beings and the natural environment in which they live (Chelazzi & Santi, 2012).

Throughout this book we will use analogies to develop the functionality and organizational structure of the university to understand it as an integrated system that favors life, enhances the developmental capacities of people who coexist in it, and makes evident the existence of a living community, such as: "biocenosis," of a series of material resources, *"biotope,"* as well as a flow of knowledge, "*energy*," and of cycles of resources "*matter*". We could also say that the "ecosystem community" is an organizational system built by synergistic interactions between individuals and members of a community based on a common pool resource.

Because university is a kind of common house, all its dwellers depend on it materially and intellectually, because they constitute a community of people, living organisms and not machines, and because they interact, cooperate, and coexist, thus forming a complex system of relations. The term ecosystem is derived from οἶκος (oikos), which means house, habitat, and σύστημα (system), which means the union of things in an organized way; and although the relationship between system and organization appears simple, it involves an unexpected potential.

If we want to organize the university in a certain way to make it compatible with life, we must study the one system that comes closest to it, and that is nature. We must not do so as someone who understands, controls, and uses it, but at the same time recover our capacity for astonishment and allow ourselves to be taught by a teacher who has developed models of organization for millions of years.

System and organization are intrinsically linked. From the perspective of the complexity we need to organize what is in disarray. Yet, as living beings - and not machines - we can only organize things through multiple systemic interactions that in turn produce new disorder; by doing so, we will have achieved the new order. Order and disorder are not only antagonistic but also complementary, which is why the resulting order may not be orderly but organized.

Nobody sets up a university with the intention to create a holistic system in itself, as a result of the sum of all components. A university will be the result of the actions and interactions between people and groups; therefore, its whole as a complex system is more than the sum of all components (Morin, 1977). Interactions t constitute the organization-system, and at the same time this organization provides coherence and functionality for interactions. For Morin (Edgar Morin, 1984), the concept of a system has three essential features:

- System (expressing the complex unity and the phenomenal character of the whole, as well as the complex nature of the relations between the whole and its components).
- Interactions (expressing the set of relations, actions and feedback that are completed and woven into a system).
- Organization (expressing the constitutive character of these interactions - what forms, maintains, protects, regulates, controls, regenerates things - and bestows the backbone to the idea of the system)

Morin resorts to the concept of organization to describe the systemic concept. For him, a system is a *"global unit based on 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).

The oneness of system-organization develops in relations, interactions, attractors, cooperation, but also in repulsions and antagonisms because *"if there is no force of repulsion, exclusion, dissociation, everything would be confusion and no system would be conceivable"* (Morin, 1976). All this makes it possible to define each of the parts of a complex system.

In a complex system, such as the university, these notions are not only concurrent and antagonistic but also complementary. As said before, when disorder is ordered through systematic organization, it will also create free interactions that disturb the new order, a movement that also connects them. From this perspective, the university organization is a paradox between order and disorder; and to bring it to a head, it is the organization that negotiates the relationship between order and disorder to preserve the balance of the entire ecosystem.

In addition to being a set of related and interdependent elements where the organization negotiates complex interactions, the Ecosystem University is not a closed space but interacts with its context. It is in this context that the interactions receive the resources and information necessary to feed the internal dynamics. According to Morín, such complex systems are endowed with a kind of homeostasis[10] that maintains them despite external influences.

Understanding university as an ecosystem is always thought of as complex, but the academic community will manage to build a systemic community feeling that is based on the values of reciprocity, co-responsibility, cooperation and the freedom of thought.

The objectives that motivate the academic community transcend study programs and research projects, and direct the focus of the university towards fundamental approaches that belong to a phenomenological dimension that is not limited to the ordered structure (top down), but is rather characterized by the lushness of the emerging organization (bottom up), thus leaving space to:

- A community of communities, where the organization mediates and negotiates the individual interests subject to the general interest, the common good.
- An environment that enhances the development of people's life projects, allowing individuals to function better than in other environments and also to be actors in their own development processes.
- Establishing links between spheres of knowledge that have been divided into disciplines.

10 This condition is fundamental for the self-perpetuation and self-reproduction (Morin, 1995). Morín also says that this opening turns the organization into a "living organization and, therefore, into an auto-eco-organization" (Morin, 1984, p. 206), "the concept of organization, biological and a fortiori sociological, is a supra-macro-concept that forms part of another, the Organization-System-Interaction" (Morin, 1977, pp. 48–49).

- Preparing people for life, for being free citizens, based on the development of moral judgment.
- Forming a socially responsible life project, based on individual autonomy and social relations enlightened by ethics.
- Searching for complexity without becoming superficial.
- Awakening the logic of science transformation through research and motivating the passion to unravel science as a means of building knowledge.

Such vitality would not be possible without the ecosystemic organization, since this new paradigm is capable of offering the necessary mechanisms to negotiate relations and interactions in order to *"integrate antagonisms as best as possible... Renew energy and the organization through empowering its environment (open system). Self-multiplication to ensure that the rate of self-reproduction surpasses degradation"* (Morin, 1995).

By opening itself to chaos, paradoxically, the university becomes capable of organizing itself, which is necessary to overcome institutional and personal behaviors that obstruct the capacity for change; and also of allowing shared activity from the logic of reciprocity, and the formation of multiple groups united by rhizomes, which guarantees the university to not only function in a purely organic way.

This generativity in the ecosystem becomes significant for creating knowledge. The organizational dynamic is directly linked to the knowledge that produces it as in evolution, always moving to a higher, more complex order. For (Piaget 1966), reason becomes an evolutionary reality characterized by an *"operative, novelty-producing mechanism,"* which is rooted in the change of paradigms.

The social-creative capacity of the different research groups and their close relationship with teaching (formed by the academic community involved in research) has an impact on what is institutionally established, giving the university the capacity to reflect and choose.

The ecosystem scientific community can explain what is known because it understands it (Sánchez Parga, 1997), and its value is the reciprocity in the dialogue of knowledge on the part of its members, which builds the free flow of ideas, a space-time dimension that enables people to reappropriate the knowledge of others, enrich it and reshare it.

The Ecosystem logic of the university community guarantees that it can rethink itself, even recreate itself and therefore respond to the dynamics of administrative objectivity and the subjective vitality of the search for knowledge. The community shapes education, which cannot be understood in parts but has to be seen in a holistic and complex way, with its own movement, meaning, emotions, self-regulation. This is the common agenda that creates the identity of the university community and draws attention to its values.

How we produce, think and investigate our own knowledge, how we define the theoretical objective, the rupture of the internal epistemology, makes us question the situations and challenges that present themselves at the university as well as the importance of participatory work, the re-dimensioning of the university, the shared values, the leaderships based on knowledge and more.

Another important factor is that the ecosystem logic is connatural to the human being, permeates our nature and our way of acting because it precedes us thousands of years and is inscribed in us; for this reason, ecosystem logic is positive even from the perspective of innovation since changing from an old university to an ecosystem somehow returns us to our roots and therefore reduces all forces of inertia that are opposed to change.

The concept of the ecosystem enlightens the traditional university and helps it situate the joint activity that is conceived and performed as a whole that is greater than the sum of its parts, as the raison d'être of the scientific, academic, educational community, in short, of the university community. This perspective goes beyond the rationalization and efficiency that often lead to policies, use technologies and disciplinary measures and regulations that tend to measure the university by data, indicators, certifications and rankings, ignoring the knowledge of a sharing, reflecting, and creative university.

The ecosystem paradigm will help the university's effort to read itself from within (that is, from the subjective vitality of the community rather than from administrative objectivity) and will enable it to provide answers to the methodological challenges and appraise the different spheres of administration to make it compatible with the vitality of the community. The challenge is to establish a new organization that is compatible with the fertile chaos for creation and innovation that takes advantage of it to move from official policies to shared practices, because "creation is what proceeds from the chaotic relationship between order-disorder-organization" (Morin, 1984, p. 188).

Contrary to what it seems, *freedom* is not the primary condition for ecosystem complexity, but rather its consequence. It emerges from the potential of creative action and the ability to choose, as well as from the combination of strategies, shared responsibilities, a logic contrary to the principle of all or nothing, and the flexibility of the ecosystem. That is to say, the starting point of *freedom,* which is the basis of all university autonomy, is the complex combination of entropy (tendency towards disorder) and self-organization in the midst of uncertainty.

Ecosystem Complexity and Self-Organization in Social Groups

Conceiving social forms and institutions as living entities that participate in the same ecosystem constitute the basis of the approach of a biomimetic[11] ecosystem.

From the ecosystemic perspective, anything that has been institutionalized - the system - is a posterior - not prior - reality that expresses life. Luhmann (Luhmann, 1998) describes social units as systems that precede the ecosystem and proposes a form of action understood as social technology, applied from the outside toward the inside and from the top down. Based on his communicative action theory, Habermas, however, establishes a tense and dialectic relationship between the world of life and the system that leverages a form of social action based on consensus from which the world of life seeks to prevail over the system. In relation to the latter, ecosystem biomimetics does not simply seek to produce any kind of consensus, but agreements that express institutional forms as living organisms from the perspective of collective interest.

Luhmann's work is important not only for sociology but also for administrative science, and his fundamental ideas can be found in two texts of his vast work devoted to exploring various subsystems of social life. The first is "Organization and Decision: Autopoiesis, Action and Communicative Understanding" (Luhmann, 1997); the second "Theory of Social Systems (Luh-

11 Biomimetics (from bio=life and mimesis=imitate) studies nature as a source of inspiration for the development of technology or for resolving human problems drawing on knowledge of millions of years. For the case of university organization, this text discusses various perspectives, metaphors and analogies inspired by nature with the intention to understand a model of organization more in line with the human condition.

mann, 1998). According to García Blanco (Corsi et al., 1996), Luhmann initially imagines the world and society as being made up of systems that are part of an ecosystem, with the peculiarity that the ecosystem holds more possibilities for development than the systems are able to implement.

Luhmann distinguishes three systems: the living system (which reproduces itself through life), the psychic system (which reproduces itself through consciousness) and the social system and its respective subsystems (which reproduces itself through communication). Each subsystem (political, economic, artistic, religious or educational) is autopoietic, that is, it reproduces itself until it differentiates itself from the others in a way that is not necessarily orderly. But what characterizes each system is that "it is closed by its own operations and its environment only affects it to the extent that it has determined it"(Corsi et al., 1996).

Up to this point it is coherent with our approach; yet Luhmann understands complexity in terms of the differentiation of organic or inorganic systems, linked through a merely formal mode of communication, similar to the computational logic based on *inputs and outputs* in the language of the administrative sciences; for our purpose, however, these are coexistent and mutually irreducible. Luhmann's approach to complexity promotes an ethics of control that is contrary to the ecosystem perspective but, at the same time, supports "an understanding of the world in terms of networks of observers from horizontal and different perspectives that cannot be unified by totalized observation" (Corsi et al., 1996).

In the two volumes of his "Theory of Communicative Action" (Habermas, 1987) (Habermas, 1981), Habermas takes a different approach and presents concepts related to system and lifeworld. In general terms, the author seeks to offer clues to the realization of "true" modernity, that unknown to instrumental reason that has reduced rationality to technique. Habermas' challenge is to rectify the unfinished project of the Enlightenment.

To achieve this goal, he proposes to look at ethics from a linguistic point of view; in other words, Habermas' ethics is based on the potential of language and dialogue, on the idea of the individual who dialogues "rationally" and believes in the constitution of a free and rational subject. He proposes a discursive ethics in which, through dialogue, the ethical problems of contemporary societies would be resolved. Consensus is achieved through communicative rationality to resolve the moral issues of contemporary societies.

Morality is not a pre-established dogma but the result of the procedure deployed from dialogue and consensus. Yet, such communicative rationality requires a series of conditions of symmetry, that is, an ideal situation of speech based on free, equitable and critical participation.

In the above sense, language is not a simple "means" of communication or transmission of meaning. It has a *telos*[12], which is communicative rationality, an understanding that allows the constitution of a world of meaning. Habermas' paradigm is intersubjectivity, not relativism or dogmatism. Linguistic understanding is a communicative, discursive and argumentative rationality. It allows for rational consensus within the lifeworld between interlocutors. Thus, the function of language is communicative intersubjectivity that produces lifeworld.

Lifeworld is made up of two spheres, the material and the symbolic. The material sphere is the domain of instrumental operations and the technological application to the domestication of nature through work (Díaz-Montiel & Márquez-Fernández, 2008). In the symbolic realm, subjects communicate their needs, interpret the world, and negotiate their action, all through language. Modernity has produced a split between the system and the lifeworld. Modernity has cracked these two spheres of lifeworld through rationalization and has set them against each other. We now face the challenge of integrating the two spheres of interaction.

Lifeworld interlaces communicative interactions, the communicative action that allows the conditions of validity, and the conditions of discursive rationality. Lifeworld refers to the point of view of the subject who acts in society. The system works at an external level, it contemplates society like an observer, that is, from a vantage point of the "non-involved".

The lifeworld comprises culture (continuation of valid knowledge, tradition and renewal of cultural knowledge), society (stabilization of group solidarity) and personality (formation of actors capable of responding to their actions). Each component of the lifeworld has its correlation in the ecosystem: cultural production, social integration and personality formation. The ecosystem is rooted in the lifeworld, but as the system becomes increasingly complex, it moves away from the lifeworld; its components become self-sufficient and degrade the capacity of communication. Yet, from the ecosystemic

12 The inherent purpose of each thing, according to Habermas.

perspective, this increase of entropy - combined with a dissipative system - opens the possibility of evolution to a higher state.

The fundamental question for Habermas is how to connect the conceptual strategies involved in the lifeworld and the ecosystem. He believes that the perspective of social integration focuses on the lifeworld and is achieved through consensus generated by communication; yet, the system is integrated through external control over individual decisions.

The problem is that every perspective ignores the contribution of the other. Therefore, it is necessary to integrate the two conceptual strategies and understand societies "as a system and a lifeworld at the same time" (Habermas, 1981, p. 168). The approach of the Ecosystem University engages in dialogue with but also differs from the interpretation of these two thinkers who introduce the distinction between system - ecosystem (Luhmann) and lifeworld - system (Jürgen Habermas); the first one closer to the functionalist positions (from the right) and the second one, one of the last voices of the Frankfurt School (close to the European Left).

Complex systems such as the university are both products of society and producers of society, i.e. they affect the context and then adapt to it. Decisions and interactions with the context, far from being controlled, rather emerge from within it (Ilya Prigogine & Stengers, 1979). A mechanistic perspective of the organization would not agree with its dynamics (Fuller & Moran, 2000).

The very key to a dialogue between the two proposals lies in the perspective of complexity; understanding it implies recognizing that there is no single theory that leads to partiality, and avoids reductionist and simplifying general knowledge. When we recognize that the real is infinitely complex, the possibilities of advancing knowledge will also be unlimited.

This is precisely the baseline for the Ecosystem University, which opens our eyes to the complexity of reality by recognizing uncertainty, to the value of unfinished and unfragmented knowledge; but also to dialogue with reality, with the practical, with simple facts.

Morin's perspective of complexity is of great importance to understand the phenomena of organization. He argues that system-organization is unique, that one cannot understand the one without interrelating it with the other, and resorts to the concept of organization to explain the systemic conception. For him, system is a "*global unit constituted from interrelated ele-*

ments whose interpretation constitutes an organization... it is a combination of different elements that are in interdependence... it is not identified with the phenomenal object, it is projected on it" (Edgar Morin, 1974).

The organization-system that learns, engages in dialogue and produces knowledge finds in transdisciplinarity the key to understanding the complexity of reality as an organized reality, perhaps not ordered, but organized. Such transdisciplinarity invites us to learn and detach the reorganizing capacity from biology, systems theory, epistemology and other sciences in order to recognize organization as a central knowledge of all theory of matter and life.

The Ecosystem University is also transversalized[13] (Wittgenstein, 2014) by the *dialogical principle*, which implies to understand that the more autonomous an organization is, the more it depends on its environment, and that the university maintains a duality with society but also a unity, that it produces knowledge and acts on society. [2] The *principle of recursion*, which implies that products and effects are both causes and producers of what produces them, the university is a product and producer of society. It is produced by the interactions of individuals, but eventually it is the university that produces individuals. [3] The *holographic principle*, which implies that not only the parts are in everything, but the whole is in the parts. The ecosystemic dimension of the university produces uniqueness in the midst of diversity without negating it; in a recursive manner, it is the organizational knowledge produced by diversity that self-organizes the instituted unit and, in turn, organizes the diversity of groups.

Thus, the university is not only an institution because it is organized and it is organizing itself, that is to say it is alive. The simple understanding of the university as an institutional structure moves into the background because it becomes instituted by the life of those who form it.

One certainly needs to make it clear that this perspective of complexity in itself does not prove anything, meaning it must not be understood as absolute truth, but as a method, a way of thinking to recognize the multiplicity of variables in their context. The Ecosystem University, nevertheless, must deal with uncertainty, complexity and diversity - far from the contradictions hidden by simplifying knowledge, far from the alienation caused by positivist visions that ignore continuously unfinished options that operate under a communitarian and solidarity-based worldview.

13 The principles discussed henceforth have been developed by Morín (Edgar Morín et al, 1994).

The Ecosystem University should open itself to at least six phenomena linked to complexity:

1. Thermodynamic Non-Equilibrium: What is known as order can be explained from a new point of view if we approach it from thermodynamics, if the ecosystem university is an organization-system (Edgar Morin, 1984); then we will try to get involved in thermodynamics to understand that it is also possible to achieve order in dissipative systems in spite of the constant generation of entropy that results from the high level of exchange with its environment. This affirmation originates in the Brussels School, where Nobel Prize winner Ilya Prigogine (Prigogine, 1997) analyzes the variation of entropy and its fluctuations as entropy jumps lead the system to evolve to more complex systems. According to Prigogine "new order emerges" " (Nicolis & Prigogine, 1997) when the system faces a "bifurcation" or enters a "transitional phase", changing its organized and structured mode of operation. When the system jumps to this new state or higher level of order, it requires more energy to maintain its new structures. Systems, therefore, are far from being in equilibrium, and the entropy that causes instability plays a critical role in creating a new "order of fluctuations." Their ability to maintain their organization while adapting to a growing environment of entropy makes dissipative systems particularly interesting for organizational theory.[14] The university is a dissipative system in itself because it is a product and producer of society, which implies a series of exchanges of knowledge, resources, etc. Within the context in which it develops, the phenomenon of non-equilibrium therefore opens the door to a dynamic university organization that transitions to new levels of order and organization.

2. Chaos Theory: Analyzes the non-linearity of a system from a perspective of dynamics. Lorenz (Lorenz, 1963) argues that small variations in the initial conditions may imply large differences in the results. That is to say, in the long term, an organization that depends on the interaction between the parts of the system. Even though the systems, to which the initial conditions are applied, are deterministic, its behavior could strictly speaking be determined in advance. Rayleigh-Bénard[15] arrive at similar conclusions as

14 The term "Organizational Theory" will be used in this book from a strict interest of research and to refer to the broad set of approaches from which the study of the organization has been approached, without making any distinction between the multiple disciplines, analyses or theoretical orientations.

15 Caldwell analyzes the effects of non-linearity in the Rayleigh-Bénard experiment, agreeing that small changes or oscillations produce significant results [186].

described by an experiment of a fluid located between two layers at different temperatures. They establish a zone called "deterministic chaos" or "edge of chaos," in which the molecules of the fluid are attracted by multiple basins showing strange dynamics. These multiple basins facilitate the emergence of a new order; the appearance of new attractors creates disturbances because the system changes from one basin to another, and although the attractors are dependent on the initial conditions, they keep the system far from equilibrium. Therefore, people's freedom in the university should not be a reason for fear. There are forces of reciprocity that achieve a phenomenon of equilibrium, even if within the system-university everything was in non-equilibrium.

3. Catastrophe Theory: Focuses on the sudden appearance or disappearance of the attractors due to critical changes in parameters, which in turn generates catastrophes that imply transitions of the system to new states of order. The changes arise as a consequence of the control variables and the consequent transition from order to disorder. Thom [187] focuses his study on the behavior of the discontinuities coming from the bifurcations that provide the basis for changes in unstable structures. Thom uses the term 'catastrophe' to designate discontinuities in forms. The forms of organization in the university ecosystem are multiple and dynamic. The division of groups and their new associations happen like a "catastrophe" necessary to further evolutionary leaps to new states of order with greater complexity and maturity.

4. Complex Networks: The study of complex networks seeks to find patterns of macro-states that are produced by the interactions of micro-states, thus linking the emerging order to changes of connectivity, where actors create and dissolve relationships according to the novelty of an idea on which they interact. This activates nodes and creates particular and innovative behaviors. Moreover, the co-evolution of the system occurs because the actors are influenced by the development of non-linear behaviors [188]. The order is emerging and stems from a dynamic organization in its structures. An organization that makes the ecosystem university far from depending on the "disciplines" of science is rather "undisciplined" to question the known and evolved science.

5. Collective Intelligence: Self-organization in dissipative systems implies the existence of collective intelligence. Bonabeau [189] et al. argue that self-organization is a set of dynamic mechanisms in global structures that can exist only in a system that has interactions between the different levels of its components. The rules of interaction emerge locally and produce global patterns not by imposition but because they are the result of a collective construct. In addition, the capacity for self-organization can explain the robustness of the community (capacity for survival, even if there are failures in the system) and the flexibility to solve problems such as cooperative work (capacity to adapt to environmental changes). Self-organization requires both positive and negative feedback, as well as interaction through direct communication and randomness with respect to the search for solutions and alternatives that facilitate the growth and strengthening of the structure. Organization in the Ecosystem University emerges from the bottom up and as synergies are established, it descends as a collective commitment from the top down.

6. Boolean Networks: Boolean networks are based on the analysis of the number of actors and connections, such as scientific networks and collective intelligence, for example. Boolean networks can be found in a system operating in a chaotic regime, or in a regime close to a transitory phase between order and chaos. Kauffman argues that dissipative systems allow us to understand where order emerges, but not under what conditions. Furthermore, he questions the thermodynamic model and its usefulness for understanding the co-evolution of systems, concluding that order and the most complex behaviors emerge at the edge of chaos, and also that those processes that lead the system to the edge of chaos are those of natural selection, mutation and recombination (S. A. Kauffman, 2000). Furthermore, he argues that self-organization is a sine qua non condition for the evolutionary leap in the system to take place; due to the need for adaptation, self-organization generates diversity, a necessary condition for the selection of species. For Kauffman, self-organization is a fundamental condition for life (S. Kauffman, 1995). In the ecosystem university, the different levels of order can be monitored, but not the conditions for this to happen. Therefore, the organization and the policies to be taken will always be new and depend on the conditions of the moment but with the long-term certainty of the evolutionary leap necessary to maintain its vitality.

In conclusion, in the face of complexity we need to understand the non-linearity of processes from a dynamic perspective of the system. One needs to remain open to the possibility of abrupt changes as a consequence of evolution and due to the appearance of new states and properties that emerge from within the system, just as it is fundamental to approach the organization as a network open to interaction with other networks.

The imminent influence of the environment triggers a series of unpredictable events that - due to the interconnection of the system - permeate it by modifying its power logics. If we add the emergence of new states deriving from evolutionary leaps, the condition of self-organization becomes extremely relevant as a mechanism that promotes evolution and averting collapse.

The characteristic of adaptability of complex systems understands evolution as a process of gradual and dynamic changes. In the midst of continuous change, the system functions on the basis of local rules that are also changing as the system advances. The appearance of the new order depends on the correlation of the interests of the actors; thus, global behaviors generate global rules. The system's capacity for self-organization arises from this same correlation, aggregation or combination of actors or systems around common interests; adaptability is, therefore, a fundamental prerequisite for self-organization.

The Strategy: Biomimetics

As an Organizational Strategy

In the context of the study of Biophysics as a science, which examines biology by applying the principles and methods of physics, emerges, by contrast, the term *Biomimetics,* which was coined by Schmitt (Schmitt, 1969) and takes a biological approach to engineering. The concept refers to the study of the form, structure or function of materials and things, as well as biological processes for developing artificial products that imitate natural ones.

Today we can find some terms that refer to the relationship between *bio* and the different sciences: *Bionics,* for example, which relates to the medical sciences and was initially developed by Steele (J. E. Steele, 1983). *Bio-inspiration* is a "*more general term and alludes to the use of biological phenomena to stimulate research in non-biological science and technology*" (Whitesides, 2015); it suggests research topics that can lead to results in more direct ways, are accessible and have a universal basis since biological conditions transcend cultural or methodological settings.

Biomimetism (Merrill, 1982) means learning from the world that surrounds us and imitating the way nature solves its problems or getting inspired by it. For millions of years, nature has learned and created what serves it, works and lasts (Benyus, 2002).

In spite of the multiple approaches that the various fields of science take to biomimetics, one common factor is that nature will help to find new concepts that can be applied in technological, social, economic, environmental and other fields. According to the European Union's research agenda, for example, it should pursue projects that offer nature-based solutions, thus turning the EU into the leader of projects such as "*Innovating with nature*" for more sustainable and resilient societies. This policy sustains that "*these nature-based solutions provide efficient, multi-purpose and flexible alternatives for various objectives*" (European Commission, 2017).

In the midst of all the definitions of and approaches to Biomimetics, the International Organization for Standardization (ISO 18458, 2015) has standardized its concept as: "*interdisciplinary cooperation of biology and technology or other fields of innovation aimed at solving practical problems by analyzing the functions of biological systems, their models and their application to a solution… philosophy and Interdisciplinary design approaches taking nature as a model to meet the challenges of sustainable development (social, environmental and economic)*".

Life on earth - ranging from bacteria to the most complex beings - as well as in cities, industries and structures or organizations of society, depend on the functioning of the ecosystem and the energy reserves (Bejan, 2000) accumulated throughout history. In a certain way, an ecosystem is in itself a living organism, the power of its cycles activate the living and inert world (Espinosa Rubio, 2007).

It is not merely a question of how to make better use of what nature offers, it is one of "rebuilding human systems to make them fit harmoniously into natural systems" (Riechmann, 2014). In his paper "A Transdisciplinary and Biomimetic Perspective on Global Citizenship Education," Collado argues that drawing on natural ecosystems and biomimetizing human cultural systems would turn the latter into political, educational and epistemological tools that can transform the *socio-ecological metabolism*.

Two conditions make the ecosystem perspective attractive for the university organization: systemic complexity and its close relationship with self-organization. They can present interesting lines of analysis and provide concepts that allow the university to combine critical reason and instrumental reason; valuing research as a transforming axis in the comprehension-production of knowledge and its feedback on scientific and teaching agendas.

If *systemic complexity* is the fundamental feature of a university, it would seem that *self-organization* is the way to generate transformation within it. Thus, the focus is on a culture of innovation understood as a set of assumptions, values and behaviors that facilitate innovation without major resistance.

> Additional evidence is Stewart's assertion as the conclusion of a study that applied a model derived from complexity called "conditioned emergency": *"By applying the theory of complexity within organizational research, we feel that our experience has shown that such concepts are of critical value in helping those organizations involved in transformation efforts to ensure lasting commercial benefit"* (Stewart et al., 2000) (McCarthy & Rakotobe-Joel, 2000).

Understanding organizations as systems of complexity offers a different perspective from the reductionist approach of the current paradigm. Although the theory of organization is only now being permeated by these concepts, one cannot neglect the characteristics of self-organized systems. Their high levels of agility, flexibility and robustness allow for the projection of flexible, dynamic organizational structures with a great capacity for adaptability and response to the environment, in addition to transforming management and governance models for decision-making in the absence of the hitherto traditional central controller.

As a Strategy for Innovation

Introducing innovative organizational elements to the university produces forces of inertia that one must avoid as much as possible while not putting the context aside. This is the only way to develop options for change, make decisions and make things happen.

From the perspective of complexity, university organization focuses on dynamics, including uncertainty and unpredictability, and regarding order and disorder not only as antagonistic but also as complementary factors (Edgar Morin et al., 1994). With respect to change management it is of no use to try to control the variables in each situation; what will work, instead, is to reflect and critically understand how to immerse ourselves in human dynamics and how these relate to multiple variables and nuances. Styhre (Styhre, 2002) analyzes change management from the perspective of complexity and argues that it is like unfreezing the organization from rigid linearity. According to Lewin, it is a non-Euclidean cyclical process:

> An analysis of the activities of organizational change based on a framework of complexity theory recognizes ruptures and fractures, bifurcation points, energy and information flows, etc. that these constitute, permit or inhibit organizational change. From this point of view, organizational change is never just a one-dimensional series of successful activities, but always takes place in the midst of turbulent transient states and interconnected activity flows. (Styhre, 2002, p. 349)

The option of biomimetics as an organizational innovation strategy for an Ecosystem University is based on the following reasons:

1. Similarities between the ecosystem characteristics and those of the University organization system: understanding the University as more than the simple sum of its parts and as a complex system that is reflected in the reality of the ecosystems, allowing many criteria of nature to highlight the options of the university organization.

2. Managing change: the perception of the simplicity of ecosystem processes, by the very fact of coexisting with them on a daily basis, facilitates the introduction of small modifications with great impact. This means building an organizational culture that is based on stimulating the connatural and daily logics with which life has established itself over thousands of years.

3. The culture of innovation as the basis of evolutionary transformation: the need to understand the dynamics that produce and reproduce values in an academic community. The need to study these values, valuations and their link with both perceptions and actions that are carried out requires a culture of innovation that links the actors with the values of change and permanent evolution. To turn this into reality requires combining the values that motivate the university and the values of those who implement and assimilate the changes.

4. Knowledge management as a dissipative system: organizations are repositories of collective memories and shared experiences understood and perceived from individual and collective perspectives. These in turn have created flows of complex patterns of communication with their environment, and are influenced, encouraged or impeded by the interactions and responses of their interlocutors inside and outside the organization. In the past few years, the boundaries of an organization have become blurred and turned it into a knowledge organization. This is the only type of organization that can narrow the gap between university and society. Only the optics of a dissipative system that exchanges knowledge with its environment will allow the organization to make the necessary evolutionary leaps that will guarantee its survival.

Similarity Between the Characteristics of the Ecosystem and the System of University Organization

Ecosystem principles for the university

Ecosystem principles are open to multiple approaches depending on the science that is applied - ecology, biology, design, chemistry, biomimicry, etc. In many cases, these approaches use sets of general principles but tend to deepen the complexities of certain specific aspects.

The principles presented in this book are based on two sources that contemplate a relatively concrete characterization: Biomimicry Guild (Guild, 2007), which offers a non-linear model, and Pedersen Zari et al. (Zari & Storey, 2007), which synthesizes a series of proposals.

Although the following principles do not aim to encompass or define all characteristics that could be in an ecosystem, I will examine the most important ones. It should be noted that they are not independent and one often superimposes the other; and that the definitions are short since this book will elaborate on them further on. Finally, next to each principle we will locate an analogy with the Ecosystem University. It is left to the reader discretion to imagine more possibilities, but for the purpose of this work we will use the following principles:

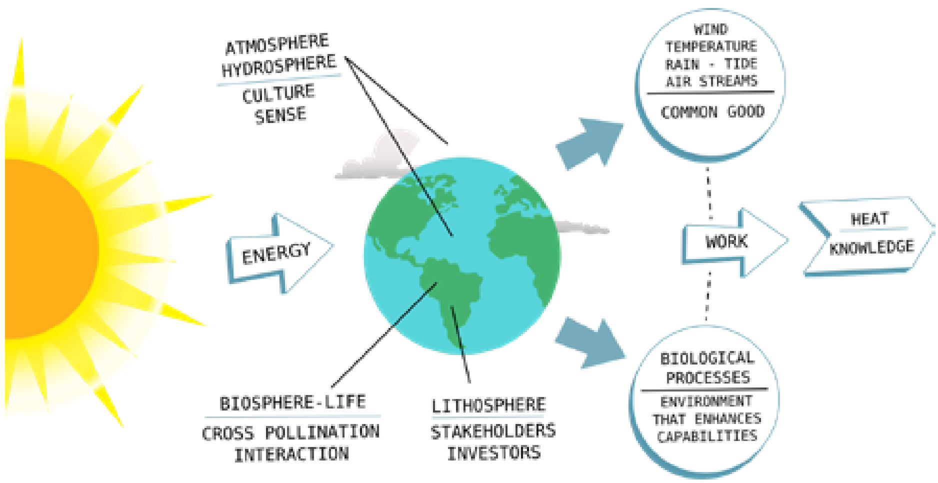
First principle:
Energy as a Source of Any Ecosystem Cycle (Zari & Storey, 2007)

Keywords:
Energy (knowledge), Open Ecosystem (University)[16]

16 This energy-knowledge analogy is explained through a metaphorical analysis of a dissipative system. The metaphor can be found in the glossary of terms.

An ecosystem is a house of life that accommodates relations between living beings and their environment, although it is much more than a means for life (Francisco, 2015). It is, in a way, a living organism (Figure 1). The mineral and living world is immersed in its cycles; through photosynthesis, plants have converted billions of tons of biomass (resources[17]) that constitute the basis of the food chain (Kibert et al., 2003). This matter is stored, distributed, consumed, recycled in the form of mineral elements, replenished with solar energy, and returns through the life-sustaining cycles of each organization.

Figure 1
Energy as a source of the entire ecosystem cycle



Elaboration: Salgado-Guerrero, J.P.

All these interactions, movements and activities require energy that is extracted from three main sources: solar radiation (Xiong & Bauer, 2002), energy from the earth's core (seismic or geothermal) and gravity. Solar radiation is the most important source of energy and accounts for 99% of our planet's energy balance.

17 The word resources refers to the tangible and delimitable goods that the ecosystem has. The present analysis defines the term Common Pool Resource as including not only material but also immaterial goods.

Solar energy then feeds the cycles of the ecosystem and produces work. According to Baumeister (Baumeister, 2007), organisms tend to use "free energy," meaning that by ingeniously using "complementary" energy, it is still taking advantage of solar energy through a medium that is not directly derived from the food chain. An open system (university) exchanges energy with a macro ecosystem (social context) spontaneously or not spontaneously, and uses the energy from those exchanges to produce more specific results, such as seeds that use the wind to disperse.

The sun determines the cycles of days, months and years, influences rotation and translation, and its impact on the cycles and life patterns of the earth are undeniable (Benyus, 2002). The organizational factors of ecosystems are determined by the energy relationship.

The Ecosystem University is no longer a self-referential ivory tower, it opens itself up to other worlds to gather knowledge, go beyond the truth of positivist science and also to house the real knowledge and social practices that do not fit into narrow disciplines. The aim is to open up universities to dialogue with living knowledge and feed these institutions with energy.

This principle creates a kind of spiral "wiki"[18], where dialogue feeds and validates each level of knowledge development, no longer by inbred "pairs" of other academic institutions but by the social acceptance of the generated knowledge. This knowledge is no longer simply produced in the university and then transferred from above to the ignorant, but instead it is co-generated and performed with them. A real conversation, in which the partners of the dialogue set off the reflexivity of the other to co-produce a living text, is the one that feeds the university dynamics to motivate new cycles of conversation and social collaboration.

The reflective condition of the university implies that one can critically recognize what is not working in order to act on it. This implies a new ethic that distances itself somewhat from the rigidity of efficiency and in turn establishes the continuous desire for reorganization as valuable, which is nothing more than an inclusive and collective process of creative construction and deconstruction to produce better conditions for the common good.

18 The term wiki (a word derived from the Hawaiian wiki, "fast") refers to the name given to a community whose explicit knowledge is built directly from where the users create, modify, correct or delete it and which they usually share. (Wiki, 2020)

Opening up to the context and taking advantage of it conditions the organization of the university. One can no longer speak lightly of *top-down* decisions, or allow rankings to determine university policy, or carry out a clumsy materialization of *copyright* property rights. The vitality of the Ecosystem University does not discard these tools, but conditions them, because those tools are replaced by society to sustain the university materially and intellectually.

Second principle:
Evolution and Adaptation (Guild, 2007) (Zari & Storey, 2007)

Keywords:
Homeostasis (culture of innovation and research). Entropy (entropy of the organization Ecosystem University).

The life cycle does not originate in opposition to but right within dissipative entropic processes (Rísquez, 2002). This is possible thanks to adaptation and evolution (Reap et al., 2005): when the organism (actor or group[19]) adjusts behaviorally and physically, this produces adaptation[20]; evolution occurs as the result of a series of genetic changes which produce a leap to a higher organizational state[21]. The internal dynamics of ecosystems is greater in higher states and can be explained by the constant increase in entropy, which implies a constant flow that keeps the ecosystem dynamically stable (T. F. Allen, 2004). The apparent maturity of an ecosystem is actually a state of crisis that motivates it to jump to a higher organizational level. These crises are defined by the carrying capacity (multiple interactions in the work of the community) and flow of resources and energy (Berkebile & McLennan, 2004).

19 In an ecosystem where diversity is important, the synergy between the diverse factors is even more important, and this will be discussed in greater detail below.

20 This book understands adaptation as the relationship between corporate and individual behavior. These behaviors are directly related with the organizational topology which in turn has a relationship with the entropy of the ecosystem.

21 This evolutionary leap to a higher state generates a transformation in the hierarchy-heterarchy relationship of human groups, which shall be explained in greater detail further down on. For now, one must take into account that evolution has a direct relationship with entropy.

Ecosystems have the capacity to maintain a state of equilibrium-non-equilibrium (Cannon, 1932), and even if some conditions change, the macro properties are maintained[22]. This feature is generally known as *homeostasis* and involves an adaptive reaction to keep the essential *variables* within an admissible range (William Ross Ashby, 1947). Homeostasis is related to the capacity to generate behavior (University culture) and learning from living beings (Di Paolo, 2000) (Actors and groups of the Ecosystem University).

The Ecosystem University perfectly uses everything that can contain energy as a resource and knowledge, but we must bear in mind that who defines whether or not the optimization of a resource is efficient depends on who uses it. From an organizational perspective, it is necessary to create an environment that favors the capacities and development potential of individuals and their groups. From a linear point of view, it would seem that granting autonomy and freedom to individuals and groups could make everything spin out of control (Kelly, 1994); however, mediated by the need to sustain the common ground, it is this very freedom and autonomy that negotiates interests according to superior interests.

Contrary to the efficiency paradigm where every university unit fulfills a specific and unique function to prevent degradation, in the Ecosystem University the necessary condition to produce homeostasis depends on the redundancy (Low et al., 2003) of the life of some individuals, which is based on the diversity and multiplicity of functions, and which can mean life or death for the ecosystem (McDonough & Braungart, 2010) (Ilya Prigogine & Stengers, 1979). Like some ecosystems in nature, it is also necessary within the university to use resources for more than one function (Benyus, 2002). The prevailing logic is one of optimization rather than maximization.

Third principle:
Locally Focused and Receptive (Guild, 2007) (Zari & Storey, 2007)

Keywords:
Simple, Gregarious (groups organized by affinities and interests).

22 This definition introduced by Cannon comes after the first definitions of homeostasis that referred to the internal and physiological regulation of body functions.

In an ecosystem, the interactions between the components and the context favor evolution, depending on the properties of the biosphere. The approach of this book is that an organizational culture prone to innovation and based on free interactions produces organizational evolution in the university. Lovelock (Margulis & Lovelock, 1974) (Gaia hypothesis) suggests that living communities (academic community) not only depend on, but can influence their environment (society). These interactions with respect to locality or context are also internal and maintain the condition of dynamic equilibrium (Benyus, 2002).

The simplicity[23] with which biological and natural processes take place in the ecosystem is also related to the spontaneity of relationships with the environment or context since they are motivated by satisfying specific and therefore desired needs, which makes complex processes apparently so simple that they hardly warrant attention. Hidden behind the growth of a plant or the simple fact of it feeding us, we find a complex maze and a network of simple and reliable systems and subsystems that function interdependently.

In the Ecosystem University the populations and research groups form in a functional way and depend on how their basic elements are organized (homogeneous interests, although they later become heterogeneous due to increasing entropy,). Gregarious conditions and a hierarchical organization are not imposed but emerge in a complex system (Levin & Segel, 1985), and as a result the dynamics will restrict interactions and development over time (S. A. Kauffman, 1992). Common interests are superimposed on the characteristics of individuals, which is why cooperation can be seen not only in the same species (same work function or field of science) but also between individuals of different species (inter- and transdisciplinarity). On the other hand, and very importantly, gregarious or hierarchical organization patterns are a consequence of self-organization (Crawford S Holling, 1992) (O'Neill, 1986).

It is not a question of subordinating the different points of view to one, but of understanding the prevailing interdependence between all factors.

Since affinities or interests motivate the formation of groups, they are subject to possible ruptures and recompositions. Contrary to what it may seem, such dynamics bears an enormous potential for university organiza-

23 The characteristics of simplicity, functionality, and dissipation are developed in this book as fundamental factors for change management. They will be developed further down.

tion; groups can start from scratch or opt for new directions, going for the best alternatives depending on the also changing context.

Communication is also an issue that is enhanced by the focus and the reticular connections permitted by the rhizome organization. The communication channels need no mediation of any kind and are based on the exchange of knowledge or common interests.

The Ecosystem University groups are not units but dimensions, and each of them chooses the path and direction of its activities; this does not mean that they contradict the common interest, since they contribute to it in different ways. Creation does not have a beginning or an end because those who participate in the group simply reorganize themselves to continue to develop if the group has to change form; this preserves the nature of the groups, even if they experience various metamorphoses.

This principle revitalizes the bureaucratic machine inside the university, empowers its internal autonomy, heterogeneity and multiple possibilities of direct exchange; the groups do not imitate anachronistic structures and, depending on the circumstances, they can therefore reinvent and reorganize themselves at any time.

The organization of the Ecosystem University depends on the structure that results from interactions and synergies; the values built bottom up permeate the organization top down in a continuous cycle, where innovation and creativity are in permanent dialogue with the instituted order; power is therefore diluted and distributed, and processes do not necessarily have to be hierarchical or centralized.

Fourth principle:
Nonlinearity and Non-Equilibrium Equilibrium

Keywords:
Constant flow, creative limits, cross-pollination[24], feedback cycles.

24 A popular, unattributed story uses the following parable to explain cross-pollination: *"There was a farmer who had the best crop of corn grain, every year he won the first prize in the town fair, however, at each fair he distributed a quintal of the most select of his product among all others who participated in the competition. Someone asked him: - How is it possible that you give away your best seed to your competitors? Don't you see that they could beat you? - The farmer answered: "Don't you understand that the bees that pollinate your plants also pollinate mine?*

In a complex adaptive system, such as that of the Ecosystem University, the course of development depends on emergencies and fortuitous events and is altered depending on available alternatives. This makes it impossible to project any future with certainty; there is a constant *dialogue-action-knowledge* that operates at local levels, all dependent on its history since the knowledge it provides is the basis for the projection of the next action based on the current range of possibilities (S. Kauffman & Levin, 1987). [25] The fact that the path depends on the projection of past patterns does not cause linearity but an ever unfinished spiral; this refers to the fact that local rules for interactions change as the system evolves and develops further. The same restrictions apply to any complex adaptive system, which generally shows how the future path depends on the developments of the past.

This paper includes interesting examples from an Andean non-linear worldview, which directly influences the actions taken by community actors to define their development alternatives. After having lived with Andean communities for over 25 years, Herrán (Herrán Gómez, 2015) argues that unlike most Eurocentric cultures, the *runa*[26] do not see the past as behind them but as having preceded them because it was before they arrived at that stage (Figure 2). This worldview has much to do with the non-linearity of ecosystems; Andean time is not linear, but cyclical (Qespi & Eusebio, 1994). The future is consequential, a product of human action, and as far as the past is concerned, it is connected with the present and the future in the same place (Ñawpa-ñawpa, ñawpa, Qhallaq[27]). Quoting Estermann (Estermann, 1998), Herrán specifies that Andean time is not a measurable *continuum*, a *quantum*, but discontinuous, heterogeneous and qualitative.

Andean time is cyclical because it is formed by the transition from one epoch to another that repeats itself. The Andean worldview implies that the *runa* live in time as they live in space and therefore permeate the production

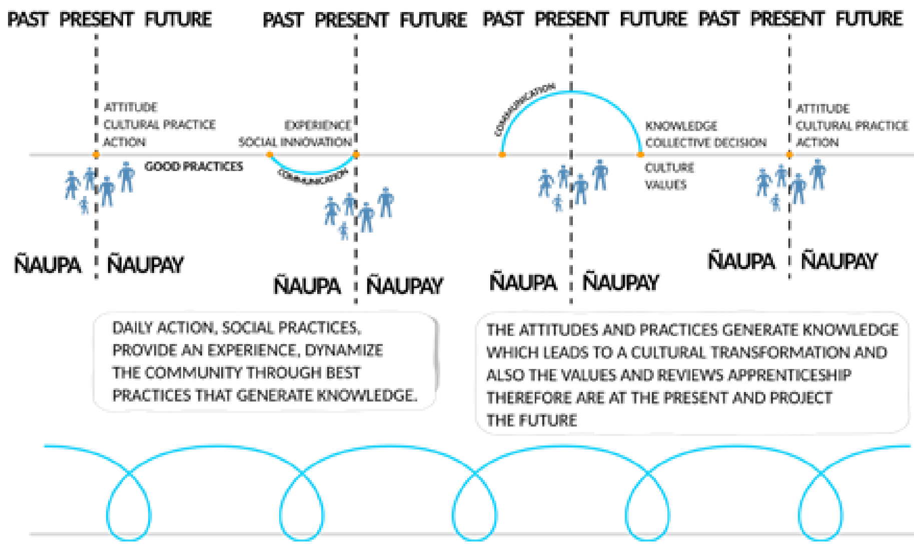
25 Since emergence and entropy are fundamental factors in the ecosystem, it is very difficult to design possible futures on paper. Therefore, planning should project rather than predict based on a continuous cycle of *action-communication-knowledge*.

26 The word runa refers to the native Latin Americans.

27 *"Ñawpa-ñawpa"* is a Quichua term that refers to a past that has been overcome by another past, surpassed by another time that is also past but more recent. *"Ñawpa"* can mean recent past, or the present to anticipate the future; the present as the past of a future that will come, therefore, the immediate past, the present and the immediate future can coexist at the same moment and the same space. *"Qhallaq'"*, on the other hand, means the remote, non-historical past of darkness and disorder, unrelated to the present [96, p. 134] [97, p. 176].

practices and the economy (Herrán Gómez, 2015. Thus, *"history is a cyclical repetition of an organic process corresponding to the cosmic order and its relationality"* (Estermann, 1998).

Figure 2
Non-Linearity as per the Andean cosmovision



Elaboration: Salgado-Guerrero, J. P.

From this perspective the Ecosystem University takes dimensions according to the protagonism of the actors and the development process. It is the actions that are socialized and from them knowledge is built around the action. Hence, this Ecosystem University denotes continuous social dialogue (Broekstra, 1998) that takes on the process of development and by acting as the center of its activities, it is created (*autopoiesis*), recreates, forms and transforms; defining communication for development (Herrán Gómez, 2015) as a center that breaks the traditional mold of development for attaining economic goals and well-being, without having to abandon the paradigm of human development.

Another type of non-linear relationship is that of cross-pollination; a popular folk tale provides the following parable as an explanation:

> There was a farmer who had the best crop of corn that would win him the first prize in the village fair year after year. And yet, each time he would bring one quintal of the most select of his crop to share with all other participants; someone eventually asked: "How can you pass on your best seeds to your competitors? Don't you fear that they might outperform you?" Replied the farmer: "Don't you understand that the bees that pollinate their plants will also pollinate mine?

Anything that is predictable, plain, dead, is the result of worshipping linearity and succession, while non-linearity imprints life in the university through synchronous cycles of multiple exchanges.

Cross-pollination[28] and non-linear patterns are fundamental for the capacity for resilience and adaptation in complex systems (May, 1999); essential for absorbing disturbances and for regeneration and reorganization (Folke et al., 2004), although this may contradict the linear logics of maximizing efficiency. We must open the university to the possibilities of the unexpected to make it receptive to resources and knowledge from the environment, and allow it to generate multiple responses and multiple futures.

An Ecosystem University that seeks to adapt to the environment and also transform with it as it grows and develops must create strategies to learn from crisis and use it as an opportunity for self-improvement and, at the same time, create the capacity to face crises. The corresponding results, in turn, are the basis for the adaptability of the system (Folke, 2006).

Fifth principle:
Optimization rather than maximization

Keywords:
Recycling, efficiency-equity-resilience, order-disorder, multifunction, adaptation to functionality.

28 The advantages of cross-pollination are so significant that throughout evolution, nature has relied on it and refined the processes to avoid self-pollination. Closing the organization to learning would mean to favor inbreeding and self-referencing. Contrary to what seems to be its strength is deceptive because which crystal is also extremely fragile. According to the FAO, cross-pollination is the transport of pollen from one plant to another, generally carried out by insects, which directly affects crop quality and quantity [251].

Due to the complexity of Ecosystems and their constant dynamics, we must rethink the concept of efficiency, since these tend towards interdependence and self-organization based on redundancy and diversity.

Sharifi et al. (Sharifi & Yamagata, 2016) conclude that the sustainability of ecosystems depends directly on whether they are capable of combining flexibility, efficiency, diversity, adaptability and redundancy. The *flexibility, adaptability* of its organization and *redundancy* depend on the ecosystem´s capability to substitute functions among its members, i.e. to transform to minimize external impacts. This has a double relationship with efficiency; on the one hand, if there is a high capacity to minimize impacts through *redundancy,* the organization is sustainable and efficient; on the other hand, however, overlapping functions and possible replacements can also negatively affect efficiency by depleting resources. The challenge is to maintain a balance through building resilience, a quality considered the greatest asset for any organization in today's constantly changing world.

Efficiency and equity are related to *entropy.* When the entropy value is too high, the community has more possible ways in which to act, i.e. greater disorder. But this also increases its ability to meet needs and develop potential.

Therefore, ecosystems optimize the use of energy and resources from the perspective of the system rather than from that of its individual components (Kelly, 1994). For an ecosystem, non-linear optimization logics seem to be much more commendable than linear maximization logics. The apparent inefficiencies of individuals lead to redundancy and basic diversity to produce resilience needed in the face of crises and/or need for evolution.

Ecosystems have recycling cycles, what gets discarded by some is used by others through trophic networks connected at different levels. While matter can be recycled, energy will flow through a system (Korhonen, 2001). Biological systems deliberately degrade energy in numerous small steps, i.e. any remaining energy after an organism has done its work is used by another to ensure the best possible use of energy (T. F. Allen, 2004).

Jobs and organizational functions become mobile, depending on the project cycles, and therefore, recyclable, flexible, and open to everyone. Since the Ecosystem University remains in an unfinished state, anyone can start from a relative final and continue with the spiral of construction of possible multiple futures. This university has no room for anyone to state that "this is of no concern to me."

As said before, this principle challenges the rationality that worries about efficiency, about how to meet objectives at the lowest cost, since rather than enriching the organization of the Ecosystem University, it narrows and confines the University´s vital possibilities.

Sixth principle:
Development and growth integrated (Guild, 2007) by self-organization.

Keywords:
Bottom-up action, network, cooperation, heterarchies, self-organization, use of interdependence, emergency.

According to Ashby, any dynamic system can be seen as self-organizing (W Ross Ashby, 1947) if there are *attractors* (Lorenz, 1963) that lead to interactions to generate global patterns of behavior (Camazine, 2003). While the process of self-organization implies greater organization, the same systemic process also implies interactions that produce disorder (Edgar Morin, 1984). It is therefore necessary to distinguish between actor, attractor, ecosystem and the organization, and then define the importance of self-organization in the Ecosystem University (Polanyi et al., 2013) (S. Kauffman, 1995) (Broekstra, 1998). Svyantek argues (Svyantek & DeShon, 1993) that the second survival function of an organization is the development and maintenance of an integrated internal identity (Kwan & Walker, 2004).

According to Bonabeau, self-organization is the set of dynamic mechanisms in global structures that occur only in a system with interaction between the different levels of components (Bonabeau et al., 1999). The rules of interaction emerge locally and produce global patterns not by imposition, but because they are the result of a collective construct. In addition, the capacity for self-organization can explain the robustness of the community (ability to survive, even if there are flaws in the system) and the flexibility to solve problems such as cooperative work (ability to adapt to environmental changes).

Still, self-organization requires feedback, both positive and negative, as well as interaction through direct communication and randomness with respect to the search for solutions and alternatives that facilitate the growth and strengthening of the structure.

The number and robustness of relationships between actors are essential (McCann, 2000) for a *non-equilibrium equilibrium* in ecosystems. Actors organize with the help of different communication systems and function in different types of hierarchies and networks (Kibert et al., 2003).

The social systems have different formal and informal laws (Vogel, 2000). Organizational structures depend on the meta-objectives and the type of relationships in each group. The whole, being a community of communities, must respect the diversity since each group will have a different design of structure depending on its state; furthermore, structures will change over time, and not only from plane networks to pyramids, but also in a dimension that goes from the networking to individualistic structures.

The perspective of complexity does not exclude any of the possibilities, but appreciates them as valid as they emerge depending on the context and the group's meta-objectives.

To explain the emergence of hierarchies based on social values and valuations, we will resort to McCulloch (McCulloch, 1945); although he did not coin the term "*heterarchy*," he used it in a paper on psychology. Studying the variation of individual preferences, McCulloch found that there is an anachronistic inconsistency for the hierarchy of values that is assigned to these preferences. Thus: if someone prefers A to B, B to C and C to A, this "inconsistency" cannot be explained by a theory that assumes a simple hierarchy of values; however, it is consistent with a more complex system that follows superior orders, but does not allow the construction of a scale of values.

Cumming manages to interlace the elements of networks and hierarchies in an organizational/structural continuum (G. S. Cumming, 2016). Relating these concepts in a linear way and accepting the network as a flat hierarchy, 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 tune with the context from the perspective of heterarchies.

Ecosystems build from the bottom up, put together components one at a time, then assemble units from the simple to the complex, combining modular and nodal components (Guild, 2007). The *bottom-up* perspective does not aim to ascend to the *top* but to change the *top*. It is a process of construction that incorporates territory and context in a spiral of constant growth in amplitude and depth of transformations, and is the result of the failures and achievements of the previous action, which implies not only a change of direction but also a change of actors.

Resulting from the respective valorization of interactions, values are built from below and then ascend and descend in the form of agreements and constitutions of the organization, always respecting the emergence of values. In this life cycle of the Ecosystem University, groups choose their own organizational structures and are transformed in time as the number of interactions and synergies increases; when the maturity of the group is high it mutates and transforms, evolves into a group of groups and the rhizome cycle begins, where each of the new groups assumes its own structures to mutate them again.[29]

Ecosystem: A Community of Communities

With no desire to idealize ecosystem cycles, we will use some of them as a metaphor to understand how an organization can be sustained with the principles described above.

From a theoretical perspective, we will analyze ecosystems and their analogous relationships, more profoundly conceptualizing the similarities between natural and university cycles in the relations of resources and knowledge.

As mentioned above, we will resort to complexity as the bridge between these two types of ecosystems, without the pretense of demanding that the Ecosystem University should use the ideas of ecology, but rather with the eagerness to understand the natural dynamics of the university.

The Ecosystem University is not only a complex compilation of parts or a community of people, but its different perspectives and interests assemble them in a particular environment that emerges from their interactions.

In an ecosystem, the geological units, climate, rain, tides, wind, temperature (known as *Biotope that* we will relate analogously tothe concept of Common Pool Resource) and living beings, unicellular, bacteria, plants and animals immersed in biological processes (known as biocenosis that we will relate to the concept of an Environment that Potentiates Capacities) interact to regenerate and recreate a system-organization in a permanent way. Ecosystems evolve from energy and biomass; to further expand on this subject, we will emphasize the analogous energy-knowledge and biomass-resources relationship.

29 These complex cycles will be further explained below.

An ecosystem produces, regulates, and organizes itself without any control or authority and it sustains a paradox where death and life sustain each other in the midst of these processes. This conception is based on a complex system, which appeals both to particular interactions and to the global whole, which, moreover, gives rise to dialogue and allows mutually beneficial interventions.

Resorting to complexity in order to understand the complementary and identitarian relationship between system and organization, implies understanding the ecological whole as an interrelated poly-competence of a systemic nature since, contrary to specialization, the ecosystem promotes global knowledge. This is the only way to articulate specialized competencies to understand complexity.

The analysis of the interactions between biocenosis and biotope, and its analogy with the university, aims to understand the interaction of the actors of the Ecosystem University and their exchanges of both *knowledge-energy* and *resources-biomass*.

Before analyzing the cycles of ecosystems and their university equivalents, we need to understand two lessons derived from the nature of ecosystems that we will approach analogously to the university. The following is an excerpt:

The Phantom of Specialization

Although nature seems to have evolved into highly specialized processes and organisms to fulfill certain roles or functions, it is equally true that these depend on a cyclical whole and that their functions are not independent. Everything has a reason for its existence and is also a consequence in the great organism called “planet”.

Far from linearity, an Ecosystem University cannot shy away from life but seeks to make life compatible with its methods, accepting insecurity in order to remain alive and not extinguish its existence by clinging to safety. The Ecosystem University is not compatible with the specialization based on competition and meritocratic careerism; one needs to measure to what extent the diplomas and specialized exams contribute to forming insightful citizens who keep a critical distance to the imparted knowledge in order to make moral judgments.

An Ecosystem University understands actors as diverse beings with multiple capacities, open to dialogue, creative and willing to face complexity. However, it appears that today both teachers and specialized students also act in a specialized way, that is, tied to the program and the *curriculum*. This is not a negligible problem in the face of a highly diverse life (sometimes antagonistic), uncertainty and complexity (full of multiple forms of knowledge).

The paradigm of complexity and the concept of the whole as being more than the sum of its parts, forces the university to constantly deal with *"the permanent tension between the aspiration of knowledge that is not segmented, not divided, not reductionist, and the acknowledgement that any knowledge will always be unfinished and incomplete"* (Edgar Morin et al., 1994). It is not a question of playing off disciplines against each other, nor of making them interdisciplinary, but of understanding disciplines from the point of view of other disciplines, which is what we may achieve by understanding the whole as unfinished. The organization of these diverse points of view is what Morin calls the *organized complex unit* (Edgar Morin & Piattelli-Palmarini, 1983) and follows a *trinitarian-man* system: *individual, species and society* cannot be divided (...).

This ecosystemic implication of specialization-complexation is of great importance when it comes to understanding the university organization, since it would imply that there is no teaching of a science other than the teaching of its research and the production of its knowledge. This is how research at the university specializes knowledge and makes it more complex, so that science can be learned precisely by engaging in it.

Competence From Identity

Far from meaning rivalry, we define competence as the *capacity resulting from knowledge or experience*[30]. The complex cycles of an ecosystem illustrate the reasons for competition. Species develop competitiveness by performing a specific function in a biotope, not because they try to be better than others, but because they try to be better themselves in order to survive[31].

30 The meaning of competition has been linked to rivalry since the Middle Ages (initially politics). This link has been greater in recent years as trade was eventually interpreted in the sense of competition. The competitive element has been imposed more strongly in the domination of the economy under the liberal inspiration in the context of capitalism and the market [395].

31 A crocodile, for example, will always try to be a better crocodile in order to take better advantage of the possibilities of survival, but does not try to be a better gorilla or a better bird.

In the context of human society, ambition for individual benefit inherent in *competition* is blamed for all current crises: economic bubbles, unemployment, inequality, climate crisis, democratic crises, etc. Paradoxically, the structure and social cohesion follow opposing values such as solidarity, equity, cooperation, complementarity, etc.

Still, in the history of mankind, life expectancy has never been as high as today. Today's potential for well-being is unprecedented, our models of society display a growing exclusion of the majority of the world's population from the benefits of development. The impoverishment of the planet and social disintegration have found strength in the short-term competitiveness of economic performance.

The Community of the Ecosystem University opens itself to the context and accepts the challenge to sustain the University with that context and find the best answers. The power of the question that the university and society share lies in the comprehension-explanation of a pertinent and relevant science for society; its value lies in the reciprocity of knowledge dialogue on the part of its members. It builds the free flow of ideas and the space-time dimension, where one can *emulate* and re-appropriate the knowledge of others; it is therefore necessary to relativize *copyright* and make a qualitative leap to the *right to copy*. To emulate corresponds to the spontaneity of the exchange of energy. Again, for nature it is more important to optimize cycles than to maximize competition.

The value of emulation[32] 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 social bonds 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).

Far from establishing social relations, meritocratic competitiveness, instead, produces inequality and eventually the exclusion or elimination of the other. This misconceived competitiveness throws people into a battlefield that only produces winners or losers, and nothing but *"warrior vocations...the expropriation of the future by the dominant to the detriment of the young"* (Petrella, 2007). The self-organization of an ecosystem is a COMMON GOOD, that is, a common pool resource for achieving knowledge (...).

32 Emulation is derived from the Latin *emulatio* which means to imitate or to equal. In our context the objective could resemble the other, even to overcome it through individual or mutual improvement.

Natural ecosystems and the Ecosystem University are formed by entities united by relationships, some of which are organized in a similar way. This paper uses relatively simple biological concepts to generate useful ideas. We will abstain from explaining some well-known ecological terms, but have picked only some specific concepts of relevance that can be related to a university context and be understood in a coherent theoretical system.

For the processes that encourage behavior and change, ecosystems use *solar energy* and *biomass* as a driving force for the use of nutrients for life, growth and reproduction. The Ecosystem University also uses sources of knowledge to drive processes that feed on other resources. In addition, it uses the creation of knowledge in a similar way to energy, thus motivating and influencing the processes that involve its human elements. On the other hand, both use information as a resource to rationalize their behaviors at different levels of the system (Hwang & Horowitt, 2012).

The Ecosystem University is a strategic social actor that can interact with other institutions and governments and impact social and economic development plans (M.E. Porter, 1998). This University is a catalyst for independent actors; it contributes to regulations by providing elements of support to other social actors, ensuring that roles are performed in an organized and collaborative way. It is an open and therefore dynamic, sustainable and evolving ecosystem that drives the transformation of ideas into valuable results (Jackson, 2011). It also implies a flow of capital and resources, but above all knowledge that results from interactions between heterogeneous actors that share relationships, regulations, policies and culture.

Knowledge-energy acts as a driving force for innovation and research. It is not disconnected from the territory and, as will be seen later, depends directly on the cycles of *knowledge-action-communication* and the *continuous tacit-explicit-tactile transformation of knowledge*. The two models are developed in the form of a spiral; knowledge and ideas can be understood as existing theoretical foundations; tacit and explicit knowledge; formal, informal and specialized; intentional thoughts that trigger innovation actions, around which the entire ecosystem functions, which also involve inventions and discoveries, etc. All of these are not only produced but also managed and shared; we learn from them why they emerge in the middle of a cycle of participatory research and innovation.

Creating new knowledge and inventions within the university and introducing them into society (Crossan & Apaydin, 2010) involves mutual flows of knowledge (energy) and resources (biomass). We need to understand and regulate the double dynamic of tension and complementarity between the *research economy* and the *commercial economy* (Oh et al., 2016). Clarysse et al. found that cyclical flows of knowledge (research economy) and resource flows (i.e. the commercial economy) are partially separated but intertwined within the larger context in a complex manner (Clarysse et al., 2014).

In other words, far from being an isolated bubble, the Ecosystem University is affected by society, and in its interior creates similar conditions of diversity, complexity and uncertainty in order to bring out the capacities of each person persona (J. P. Salgado et al., 2017). The *context-biocenosis* is a *capacitating context* (Evans, 2002) (Ellerani, 2014), that is, it offers the necessary conditions for the development of those who make it up.

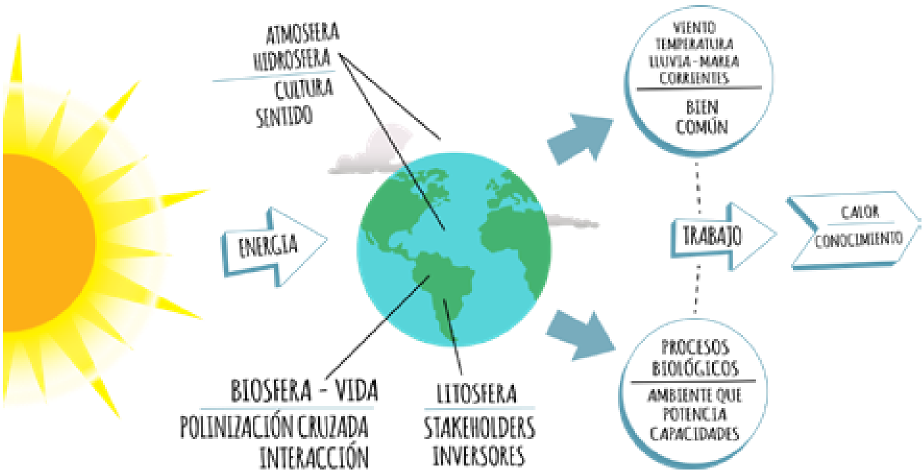
In Figure 3, we can see an analogy that identifies ecological macroprocesses such as biocenosis,[33] which we identify as any activity that derives from the interactions of life generating cycles and processes (environment that potentiates capacities, projects, networking, etc.), and the biotope[34] (common pool resource, set of resources, moral and cultural values). The interaction between these two dimensions produces work or energy to which we compare with knowledge.

An Environment that Enhances Capacities (biocenosis), through its system of values and its components, expresses a context that brings out the *socio-political-economic* conditions that sustain the Common Pool Resource (biotope); the latter, in turn, facilitates all kinds of life-related processes that produce the values and components of the Environment that Enhances Capacities. These two dimensions are a synthesis of a *culture of innovation and continuous evolution around the knowledge produced by the ecosystemic organization (*Figure 4).

33 A community of plants and animals that live together and interact [273]. In the case of the university that means that everything happens in a living way and forms an environment that strengthens the capacities for people's development.

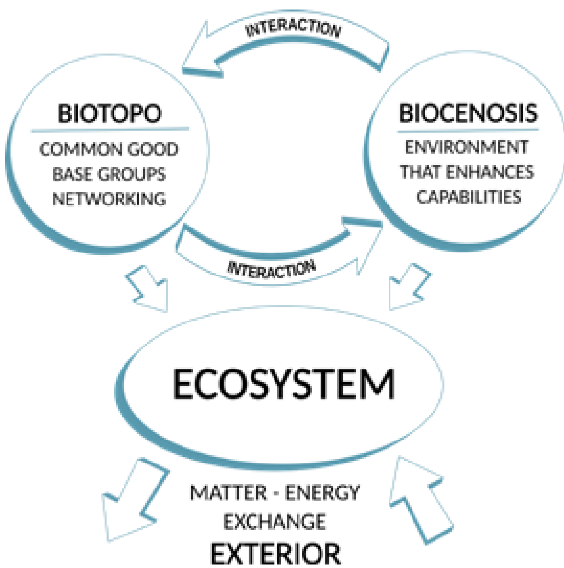
34 The place where the life of animal or vegetable species develops [273]. In our case it means the tangible common pool resource and the mechanisms that it provokes for its sustainability.

Figure 3
Analogy 1 of ecosystem macro-processes



Elaboration: Salgado-Guerrero, J. P.

Figure 4
Analogy 2 of eco-systemic macro-processes



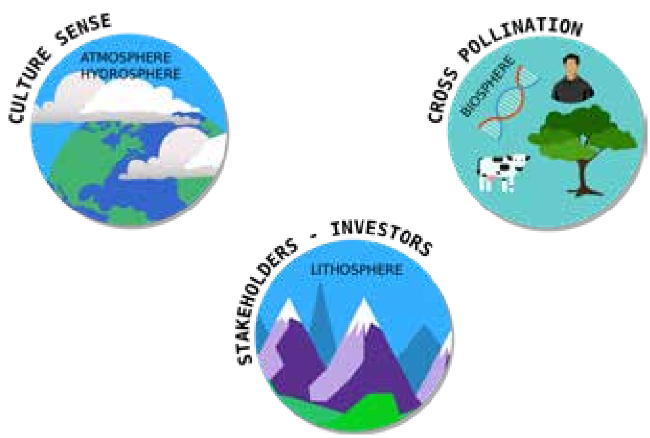
Elaboration: Salgado-Guerrero, J. P.

The Ecosystem University must facilitate spaces that favor the dynamic *comprehension-explanation* of science and the production of knowledge (Patera et al., 2016), which can only BE DONE in an environment where people can develop internal capacities that cannot be acquired in an isolated way; a theoretical-methodological contribution of socio-cultural constructivism (Jonassen, 1999) for example, combined with a focus on capacities (Amartya Sen et al., 1991), constitutes a transversal frame to achieve this objective in a university.

The development of the person is similar to the growth of a plant. It feeds on resources (chemical-biological matter) and on energy (knowledge) in order to transform them. Nobody makes the plant grow, but it develops in an environment that sets the ground for it.

The ecosystem also has its characteristics; in ecology (Chelazzi & Santi, 2012) it determines that the planet is made up of a biosphere (life), lithosphere-hydrosphere (structure) and atmosphere (environment), all of which make up a macro ecosystem (Figure 5). Below, we will try to give an overview of the analogies that we can draw in the Ecosystem University. We must bear in mind that it is embedded in a broader social context and that it exchanges energy-knowledge and resources with this very macro-ecosystem; as we go on, we will use other analogies for the micro-ecosystem within the university.

Figure 5
Classification of macro-ecosystem Actors



Elaboration: Salgado-Guerrero, J. P.

1. Atmosphere-Hydrosphere. Those actors that interact to sustain *culture and sense*. Culture and meaning are a key aspect, one of the most important ingredients for an ecosystem (Hwang & Horowitt, 2012) (Mercier-Laurent, 2013) (S. Olson & Dahlberg, 2013), as they condition the way in which each of the actors of the ecosystem produce, develop, negotiate and resolve conflicts; the way in which they self-organize to determine the rules - fundamental ones and others that can be dynamically modified (Elinor Ostrom, 2010a). Culture and meaning imply organizational behavior, meddling in the thoughts, customs, and social behavior of the community, facilitating the necessary synergy to assume shared responsibilities and resolve conflicts and problems (Herrán Gómez et al., 2014). Support, assistance and specialized knowledge to other ecosystem actors is provided by institutions, individuals or organizations.

2. Lithosphere. Those actors that interact to maintain the necessary *structure* to ensure access to and sustainability of resources. For a university, the classic model is the triple (quadruple or quintuple (Carayannis et al., 2012)) helix (Bianchi & Labory, 2016). However, the ecosystem view goes further, the actors can assume multiple roles and, what is more, they also assume these roles depending on the needs at a given moment, in a dynamic way, so to speak. For an Ecosystem University these logics provide the possibility of valuing and strengthening its knowledge production (Poma & Ramaciotti, 2008). The diverse actors include (Hwang & Horowitt, 2012) (Carayannis et al., 2012): the market, governments, NGOs, banks or all kinds of institutions that provide financing mechanisms and programs, angel investors, virtual capitalists and industries that provide mechanisms to finance various steps of creation and innovation, regulations, policies and incentives; industries or companies and industrial associations that provide requirements, evaluate solutions, develop technologies and knowledge in their R&D departments, in addition to being, of course, clients or financiers; external entrepreneurs or students, researchers, professionals from other universities and industry people who have an idea, discovery or innovation (incremental or disruptive) and wish to link up; and civil society (individuals, NGO associations) that creates social and environmental demands and requirements that in turn can profoundly affect companies and impact the development of innovation.

3. Biosphere. Those actors whose *interactions* maintain the dynamics of equilibrium-not-equilibrium of the ecosystem. An Ecosystem University is an open system composed of a diversity of actors and entities that organize themselves according to strategic objectives to sustain the Common Pool Resource, functions and actions at the level of knowledge production and institutional functioning, as well as the economic and social order. These actors maintain channels of relationships to interact with other actors, whether inside or outside the University. One should emphasize in this connection that the internal mechanisms of the micro-ecosystem (university) - albeit influenced by the macro-ecosystem (market and society) - are autonomous; this autonomy is necessary to protect the identity of the micro-ecosystem and make sure it does not get absorbed by the macro-ecosystem and lose its form and boundaries.

One must take into account that the great diversity and heterarchical form of organization depend on culture and meaning (Elinor Ostrom, 2010b), to ensure the University stays open to society, but at the same time defines its identity, the limits that protect its sustainability and autonomy for decisions and its response to the context.

The flow of energy-knowledge that crosses the ecosystem is irreversible and inexhaustible, although the chemical elements that make up all the mineral or organic forms (common pool resources) of the earth are not limitless.

The characteristics of the micro ecosystem shall now help us to explain the internal flows of the Ecosystem University. The vital elements are used and regenerated through cycles such as carbon, nitrogen, sulfur, etc. These flows transform the elements through the atmosphere-hydrosphere, form the biomass and deposits as sediments. We shall leave it to the reader's imagination to ascertain the flows in the Ecosystem University.

Note that life is the "engine" of all cycles, and the three groups of living organisms are producers, consumers and decomposers. We shall now draw an analogy between these dynamics and the Ecosystem University. For practical purposes, we shall use groups of existing actors in the Universidad Politécnica Salesiana (UPS). These groups are defined later in the case analysis, however, what is important at this point is to understand the flows of energy-knowledge and biomass-resources.

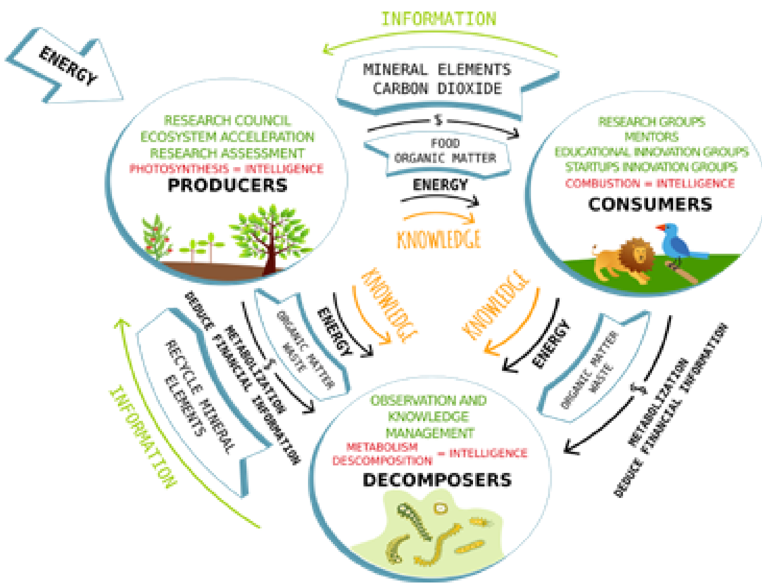
1. Producers. In general, these are plants, aquatic vegetation, i.e. all organisms capable of photosynthesis (production of organic material only from sunlight and mineral carbon gas). They are also called autotrophs. For this case study these are: Monitoring Research Councils, Ecosystem Accelerators, Research Valorization, School of Mentoring.

2. Consumers or the animal kingdom. Terrestrial or aquatic herbivores and carnivores, all of which feed on living organisms and produce energy through organic burning by oxidation (respiration). Consumers are also referred to as heterotrophs. For this case study these are Research groups, Educational innovation groups, StartUPS innovation groups.

3. *The decomposers*. Feed on dead organisms or chemical substances dispersed in the environment; they are capable of transforming dead organic matter into inorganic matter; they close the cycle, and the elements they produce will be reabsorbed by the producers. Fungi and bacteria are examples of decomposers. For the case study these are: Observatory and Knowledge Management (CreaMinka, GameLab, Improbable Network).

Figure 6 explains the flows of energy, biomass and basic elements. By analogy, energy-knowledge is transferred with a link to the biomass-resource, although it is not directly proportionally related; in other words, the flow of resources is involved in the processes of knowledge production in an organizational or general way. The minerals transported in biomass or produced by combustion or metabolic processes correspond to information exchanges.

Figure 6
Cycles between the actors of the Ecosystem University



Elaboration: Salgado-Guerrero, J. P.

The role of producers is to provide resources to consumers, who in turn use them to produce developments by returning valuable information to producers and providing information to decomposers, which can then be digested as a contribution to understanding the state of organizational knowledge. To close the cycle, this information is transmitted to the producers so that the next delivery of resources perfectly meets consumers' needs. It should be noted that producers also provide information to decomposers.

Although we could go into further detail regarding the analogies of the cycles of an ecosystem, this metaphor aims to identify the functions of the actors within the Ecosystem University and to understand their interdependencies.

Synergies for Self-Organization From Ecosystem Logics

The Ecosystem appears as a complex and dissipative open system[35]. Its horizontal structure and the need for independent interactions between its components that cause the whole to be more than the sum of its parts, requires a complete view of its macro-state in correlation with its micro-states.

However, one also needs to understand it as a living system and thus establish some fundamental principles. For analysis purposes, we will assume that for an ecosystem, the number of actors is not as important as the interactions and synergies between them, as well as the cycles it can generate.

Ostrom (E Ostrom, 2008) analyzes the behavior of the actors that participate in a *Common Pool Resource (CPR),* which she refers to as *appropriators and suppliers*. In her study she seeks to understand how a group of actors in an independent context can organize and govern themselves in order to obtain common benefits even though they may be tempted to live at the expense of others or act opportunistically. She argues that the behavior of actors depends on how well they know each other, consider and evaluate the costs and benefits of their actions, as well as how they perceive the relationship between these actions and the results, since the latter also establish a cost-benefit relationship. The problems of managing the common goods are characterized by *collective action* and, therefore, by problems related to *appropriation-provision*.

Beer (Beer et al., 2009) examines the relationship of three variables in an organization: alignment with organizational efficiency (occurs when the

35 They are called *dissipative structures* because they are maintained by continuous "dissipation" (or consumption) of energy.

organization as a whole, structure, systems, and people, aims to meet organizational objectives), psychological alignment (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 (occurs only when the other two variables exist). The success of the organization depends on how strong or weak these variables are, which in turn depend on hierarchy, incentives, emotional attachment and commitment. Beer argues that when an organization is strongly aligned to efficiency, people will want to do things right (following rules and procedures) but do not tend to do the right thing when problems arise. With a high level of psychological alignment but lack of alignment to efficiency, however, people want to do the right things, but cannot for lack of shared synergies, structures and strategies.

To understand the dynamics between individual and collective attachment from an ecosystem perspective we need to resort to *synergy*; although taken from natural sciences (Ebeling & Feistel, 1994), this term has also been applied in other fields such as economics and sociology. Synergy is about emerging bottom-up behaviors and top-down impositions. In addition, it encompasses other terms such as autopoiesis (Maturana & Varela, 1987) and the interaction between action and structure (Herbert A Simon, 1962). These synergies basically reproduce the interests of the actors, who in turn depend on the value they attach to it.

Individual or collective action generates an experience that can be perceived as good or bad, as better or worse; the first case is about morality, the second about value.[36] Nothing constitutes a value as such if it is separated from valuation (Claude & Pizarro, 1995). One can explain the direction of an emerging organization also from this perspective; since people value freedom and solidarity these become imperative. Any society is regulated by a double normative structure that corresponds to a double rationality of human activity: value rationality and instrumental rationality or of objectives (Weber, 1991), these have always coexisted, but in recent times the tension between them has worsened.

Appropriation-provision and cooperative or individual behavior depend on the value of co-creation of the common good. This brings together the physical and the emotional. This involvement means that the work of co-creation is not an option and the hope of greater value produces greater synergy among the actors (Brodie et al., 2011). Synergies -- in this case eco-

36 In Greek philosophy, Plato and Aristotle distinguished between practical knowledge *(phronesis)* and intellectual knowledge (*sophia)* [54].

systemic – bring together individual experiences and social norms, both of which are based on the values that shape these norms as they emerge.

Synergy (Hermann Haken, 1984) is what keeps an ecosystem alive. It is capable of uniting actors at all levels, making it possible for macro-level properties to emerge from micro-level interactions (Herman Haken, 1979). These synergies occur in a *non-linear* way when the system destabilizes or enters into a crisis and reorganizes itself on the basis of new attractors (values), seeking a new equilibrium of a *higher state*, but at the same time respects the history of the road travelled and the shared values constructed. This *optimizes* the *self-organization* of the Common Good. Synergies are produced on the basis of the fluctuations produced by the change from one state to another, until a new coherent state is reached.

The relationship between the emergence of values given the *bottom-up* self-organization and the imposition of shared *top-down* values build a permanent cycle of circular causality that stimulates the dynamics of both *appropriation-provision* and *corporate individual-behavior*.

The macro-level properties (shared visions, shared values) emerge from the micro-level properties (individual or group interests), only through the synergy of interactions and interdependencies.

The patterns that emerge (bottom-up) from the synergy over time gradually array and at the same time coordinate the micro elements, giving coherence and sense (direction and raison d'être) to the macro organization, which spirally influences the properties of the micro elements (top-down) as they cannot get away from these systemic properties.

If values are qualities of facts or things of the same realities or social phenomena (Sánchez Parga, 2012, p. 19), they are qualities related to action and experience, and then:

- Action and experience produce knowledge and this communicated (valued) knowledge calls for a new – collective – action. The transformation can be initiated again in a spiral way based on a cycle *action-communication-knowledge-action* (Herrán Gómez, 2015).
- If the valuation is positive, then the value is generated and the ecosystem remains stable, while with a negative valuation, people will question the experience and therefore practices and routines will be changed. Micro and macro level values maintain a constant and dynamic relationship (Meynhardt, 2003).

Figure 7
Spiral action-communication-knowledge and self-organization

Elaboration: Salgado-Guerrero, J. P.

The cycle of values that motivate self-organization exist in two ways: *emergency (bottom-up)* and *consensus (top-down)*, at the same time generates a spiral in the production of knowledge (Figure 7), based on *action-communication-knowledge-action*.

The co-creation of the Ecosystem will depend on the synergies - interactions and interdependencies - (Herman Haken, 1979) which, by their capacity to identify values, control the dynamics of appropriation-provision and individual or corporate alignment.

Following are some of the characteristics necessary for the interactions that can produce synergies:

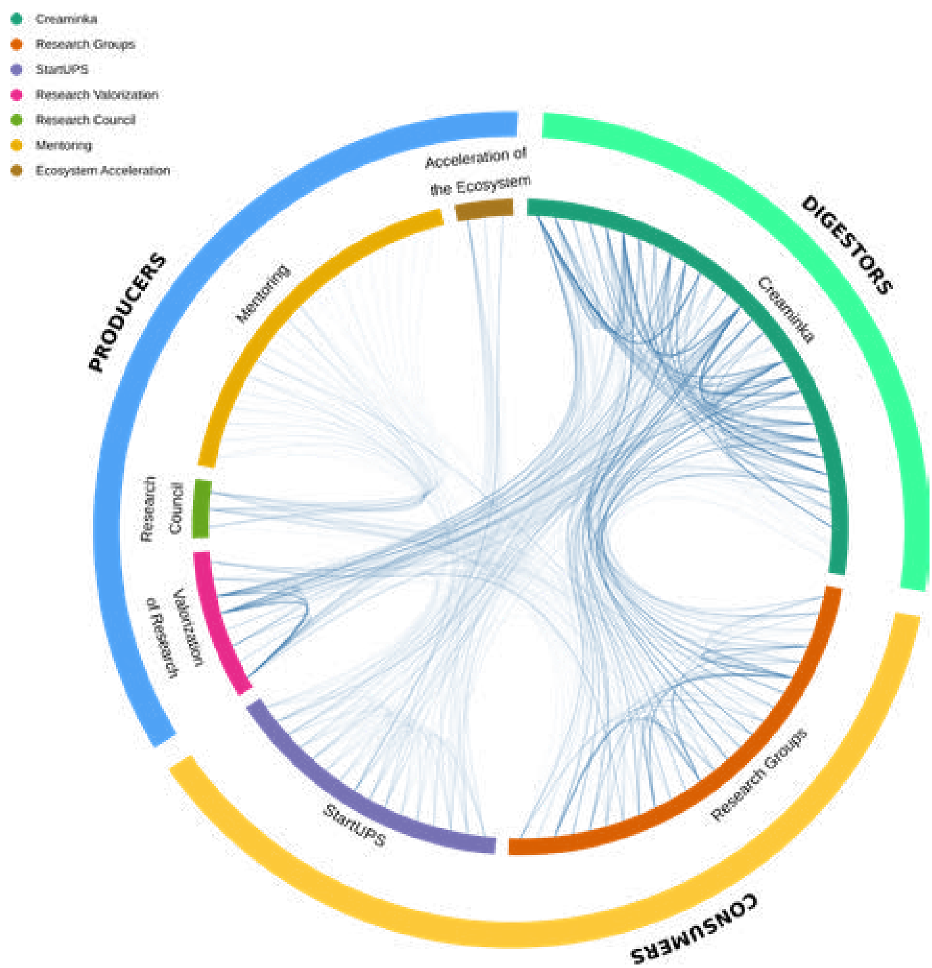
- Non-Linearity: based on cyclical processes that allow feedback, values can be co-created. This process favors both social and individual internalization.
- Determined by Context: emerging processes are created endogenously and obey the conditioning of the context. Actions and experiences developed in the context can be valued to build values (objects or facts).

- Depend on History: synergies are the consequence of a historical projection. While this may have the same meaning (direction) or may act in the opposite direction, it always relates to past and previous events. It is difficult to understand the relationship between two actors by itself. To be able to build values we first need to evaluate the history of actions or experiences.
- Butterfly Effect: Because values are constructed collectively, a small action can amplify public perception and opinion about value, generating a larger scale reaction. This process is fundamental to convene actors around the needs for change or to validate by consensus a common value that can then be regulated by the ecosystem.
- Equilibrium – Non-Equilibrium: Valorization is possible only through establishing a critical distance between two facts or objects. This distance produces moral judgment which, in turn, makes it possible to construct the values for which synergies are established. Uncertainty challenges the ecosystem, pushing it toward self-organization, which is why a constant *equilibrium - non equilibrium* - is necessary to be able to value new positions and commitments with respect to facts or objects.
- Uncertainty: the *"chaotic"* condition of the ecosystem implies that synergies can be predicted only in the short term. Yet, the collective formation of values is unpredictable; we must not forget that the trajectory influences valuations.
- Diversity: The sum of the parts and their significance form a systemic whole. Interdisciplinarity alone will not produce synergies; it also requires transdisciplinarity, conceived as passing from one discipline to understand another; the objective of synergy is to comprehend how a science produces or reproduces knowledge.
- Complexity: once again, the complex view links the concept of system and that of organization as a whole that is more than the sum of its parts; it is the synergies that constitute that additional value.

Hence, synergy among ecosystem actors produces a flat structure that is not based on pre-established functions but on the virtue of projects enriched by community value. This organization is based on meeting places and uses the functionality of the University to put it at the service of projects that catalyze intentions as best as possible.

Figure 8 shows the diagram of synergies in the case of the Universidad Politécnica Salesiana. For example, if one considers that the research groups are part of the research councils and that the latter approve the projects proposed by the former, one can see a logic of interdependence that optimizes the resources of the University. Similarly, the groups of innovation and entrepreneurship participate in the acceleration of the ecosystem and decide among all the strategies to be taken according to their needs and possibilities. The same diagram also highlights that synergies are produced based on interests that turn into concrete projects.

Figure 8
Diagram of Synergies at UPS



Elaboration: Salgado-Guerrero, J. P.

The project concept that arises from orthodox planning does not coincide with the dimension it acquires from the ecosystem perspective. In this case, the project is understood as a catalyst for synergies, a *meeting place* for creativity and freedom of thought, and at the same time it empowers people to exercise their capacity for action, that is to say, it turns them into agents[37] of change and production of knowledge.

Far from traditional planning based on control models and indicators, the project in this case takes an *integral* and therefore *complex* approach. It must provide meeting places, flexible and horizontal dynamic places that facilitate the reinvention of rules and practices of knowledge production.

The meeting places are the product of the crossroads of multiple flows of synergies that intervene in the creative and research dynamics of the University: chairs, postgraduate and undergraduate theses, career research programs, groups, centers, teachers, external demands, internal demands, research contests, publications, dissemination of results, interlinking research, technology transfer, innovation and development, ventures, and so on.

The personal interest and each aspect of an individual's identity are related to a certain dimension, which in turn *meets* the dimension of the other. The sum of interests and the search for meaning makes these people convene in a place within the community, forming motor cells: The Research Groups. University research draws on the experience of spaces and images that are crucial for the process of personal socialization.

The critical judgment itself must be the condition and main pillar of the formation, surpassing the *curriculum* and focusing on relationships of projects and situations that allow both the teacher and the student to see the world from different perspectives. The greater the freedom of thought, the greater the risks to be taken and the greater the maturity with which they must be faced, a virtuous circle for the formation of the human being.

It is a question of making the leap from what has been learned to what has been understood, in a process that involves thinking about the knowledge acquired and sharing with the teacher the understanding of how to produce it; it is a question of sharing the very research exercise.

37 The term *agency* can be understood from the social development perspective as the capacity to do or act, it will be addressed by the Capacity Building Environment below.

There is no way to learn knowledge and scientific thinking but it has to be understood in a progressive way whose axis is the research project. Without teaching research, there is no scientific production of knowledge and less awareness of scientific thought, which is why the Teaching-Research relationship is inseparable.

In the Ecosystem University the actors bring up their own problems and issues that are considered necessary for the development of knowledge, which results in personal and community growth in continuous dialogue with the field. What is known today as *curriculum* becomes a flexible logbook whose design allows us to face emerging situations and specific needs based on shared values.

Research will spark off synergies and is inter- and transdisciplinary insofar as it allows specialization science and also making it more complex in order to understand and explain it. The production of knowledge from their *projects-meeting places* results in different categories of cognition-based products.

The evaluation of the groups does not use their production to classify them in meritocratic lists, but by respecting their *diversity* and specificity, it combines their potentials with those of other groups obtaining the necessary *resilient capacity* for *evolutionary* leaps and the constant change in the *non-equilibrium equilibrium* of the ecosystem.

The Communal Complex[38]

In the Ecosystemic University, the Environment that Potentiates Capacities (biocenosis) and the management of the Common Pool Resource (biotope) is based on the development of the life of the community of people; it acts, as has been said from an ecosystemic organizational logic, where the whole is more than the sum of its parts, i.e. a communal complex opens up between the synergic relations, interactions and interdependencies of its members.

The commune functions like a body, like a living organism that has the capacity to identify and respond to problems at the same time as it organizes itself associatively, which allows it to unite knowledge and make sense of it. The organization of the commune does not happen from defined terms or

38 Communality involves decision making often in search of balance and often in times of crisis. Community implies a set of already defined values.

places, schedules and fixed functions of work, but from the exercise of freedom and multiple possible creations.

The vitality of this organism forms an organizational complex of the commune that assigns meaning to things. This communal complex is not an objective or verifiable value, its meaning does not have a material existence and therefore it is not possible to prove it scientifically, but it is possible to feel it when we share communal life, when we understand something and we can see it in our students and teachers, that sense of satisfaction and of brief happiness with our capacity of intelligence and sensibility allows us to encounter and give meaning to the communal.

The communal complex adds to the logic of pure reason the reason of emotions and ideas to form part of the communal sense, which is built by what we do and what we are. The complex, the integrated, the holistic, belong to a whole that is more than the sum of its parts, which is why the communal complex cannot be divided since it would be destroyed and lose all its meaning.

The communal complex gives meaning and direction to the movement of the organization, since each individual imprints direction and substance to their daily work, which beats bureaucratic intrusions, political party influences or academic structuralism.

Relationships between individuals based on the power of affectivity produce co-responsibility, reciprocity, and a sense of community redistribution to sustain the tangible common pool resource on which we all depend. This generates the consciousness of belonging to a culture and in that otherness we explore our own identity, which is going beyond intelligence and words. It is an affectivity that arises in the scope of a shared project, shared work, shared creativity, base for the discovery of the BEING, of the conscience to be and to be part of a whole that makes sense.

In addition to ordering, inventing and assuming the creation of the common project that takes root in instinct and intuition rather than in predictive planning, the organization chart and legislation, the communal complex of the Ecosystem University tries to recover lucidity and sensitivity in the common project.

It is not possible, therefore, to explain the functioning of a commune from the mere *common ideals of must be* because it would not encompass the complexity of *acting economically, politically and socially,* which implies the strategies, the productive systems and the social structures. The practices-strategies of the concrete action of the individuals develop in physical and structural conditions that we shall try to explain below:

- Science as such is the basis for the development of all production or reproduction of knowledge in the university, and people need to engage in science to learn science[39]; and yet, we also need to understand its limits since the rationality of scientific thought alone cannot explain its meaning. Biology, for example, can describe all the functions of a living organism, but it cannot explain the meaning of life. The dynamics of university functions: research, teaching and linkage cannot break free of the global dimension of human thought, which conditions and models the university commune, and its *economic action* based on the production of relevant, pertinent and transforming knowledge as the development of concerns that work in these social transformations.
- Knowledge production practices and actions are produced, reproduced, modified or created in the ecosystem.[40] Made up of an environment

39 "The only certainty is uncertainty, the capacity to amaze and to produce novelty by breaking the cruel anaesthesia of the known. Novelty is the basis for questioning and modifying justified and true beliefs, making a leap by way of evolution to another higher level, without fear of error, without excluding but without submitting to positivist reason, but rather leaving space for dialogue of knowledge between what can be considered as true or also as real, leaving room for emotion as the fundamental driving force for learning knowledge that is not taught but explained by itself; an ecosystem university in which science is learned by doing science, where research acts as a driving force that specializes in science but at the same time makes it complex in trans- and interdisciplinary terms".

40 A university is not constituted by being a holistic system that brings together a certain number of parts, but by the actions of its groups and the interactions between the parts. As a complex system, it is more than the sum of its parts (Edgar Morin, 1977). The interactions are precisely those that constitute the organization-system, and in turn the organization brings coherence and functionality to the interactions. For Morin, the concept of system has three facets (Edgar Morin, 1984)that he considers indissoluble: system, interactions, organization. For him, system is a "global unit constituted from interrelated elements whose interpretation constitutes an organization... it is a combination of different elements that are in interdependence... it is not identified with the phenomenal object, it is projected on it" [16]. The eco-systemic organization is the paradox between order and disorder, and it negotiates the relationship for the maintenance of the systemic equilibrium. The university maintains economic and knowledge exchange with the environment, that is, a macro-organization in the form of an ecosystem. Morín says that this opening makes the organization a "living organization...it is, therefore, a self-eco-organization" [80, p. 206], "the concept organization, biological and a fortiori sociological, is a supra-macro-

that promotes the development of people's capacities and the management of the tangible common good, this ecosystem is an *internal* means that conditions the practices of the people and groups that form part of the community, since the *economic action* of the community-university manages a limited common pool resource that must be nurtured and, in turn, sustains actors searching for the common interest, namely the development of relevant knowledge that changes society.

- Knowledge derived from the practices, which influences the performance of the groups, as well as the subjectivity from which they have learned and assimilated the communal space, which in turn can be understood as an external medium for the groups that influences and normalizes the behavior of their microsystem.
- The socio-economic and political organization of the commune is the basis for the environment that empowers capacities; from this organizational balance, it develops special institutions that act under the regulation of diverse levels of organization, whose rules also possess diverse levels of flexibility and focus on sustaining the common pool resource.
- The university communal complex recovers the intrinsic value of things beyond the utilitarian value; it is, therefore, possible that reciprocity and redistribution emerge in the middle of contractual relations that imply long-time coexistence and allow for otherness, dignifying the work over the commercial Manichaeism and promote the development of all university actor-community members.
- The non-market strategies based on complementarity, exchange, reciprocity, redistribution and co-responsibility mark the key elements of the economy of the communal university; they enable it to develop and interact within the market society, open a space in the absolutist mercantilism to organize communally and respond sovereignly to personal interests with respect to community-university values.
- The sustainability and self-sufficiency of the commune are based on a common pool resource but not isolated from the market, because the exchange of resources and capacities of development for the common pool resource depend directly on it; self-sufficiency indicates the existen-

concept, which is part of another is the Organization-System-Interaction" [222, pp. 48-49]. An Ecosystem University is always complex, but to the extent that difficulties are overcome and differences are assumed, the Academic Community that researches will manage to build the sense of communication that is based on the values of reciprocity, cooperation and freedom of thought.

ce of a flow of internal exchange relatively independent of the changes of the exterior, which permits to ensure the reproduction of the community and the possibilities of appropriation-provision of the *commoners*.

- The society in which the university is embedded, recognized as an external medium as the real base of the ecosystem, directly relates to the basic science of university knowledge production. In other words, the university is a product and producer of society and no knowledge can be generated that does not depend on and is relevant to the society in which it is immersed. At the same time this knowledge is not valid without permanent dialogue with society and without the capacity to transform society.
- The economic cycle between the university and society implies an exchange of resources and development capacities both for the university and for society. The production of resources and capacities within the university occurs when the communal university *knows how to act economically*. Put differently, the balance between economy, politics and society must prevail in the sum of all these complexities. Therefore, the *economic action* of the communal university must focus on the production of relevant knowledge that can transform society, as well as the formation of citizens who perform these changes. Failure to do so would seriously jeopardize the ultimate goal of the university.
- The focus on human action, understood as its capacity to *act economically*, implies building an economic-social-political equilibrium centered on the person, and the challenge is not to produce more, but to produce to live well or, even better, to coexist well. This, in turn, implies, giving priority to sufficiency rather than capital accumulation, giving priority to sustainability rather than economic growth[41] per se, giving priority to what is necessary rather than to commercial efficiency that leads to uncontrolled competitiveness. It is necessary to empower communities over their economies (Schuldt, 1997). Such an economy identifies with the university's mission to place the person at the center of its creative existence, fostering an environment that enhances its capacities to develop a meaningful life in the light of human dignity.

41 Sen is adamant that economic growth is not more than a means to an end, but also that for certain important purposes it is not an efficient means. I am not quoting Mismeasuring, that is to say, one can grow and not achieve development. Manfred max Neef, open letter to the Minister of Economy of Chile.

The complexity of the communal university is not limited to the productive system as economic income or knowledge production, but also encompasses the aspects described before. Uniting common knowledge and giving them meaning implies learning and sharing knowledge by the community; the characteristics of this organizational learning can be explained in the Ecosystem University from a model called *Working with People* (Cazorla et al., 2013):

- *Bidirectionality*: Implies the permanent exchange of information between those who make organic decisions and the groups affected by these. The two directions occur because groups contribute information that is incorporated into the project of the communal organization, but is also shared horizontally, allowing the other groups to contribute on the basis of this information.
- *Action-Based Planning*: Things always start with an action that generates knowledge, and this new knowledge triggers a new action.
- *People Feel Involvewd*: Active bottom-up participation activates validation of the acquired knowledge and strengthens organizational learning that descends as consensus top-down.
- C*onditions Application of Policies*: Development initiatives (bottom-up) fundamentally depend on the outcome of the organizational learning process. This learning process conditions the implementation of community development policies (top-down). (Cazorla, et al., 2004, p. 230-232)

Organizational learning takes place along a path of communal development, which in turn creates the conditions for mutual recognition of diverse interests; in addition to the social conditions for reducing resistance to change, it fosters charisma and consensus.

Still, it should be pointed out that the communal complex should be shaped by the communal management as a cultural factor for decision-making and not by communal ideals from the outside. The communication of action and best practices plays a major role when it comes to building culture and organizational knowledge. These two variables facilitate the transformation of knowledge from theoretical-individual to experienced-communal knowledge.

Community consensus is not a simple agreement but the result of a process in which knowledge is the result of action. Learning by doing and reflecting develops the capacities of the members of the communal university;

this goes beyond a simple methodology of teamwork and requires communal action that participates in organizational definition and decision making.

Communication is not a simple means but represents in itself the synergy produced by the exchange of value that perceives every organization as communication and every culture as communication.

As said before, the word - beyond facilitating communication - is the grammatical level that is used as part of the exchange. The Ecosystem University seeks to understand how the information and messages derived from communication and exchange can produce a level of organizational knowledge by the exchange and communication.

> Communication as exchange implies a political economy of the word, a communicational model that favors exchange; the word is loaded with a practice where social and economic elements are a substantial part of the institution of the commons and are not relegated to the need or domain of instrumental reason. The word represents an exercise of synergies produced by an exchange of knowledge and, therefore, the construction of values[42] (Juncosa Blasco et al., 2019).

Managing Change

The University needs to have the capacity to rethink and criticize itself, to raise new issues and answers, and therefore, it must be open to changes and new ideas. Innovation is not a simple reality but requires a more diverse and networked vision of the conditions for innovation, which involves the need for a global and analytical conception, but above all a complex perspective.

The greatest risk in managing change is to end up pushing for change for the sake of change, or a type of innovation that has no social effect because it is not produced by people. If the final aim is to consolidate an academic community, then this community must provide feedback for the innovation process, assuming, therefore, an organizational culture of innovation that is a strategy in itself.

The problem is that if innovation is expected to come from the same actors who are affected by the consequences of that innovation, this can produce unwillingness to change and a kind of unproductive comfort zone that

42 The values built from synergies are the result of a common assessment of interests, therefore, more than a must be or a utopian goal, they are values-obligations necessary to ensure the sustainability of the Common Pool Resource CPR.

people are reluctant to leave. Taking advantage of the fact that, in the world of science and technology, ideas often come from the study of nature (Hawking & Jackson, 2008) we will use three basic vectors proposed by Whitesides (Whitesides, 2015) to group the characteristics of ecosystems developed from the perspective of the organization and management of change: functionality, simplicity and dissipation.

Functionality

In nature, ecosystems exist thanks to energy, which they virtually never waste. Something that does not fulfill a specific function or produce some kind of benefit will simply be ignored. Although it is difficult to understand what kind of improvement or benefit organisms are interested in or how these can be achieved, studying them is gratifying because it provides answers that researchers often ignore (Vogel, 2000).

Ecosystems prioritize optimization rather than maximization, which is generally the opposite when it comes to mechanical or linear organizations. Ecosystem complexity implies a balance between *efficiency and equity* and trigger a vision where these are not only opposed but complementary. Optimization entails adaptability to the system's functionalities, recycling information, processes and materials, in addition to seeking multifunctionality (Biomimicry Guild, 2009). Maximization only focuses on the result of efficiency, justifying the means and breaking the interactions and interdependencies of the network.

The decomplexation and consequent pyramidalization of the organization can mean strength in a certain sense; for example, orders are obeyed quickly and compliance is effective thanks to extreme control (Herbert A Simon, 1962). The rigidity of these systems avoids redundancy[43] and therefore increases efficiency (Scheffer & Westley, 2007). However, the rigidity of the system impedes *learning* capacity (Pahl-Wostl, 2009) and considerably reduces *resilience* (Scheffer & Westley, 2007), generates slowness of response and disconnection from environmental concerns, in addition to being prone to problems of justice and equity (Duit & Galaz, 2008). Despite high potential efficiency, this does not imply robustness. According to Beer (Beer et al., 2009) the psychological alignment of individuals in these circumstances is motivat-

43 Redundancy is a concept addressed below as a fundamental feature of resilience.

ed by internal singularity and by objectives regulated by norms, which does not exactly motivate the propositive action and emotion necessary for a common development.

The key to pursuing optimization rather than maximization does not lie in exercising control but relying on self-determination and self-organization, which can be frightening at first. The crucial question is: can there be order without control, and, therefore, can there be order in chaos?

In reality, structure and order are possible even in chaos (Fernández et al., 2014), thanks to self-organization. It requires of course non-linear patterns and the outcome may not be an orderly order but an organized order. Some of that incomprehension of organizational complexity derives from the classic notion of science that *wild* and disordered nature requires our human actions of control to be ordered. Instead it is a matter of understanding, as Morin (Edgar Morin et al., 1994) says, that order is not only antagonistic but also complementary to disorder. In other words, if we try to impose order on disorder and resort to a systemic organization, this while not only lead to new order but also produce interactions that cause disorder.

While transitions are perceived as chaotic, they are actually a process of vital renewal that seeks a new type of organization.

Some authors even argue that the use of control can lead to disaster, albeit inadvertently (Pascale et al., 2000). So there is confusion between control and order. The paradigm of the machine organization has made us think that control produces greater efficiency, but in a real world,organization is organic, refuses to abide by identical rules, and control loses meaning (Wheatley, 1993).

With regard to control, McMillan (McMillan, 2004) believes that it is necessary to be aware that, in the long run, the future is unpredictable for any organization; that we must look at order and disorder as something that we need to encourage, and that a new order will emerge from something that looks like confusion; also that we must learn to work with and not against disorder. To this end, we must look for patterns, analogies, similar tendencies, fractal structures, as well as evidence of sometimes strange *attractors* (Lorenz, 1963).

Burns (Burns & Stalker, 1961), for his part, clearly establishes differences between mechanistic and organic organizations. In his work on *innovation management*, he establishes the differences set out in the table below:

Table 1
Differences between mechanistic and organic organization

A system of *mechanistic* management is appropriate for *stable* conditions and is characterized by:	**A system of *organic* management is appropriate for changing conditions that constantly produce new problems and unforeseen action requirements, to which functional logic cannot respond; it is characterized by:**
Differentiation and specialization of tasks and functions.	The contributory nature of knowledge and experience.
There is a tendency to seek technical improvement rather than an objective solution to the problem.	2. The "realistic" nature of the individual task, which is determined by the overall situation of the organization.
The precise definition of the rights and obligations and the technical methods corresponding to each role.	3. The continuous adjustment and redefinition of individual tasks by interacting with others.
Hierarchical structure of control, authority and cascade communication.	4. The understanding of "responsibility" as something not merely limited to rights, obligations and methods. (Problems are shouldered and responsibility is not delegated).
5. A strong hierarchical structure due to the concentration of knowledge at the upper levels of the hierarchy that make decisions regarding the different tasks and the respective impact evaluations.	5. Commitment to the organization beyond any technical relationship.
6. A marked tendency for vertical interaction between members (i.e. between superior and subordinate).	6. A network structure of control, authority and communication. Sanctions applied to the conduct of individuals in their work function derive from the interests of the community and the survival and growth of the organization rather than from a contractual relationship, represented by an immediate superior.
7. A tendency for operations and work behavior to be governed by instructions and decisions issued by superiors.	7. Knowledge can be located anywhere in the system, which then becomes the *ad-hoc* center of authority and communication control; it is not only in the responsibility of the organization´s head.
8. Insistence on loyalty and obedience to superiors as a condition of membership.	8. Communication is also lateral, not just vertical, and takes the form of a question rather than a command.

9. Greater importance on making a career within the organization than enriching knowledge, experience and capabilities.	9. Communication content that consists of information and advice rather than of instructions and decisions.
	10. Commitment to the organization and the *"technological ethos"* of progress and growth is worth more than loyalty and obedience

Source: (Burns & Stalker, 1961). Prepared: Salgado-Guerrero, J. P.

The optimization of the energy needed to produce change must be based on the functionality of the system, and its organicity implies that innovation must lead to individual and collective development.

Simplicity

Biological and natural processes are apparently so simple that they hardly warrant attention. Behind the growth of a plant or the simple fact of feeding us, for example, lies a tangle of complexity and a network of simple and reliable systems and subsystems that function interdependently. Introducing organizational changes that follow the same logic as nature, permits them to be assumed with the same *naturalness*.

Simplicity is imperative when introducing changes to reduce the forces of inertia. In this respect we can speak of the *"butterfly effect,"* meaning that small changes can have a great impact. Minor actions can produce major changes since sharing best practices generates a knock-on and often a systemic effect. The butterfly effect has a major impact in societies and organizations that are complex, dynamic (McMillan, 2004) and highly interconnected, where a small movement will affect the whole network. Although it is impossible to predict people´s reactions, the effect of their actions, or to trace the origin of the initial vibration, a complex network will always amplify or reduce the vibration wave; so if one is smart enough to introduce small changes that are assumed to be natural, these will eventually permeate the organization and produce mostly positive results, since the actors of the organization would not claim credit for those changes if these had negative effects.

Encouraging people to take on changes that are perceived as small, connatural and having potential for individual and collective development, can be very effective for creating organizational change of a certain scale.

From the traditional and linear perspective of organizational change, people often argue that methods and approaches will work more or less the same in most situations. Considering the complex perspective and the butterfly effect, however, this assumption must be contested; the effects and results generated by the initial movement can be totally different depending on the context; the butterfly effect is also referred to as sensitive dependence on the initial conditions (McMillan, 2004) and these are different for each person and each set of circumstances. Because of its specific history and culture, every organization is unique, and each actor, each group will respond distinctively, and differences may be slight or substantial.

As for the most important conclusions regarding the butterfly effect, we can emphasize that dynamic and dissipative systems are sensitive to initial conditions, i.e. small initial variations can lead to large changes in non-linear systems, and also that these complex systems are very receptive to feedback (Lorenz, 1990).

This implies that we cannot be sure to know what those little things are that affect the system or how they will affect the outcome. Complexity challenges the certainties of the linear principles of action-reaction or cause-effect. According to Gribbin (Gribbin, 1999), the only computer that can predict and simulate the universe is the universe itself. This uncertainty implies a major challenge for introducing changes in organizations. If we cannot control the system, how can we ensure the outcome of change management? It must be clear that the fact that a system is not predictable does not mean that cannot monitor it and therefore understand and explain its behavior; it is the values and the culture of and organization that support change management, since they guarantee a *certain type of stability* in the midst of the changing dynamics. This is because what initially may seem erratic and unpredictable, over time shows patterns that although diverse, weave a whole that exists in a singular order and generates a culture of the organization.

The paradox of order in the midst of disorder is often linked to different models of chaos theory (Lorenz, 2005), fractal designs (Mandelbrot & Pignoni, 1983), strange attractors (Ruelle & Takens, 1995), patterns (Libchaber et al., 1983), and universality (Feigenbaum, 1978).

McMillan (McMillan, 2008)encourages action to find out why it makes sense to value the butterfly effect or the sensitive dependence of the system on the initial conditions when introducing changes in an organization, and recommends the following:

- Encourage all employees, regardless of their role and status, to come up with ideas for further improvement based on common goals.
- Create the possibility and support for making improvements in work routines and implementing new ideas.
- Gently introduce small and seemingly insignificant changes in the short term, and they are likely to lead to major improvements for the benefit of the entire organization in the medium and long term.
- Managers must lead the way by doing what they preach.
- Make sure that people get used to ask for permission to do certain things when changes are first introduced; it might therefore take some time before they respond to any change in the 'rules'.
- It is important to recognize that everyone works uniquely in a unique environment dependent on the initial conditions of change, and that results will therefore vary throughout the organization; moreover, these results may well be totally unexpected.
- Empower the efforts of middle management to achieve change and more effective ways of working.
- Involve a wide range of people in the strategic processes and the future of the organization; this will help create multiple dynamics of change at many levels and in different areas.

Dissipation

Life develops only in dissipative or open systems. We are used to studying things from a linear perspective and without exchanging energy with our environment; however, almost all biological systems are dissipative and maintain a free flow of energy. Increasingly, science focuses its attention on these systems and tries to apply their logics to social organisms, cities (Folke, 2006), economies, etc. (Barabási, 2009).

Organizational knowledge appears as a dialectical process that creates new limits through dynamic interaction between agents-structure and tacit-explicit knowledge (Ikujiro Nonaka & Toyama, 2003). Furthermore, the creation of knowledge is a continuous and self-transcendent process that generates a new vision of the world and new knowledge (Ilya Prigogine & Hiebert, 1982). In his work *"Creating the Organizational Order of Chaos: Corporate Self-Renewal in Japan"* [216], Nonaka describes how understanding chaos theory could be used to create disorder and instability to produce important changes, where in the style of an open dissipative system, an organization would generate internal chaos linked to its external environment.

Opening the ecosystem or making it dissipative would imply:

- Ambiguity in the vision of the future, paradoxically, says Nonaka, this would open up the world of possibilities for creativity and broaden the range of possible responses, as well as for diverse interpretations and a much broader strategic vision. On a personal level, it would provide the opportunity to engage with the strategy *"each in their own way"*, which would be motivating and increase the energy for change and the creation of a common future.
- Fostering dynamic cooperation between actors produces different feedback that encourages changing views, sharing knowledge, and solving problems.
- Communication with the outside world must empower the novelty of information as well as new technologies; this would increase chaos and compromise the state of apparent equilibrium.
- Crisis[44] can help stimulate creative activities, new ideas and approaches to solving problems, often resorting to knowledge from outside the organization. Although it is not a question of leading the organization into crisis because of the crisis, this could be disastrous because the lack of an objective would generate despair; according to Nonaka, this would be as if a manager "put people on a second floor telling them to jump" (Ikujiro Nonaka, 1988).
- Direct dialogue between actors and involving them in the discussions independently of their state, as well as mobility between areas and roles helps increase redundancy and consequently resilience.

Opening the organization for interaction with the context and making it dissipative is to understand that change is not a *necessary adjustment process at a certain moment*, but according to McMillan (McMillan, 2004) "*a process of constant adjustment*". A mechanistic view of the organization would

44 Etymologically, crisis is the opposite of accepting an inevitable fate. The time of crisis is that of decision, intelligence and courage. In the face of a social or political crisis, the decision on which path to take depends on who has the power and the capacity to convince others. Our word "crisis" comes from the Greek ("κρίσις"): with the meaning of "separation", "distinction", "choice" (*Etimologia de la palabra crisis*, 2017).

wrongly try to freeze the time to produce the necessary changes – only the world does not stop turning for an organization trying to adapt to changes.

The continuous contact and interaction with the context produces a series of subjectivities. How to monitor such a dynamic and changing environment that at the same time reconciles an endless number of variables? Stake (Stake, 1995) argues that monitoring or research (in this case within the organization) must respect the continuous dynamics of change, and therefore be empathetic, i.e. respond to contingencies[45] and develop progressively. Only this type of research will produce organizational knowledge created from action guidelines and strategies, allowing the organization to be sustainable, flexible and capable of learning.

Action-research uses multiple methods that depend directly on the information that needs to be generated (Banister, 2011). *Subjectivity* should not be seen as a problem that we want to eliminate, but as an essential element we need to understand (Stake, 1995).

Knowledge in the organization implies learning, and such learning is not limited to the development of specific *skills*, but takes into account the system as a whole that interacts with the context (Senge, 1990), where the biggest problem is not how the University produces knowledge, but the potential gap with the context. From the perspective of knowledge management, as will be seen below, only interaction with the environment facilitates the transformation of organizational knowledge into a tacit-explicit continuum. Then one also *learns to learn* and, more importantly, one *learns to be*.

This book seeks to respond to the challenges that arise in a University whose organization follows an ecosystemic and dissipative approach, where the *logics of the problem are not identical with the logics of the solution* (Dostal et al., 2005), and reference points are needed to tackle them - exogenous knowledge or, in other words, exchange of *energy* with the context.

The Culture of Innovation as a Basis for Evolutionary Transformation

Universities are systems of multiple components an aim to offer the best conditions for learning and human development; however, defining the space of influence of the university is not easy. The ecosystem must be flexible enough

45 The term emergency refers to situations that emerge from within the organization.

to adapt to evolutionary changes and internal and external conditioning factors, as well as to effectively manage the resources and relationships that allow effective development of each of the states.

The complexity of the Ecosystem University makes it resemble a biological organism, in which the topology of groups and their evolution depend on a multitude of interactions[46].

For Levin (Levin, 1998), complex ecosystems can arise from disorder with minor agreements that become simple rules but that organize behavior with well-defined patterns, that is, organization with disorder; in his study on complex adaptive systems, Levin establishes three fundamental principles:

- Constant diversity and individual identity of components[47].
- Specific relationships between these components.
- An autonomous selection process among the components, based on the results of the interactions between them, and consequent replication or improvement.

The non-linearity of processes and the diversity of energy flows with the context, through which actors add value to their projects, change as they develop. Levin concludes that it is because of this very dynamics (the multiple meeting places) that the environment easily conditions the limits and qualitative changes of the Ecosystem. Therefore, a dissipative and complex system becomes practically uncontrollable; the alternative is to modify as much as possible the environment in order to influence the auto-organizational dynamics that facilitate an adequate autopoiesis[48] and keep the ecosystem alive.

46 Portugali justifies this statement by analyzing the interactions and their relationships with self-organization, making an analogy to the city as a complex system in (Portugali, 2012).

47 Here Levin makes a reference to Gell-Mann (Man, 1994).

48 *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).

According to Nemeth, the management of these ecosystems requires *"… experience, intuition, improvisation, expecting the unexpected, examining preconceptions, thinking outside the box, and taking advantage of fortuitous events. Each trait is complementary, and each has the character of a double-edged sword"* (Leplat, 2009).

The independence of actors in the ecosystem favors *"self-organization that evidences the adaptive capacity of the system, and these emerge 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).

The relationship between structure and functioning is of eminent importance when it comes to adaptive and complex ecosystems; it is essential to understand the relationships between the properties of the macro-state and its trophic structure[49] that emerge from the interactions between its components and that can therefore condition the ecosystem as well as the exogenous patterns that force it to adapt.

The interactions between the components facilitate evolution according to the properties of the biosphere[50]; the approach of this work is that a culture that enables innovation produces organizational evolution in the University.

Therefore, questions such as the extent to which self-organization conditions ecosystem variables, the analogous process of homeostasis (a process of extreme importance for maintaining life) in a university become very important; these behaviors are then analyzed with the help of biomimetic logic to establish some characteristics of a culture of innovation that fosters evolutionary leaps to higher states of the organization-university.

- Homeostasis is the ability of an organism to maintain a state of equilibrium (Cannon, 1932) (non-equilibrium), i.e. although some conditions change, the properties of the organism do not.[51] From the cybernetics point of view – of particular interest for this book because of its relationship with biomimetics -- homeostasis implies an adaptive reaction to keep the *essential variables* within an acceptable range (William

49 Structure or food chain is the process of transferring nutrients through the different species of a biological community.

50 Authors such as Margulis et al. consider the biosphere to be a super-organism resulting from the biotic and abiotic conditions of the planet (Margulis & Lovelock, 1974).

51 This definition introduced by Cannon comes after the first definitions of homeostasis that referred to the internal and physiological regulation of body functions (Cannon, 1932).

Ross Ashby, 1947). In cybernetics, homeostasis was used to explain the initiation of behavior and learning in machines and living beings (Di Paolo, 2000). A dynamic system has a high homeostatic capacity if it manages to maintain its dynamics close to a certain state or attractor. For the present study, the homeostatic capacity of the ecosystem depends on the resilience footprint, where the multiplicity of states in which groups may exist permits the ecosystem to adapt to changes or disturbances and assumes the *zone of viability*[52] without folding the system. Thus, homeostasis can be understood as an adaptive process of self-regulation that varies over time (Williams, 2006). Svyantek (Svyantek & DeShon, 1993) argues that there are two survival functions of the organization: the first is adaptation to change; experience in defending the group and advancing its cause in context creates a cosmovision. Self-organization According to Ashby, any dynamic system can be seen as self-organizing (W Ross Ashby, 1947) as long as there are *attractors*[53] that lead to interactions that facilitate global patterns or behaviors (Camazine, 2003). Although the process of self-organization implies greater organization, the same systemic process also implies interactions that produce disorder (Edgar Morin, 1984). We then need to differentiate between the actor, the attractor, the ecosystem and the organization to define the importance of self-organization in an ecosystemic University (Polanyi et al., 2013) (S. Kauffman, 1995) (Broekstra, 1998). The second survival function of an organization – according to Svyantek (Svyantek & DeShon, 1993) - is the development and maintenance of an integrated internal identity (Kwan & Walker, 2004).

As far as constant change in an organization is concerned, the ability to self-organize is fundamental, since without it, the system would soon wear out. On the other hand, an open system will always be open to changing conditions that come from the context, *organizational change is never only a one-dimensional series of successful activities, but will always take place in the midst of the turbulent transient states and the flows of interconnected activities"* (Styhre, 2002).

52 *Viability zone* is a term coined by Ashby as the zone of *ultra stability,* in which the system operates normally. If the value of the variables crosses the limits of its viability zone, the system has the possibility of finding new parameters that return the challenged variables to their viability zone (W Ross Ashby, 1947).

53 *"Attractor"* refers to the chaos theory of (Lorenz, 1963).

In fact, evolutionary changes occur in situations of crisis; without a culture capable of continuously responding to state change, an ecosystem perspective would be unsustainable. On the other hand, considering the organization as mechanical and not ecosystemic, would imply exactly the same - rigidity and lack of innovative culture -, which would cause trouble for the organization in the case of disturbances. It may turn out to be more costly to ignore culture than to deal with it (Millington & Schultz, 2009).

Acting on the edge of the critical state (Bak, 2013)does not necessarily imply unsustainability of the system, as continuous extinctions and replacements tend to perpetuate the functioning of the system thanks to its capacity to adapt [244]. It is therefore necessary to develop sustainable approaches that imply understanding the stages of development and its ability for continuously learning (Pahl-Wostl, 2009).

Resilience is key to making adaptation possible, and heterogeneity or diversity (Levin, 1998). is one of the essential variables. Meritocratic concepts are therefore counterproductive for an innovative culture that is predisposed to evolution. Hierarchical systems of simplified structures are fragile and vulnerable because they have no alternatives to respond to stress caused by changing conditions or human factors.

Further below, we shall examine the resilience of an ecosystem in greater depth and this book suggests the following definition for *University Resilience*: *"The capacity for evolutionary self-organization, based on the production of relevant knowledge to allow interaction with the changing conditions of the environment, allowing it to give a proactive response that is creative, imaginative, resourceful and performs the very characteristics of its identity."*

Evolution forces us to venture to discover new things, often by accident, which is usually the case with scientific discoveries and inventions; at the same time, evolution also forces us to prepare the human element, prepare the mind to innovate.

A Culture of Innovation is a strategy of evolution in itself. This new conception envisages new challenges for the University (Herrán Gómez et al., 2014, p. 14):

1. The fundamental participation of teachers and students in the process of producing knowledge from research that enables them to move

from teaching to understanding and explaining how knowledge is produced, and to integrate in their practical work the unconditional connection between Teaching and Research.

2. The centrality of the Human Group (Research, Innovation, etc.), rethinking the relations with satellite instances, providing meeting spaces, stimulating the emergence of the groups and the coherence with the research agendas.
3. The necessary sustainability of the innovative solutions that were found.

There is a fourth challenge that results from the previous three: The consolidation of the Scientific or Academic Community.

The context conditions the origin of innovation, it influences the groups of the Ecosystem University either by the origin of the resources or by their trajectories, by the way in which they face situations and the animation from the highest instances, etc.; interaction with the environment and the production of knowledge demand planning, recognizing that innovation and change are established in two directions: those innovations driven by the logic of management (top-down), and those that arise from knowledge production practices either from professors or from research groups (in situ, bottom-up).

We need to approach innovation in the Ecosystem University from the practice of a dialectic vision of reality. The main question is to what extent innovation and transformations are put into practice and how these innovations are effectively controlled from the beginning till they are adopted. Those who promote and manage change and those who implement it need to negotiate all along. As mentioned above, this requires an Academic Community that is prepared for the new, for a shift in paradigm, and greater flexibility. The most important changes are not structural, legal or external, but those within people, regarding their attitudes and behaviors.

Organizational culture refers to accepted values, the expectations and conceptions that characterize an organization (Beer et al., 2009) and therefore its actors. This culture is a social concept and thus forms the bonds of community in the organization. Therefore, it depends on its history, on what has worked and what has not. A common mistake when driving innovation in the organization is that nobody knows its origin or the projection of these values (K. S. Cameron & Quinn, 2005) The future is the continuous sum of those present; therefore, no matter how many objectives are established, these will be the result of multiple changes in the consensual vision, the sense (direction and raison d'être) of change[54], benefits, appropriation and provision (E Ostrom, 2008), the required indicators and metrics, accountability, communication systems, the demands of the context on the organization.

In a social system or organization, the whole will always be greater than the sum of its parts (Edgar Morin, 1984) and the action of a single person or group can therefore cause major synergies, such as creativity, motivation, orientation, etc. What is referred to as *emerging properties* (Dostal et al., 2005), that is to say the interaction of the individual components (people, departments, stakeholders) that give rise to patterns of behavior as an emerging global structure (Strümpfer, 1993).

While the presence of these emerging properties is favorable for self-organization, the assertion derived from ecosystem complexity that the *whole is greater than the sum of its parts* implies that it is the interactions between actors that make the difference, which is why organizational culture is so important.

On the other hand, it is necessary to guarantee the dynamic capacity of the strategy so that we can improve it any moment; still, innovation should always point to the globality, complexity and interrelation of all components.

Fostering a culture of innovation at the university will basically depend on the following factors:

- Powerful teams in the sense of autonomy. The fundamental factor for success of these groups is the possibility of combining their institutional adaptability with the administrative ability to merge new management values with traditional academic values.
- A highly developed context. Establish mutually beneficial logics with the political, state, public, private, social, and academic sectors, networks, etc. in short, with the actors of each of the parts of the expanded ecosystem; by using a thermodynamic metaphor, these actors can provide the Ecosystem University with knowledge-energy.
- Diversification of resource sources. This not only favors the expansion of functions of university activities, but also frees us from depending

54 Further below, this book proposes a different vision of planning that results from a continuous cycle of communication-action-knowledge that helps to project the possible futures of the organization according to the collective feeling and the relevance of the context. A similar practice in the field of social development is proposed by Herrán (Herrán Gómez, 2015).

on the strength or weakness of a single source of resources. Thus, we need to understand the benefits and limits of redundancy.

- A motivated faculty. It is important for the academic groups of the University, whatever their nature, to maintain their traditional values and practices while integrating new management practices through a continuous and strategically defined training on the part of the University. Emotions, as mentioned above, also entail a cognitive particularity[55].
- Integrated innovative culture. The capacity of the University to preserve its specific and original identity and, at the same time, innovate the logics of its academic work.

Well-led rather than well-managed changes. The lack of traditional command structures or hierarchy implies that people do not feel obliged to follow anyone. Therefore, leadership comes from within (Molitor, 2009), from the culture of the organization, people become leaders by leading and being a magnet for talent will attract talented people. Self-organization in a culture of innovation is the product of passion that groups have for what they do and the credibility they build over time (Deutschman, 2004).

Finally, the importance of organizational culture modifies the perspective for understanding quality; the frame of reference for quality moves from understanding it as a set of tools to understanding it as a cultural phenomenon of assuring institutional identity (K. Cameron & Sine, 1999).

Entropy: The Only Certainty Is Uncertainty

Entropy analysis offers the possibility to understand the highly complex phenomena inside a system in a relatively simple way and to encrypt them in a global vi-

55 Alessandrini develops a work based on Nussbaum to ensure that emotions are not only the fuel that feeds the psychological mechanism of the human being who reasons, but that they are also a constitutive part of the reasoning part of the subject, giving meaning to what surrounds him by creating values and valorizations and, therefore, giving meaning and value to knowledge [364]. Recognizing a cognitive content of emotions means not only moving away from the accusation of irrationality but also understanding that intellectual activity needs togo hand in hand with sensitivity in order to capture and communicate knowledge [313]. Emotions support the processes of agentivity that cannot be ignored by the cold intellect; the motivations that accompany the decision to act affect the constitutive part of the system of ethical reasoning that constitutesthe the basis of the process of participatory social innovation and, therefore, of knowledge creation.

sion of this system. Perhaps this explains the countless analogies between thermodynamic and other types of systems that aim to understand their complexity.

In this section we shall explain the reasons why the entropy criterion is highly useful for the analysis of an Ecosystem Model for the University; a selection of entropy definitions for different systems. Understanding their functioning in matter systems and living systems will help us understand the complexity of entropy for an ecosystem. Some approaches to entropy:

In Greek, entropy (τϱπη) means transformation or evolution[56]. Rudolf Clausius first proposed his concept when he laid the foundation for the Second Law of Thermodynamics (Clausius, 1867); this term was assigned to the measure of energy of a body that cannot produce work, defining it as transformational content. Furthermore, Clausius' considerations imply that energy in the universe is constant and entropy keeps its level or tends to the maximum.

According to the second law of thermodynamics, entropy never decreases in an isolated system, which establishes the irreversibility of systems. These systems spontaneously evolve to thermodynamic equilibrium, which is the state of maximum entropy. However, in non-isolated open systems, entropy can vary as long as the entropy of its environment experiences at least the same change in entropy change, as entropy is a system state function. The change of entropy defines whether or not the system is reversible. Irreversible systems experience an increase in the combined entropy of the system and its environment.

56 As an interesting anecdote, Heinz von Foerster in 1984, while participating in the symposium relates that: "When Clausius thought about it (that, by joining two containers with different temperatures, heat will transfer until temperatures are equal) very carefully, he realized what was happening: the decrease in the difference between the two temperatures, more and more reduces the pssibility for convertibility, the change, the conversion of thermal energy into work. Therefore, I wanted to give this possibility of being able to activate or change heat at work a good and catchy name. At that time it was very popular to use Greek for neologisms. So he went to his dictionary and looked up Greek for "change" and "transformation". He found the word trope. "Aha," he said, "but I'd like to talk about not changing, because the longer these processes last, the less heat you can turn into work. Now, unfortunately, either he had a lousy dictionary, or he couldn't speak Greek very well, or he had friends who didn't understand what he was talking about. Instead of calling it utropia, because ou is the Greek word for non, as in "Utopia" (without place) - and utropia as he should have called his new concept - for some reason he called it "entropy", because he thought en is the same as the Latin in and therefore means "no". That's why we're stuck with the wrong terminology. And what's worse, no one checked it!... So, in the right jargon, when these two containers are brought together, the utropia of both increases, because the possibility of change, to transform heat into work, becomes less and less.

The variation of entropy is defined as:

$$dS > \frac{dQ}{T}$$

Equation 1: Variation of entropy

Where S is entropy, Q is heat and T is the absolute temperature in °K. Although the principle of evolution was first expressed by Carnot in 1824, Clausius' considerations of irreversibility still get the attention of the scientific community.

Ludwig Boltzmann (Boltzmann, 1898) introduces a definition of entropy from statistical mechanics[57] by analyzing the microscopic components of the system, which he defines as molecules and atoms and shows how these can be arranged in the system. Therefore, entropy is the extent of disorder or tendency to disorder of the particles and indicates how system wears off over time. Statistical mechanics, as expressed by the definition of the concept of entropy, as being thermodynamic, is expressed by its experimental definition.

It was Max Planck who defined the formulation for Boltzmann's entropy as:

$$s = klnW$$

Equation 2: Entropy of Boltzmann

Where S is entropy, K is Boltzmann's proportionality constant and W is the number of states that the system can assume, or the number of possible dispositions of system particles. In other words, entropy is proportional to the logarithm of the number of micro-states that could result in an evident macro-state of the system. This is why entropy is associated with disorder because the greater the number of states, the greater the entropy, the greater the disorder and the lower the quality of energy. The interpretation of entropy in statistical mechanics is the measure of uncertainty or mixing that a system has, according to Gibbs.[58]

57 Statistical mechanics is a branch of physics that, through probability theory, seeks to deduce the behavior of physical systems that are complex because of the number of interactions of their components.

58 Josiah Willard Gibbs is a well-known mechanical physicist to whom we owe Gibbs' paradox that, if in a closed system of constant pressure and temperature any two ideal gases are

Upon studying the amount of information in a transmitted message, Claude Shannon[59] gave another view of the theory of entropy in 1984, defining it as "an absolute limit of the best coding of the digital message without any loss" (Shannon, 1948). For Shannon, particles are bits used to form a symbol and entropy is the number of questions, the answer to which is binary (yes or no), necessary to determine the content of the message.

Based on Shannon's entropy definition, Henri Theil introduces the concept of relative entropy into the economy, which mainly establishes economic inequality, division or dispersion. Although it has also been applied in other ways, it is equivalent to the redundancy that in information theory is the relationship between observed entropy and possible entropy, and has been attributed parallels with: segregation, inequality, compressibility, lack of randomness or little diversity. This concept, which Shannon also referred to as equity index, is an important way of measuring diversity that has been used in biology, ecology and urban studies.

From the social perspective, it is significant to address at least three concepts of entropy: the one used from the social or cultural perspective, the one used in economics, and the one used from the urban perspective. Focusing on social changes, especially those generated by modernity[60] marked by its globalizing tendency[61], entropy finds an extensive scope for the formulation of

mixed, the variation of entropy of the system will always be positive even if both gases are the same. In other words, there is an interaction in the mixture of particles in the system that denotes an increase of entropy (Gibbs, 1877).

59 In the field of *information theory* entropy, also called information entropy and Shannon entropy (after Claude E. Shannon), measures the uncertainty of an information source (Shannon, 1948).

60 *Modernity* is a term used by the human and social sciences that refers to the historical period of the European post-medieval era, in which countless socio-cultural practices and norms emerged that are subject to constant updating and change. This period, which involves a number of historical processes, is marked by logic and reason, equally linked to the ethos of philosophical and aesthetic modernism of the Enlightenment, which later brought about developments such as Marxism or existentialism, as well as the relations associated with the emergence of capitalism and the changes in culture, institutions and politics related to secularization and post-industrial life (Berman, 1983).

61 For the purposes of this text, Globalization can be defined as: "the increasing interaction of people through the growth of the international flow of money, ideas and culture, goods and services, generating a greater interdependence of economic and cultural activities". According to the International Monetary Fund (IMF), the four basic aspects of globalization are: trade and transactions, capital and investment movements, migration and movement of people, and the dissemination of knowledge (International Monetary Fund, 2000).

analogies. The term entropy can often be found in connection with economic or political analysis; still, sociologists like Sánchez-Parga have advised not to overlook culture, which they see as being submitted to a homogenizing dynamic related to a process

> of centrifugal effect of acceleration of changes; if these result from intense communication between societies and cultures, whose reasonings and exchanges accelerate transformation, such transformations tend to adopt the same direction, meaning, and cultural forms that are increasingly popular (Sánchez Parga, 1997).

Initiated by countless social relations, the measure of this highly homogenizing interaction ensures that cultures, in a kind of osmosis, adapt to or adopt characteristics of other cultures losing part of their own, marking a unidirectionality of the changes. According to Sánchez-Parga (Sánchez Parga, 2013b), social entropy is a unidimensionality of the forms adopted by these changes.

However, the homogenizing phenomenon corresponds to another complementary, compensatory and balancing phenomenon that is produced by globalization. To the extent that cultures do not know their (generally physical) borders and their distinguishing features, these very changes begin to recompose themselves generating new cultural territorialities that are characterized by differences affirmed with greater rigor, an effect that Sanchez Parga defines as social negentropy.[62]

It is the task of other social-sciences-related investigations to establish with greater clarity the analogy that may exist in the relations between bourgeois culture and popular culture, or between the homogenizing entropy and the heterogenizing negentropy. Of interest for this study is the latent dualization that society can undergo: groups of internationalized culture and groups of culture withdrawn in their particularities.

From the point of view of social sciences, this implies that, as a result of social entropy and negentropy, there is a difference of classes of the same social groups; it is the result of new and increasingly differentiated social identities, characterized by other antagonistic disidentities. In other words, the greater the entropic and negentropic forces, the more of a globalized society with high individuality we shall get.

62 *Negentropy* is seen as reverse entropy, i.e. the tendency to order or structure, as opposed to randomness or chaos. When negentropy reaches its maximum value, i.e. maximum order, entropy is null (Zopf Jr & others, 1962).

If we add to the vision of socio-cultural behavior the fact that all human activities impact the planet depending on the resources they use for well-being, we will get a concept of social entropy with respect to development. In this sense, Bailey defines social entropy as "the diversity of social parameters" " (Bailey, 1990) and opposes social structuring. Such social parameters can be wealth, culture, knowledge, information, technology, etc. When correlations between the variables are high, i.e. when a group of individuals with similar characteristics possesses or accesses resources equitably, and if they are in similar social parameters, then entropy will be minimal. Conversely, when a group of individuals is found at different levels of social parameters, the level of entropy is higher. According to Bailey, low entropy guarantees well-being.

Thermoeconomics[63] suggests an analogy with economic systems using thermodynamic terms such as matter, energy, entropy and information. It considers economic systems as dissipative structures, where human activity, marked by transformations and exchange of resources, goods and services, consumes energy [430]. According to the second law of thermodynamics, "the amount of entropy in the universe tends to increase over time". From this vantage point, entropy in the economy can be defined as "a measure of quality" between the energy that enters the system and the energy that results from it [429] and is directly linked to the destruction of the exergy, which is the useful energy to produce work.

$$\Delta \mathrm{E} = \mathrm{T}_0 \Delta \mathrm{S}^{\mathrm{tot}} = \mathrm{E}_{\mathrm{i}}^{\mathrm{tot}}\text{-}\mathrm{E}_{\mathrm{out}}^{\mathrm{tot}} = \sum_{\mathrm{i}} \Delta \mathrm{E}_{\mathrm{i}}$$

Equation 3: Energy Variation

The equation defines the destruction of exergy ΔE in relation to the total increase in entropy ΔS^{tot}; E_i^{tot} is the total value of the incoming energy; E_{out}^{tot} is the total value of the outgoing energy, and ΔE_i is the destruction of exergy in the process i.

63 Thermo-economics is a heterodox school of economics that establishes an analogy between economic systems and thermodynamic principles. The term was first used in 1962 by Myron Tribus (Gong & Wall, 1997).

From this perspective, the term Exergy is taken up again as a way of evaluating environmental impact from a cost-benefit perspective. Minimizing the cost of living reduces entropy and, consequently, minimizes environmental and social impacts.

Prigogine (Ilya Prigogine & Stengers, 1979) looks at the city as a complex ecosystem that can be considered as a dissipative structure that consumes energy and, therefore, also has entropy. Müller (Müller, 2010) on the other hand, asserts that complexity is a factor that ensures self-organization. Alluding to F. Müller's "*Sustainable City 2010*" and in search of a new "urban ethic" in accordance with eco-urban planning, Fistola [431] seeks to define the characteristics of a so-called *anthropogenic entropy* that, in his opinion, is the main antagonist of urban sustainability.

According to Fistola, the crisis of urban systems is generated by the endogenous functioning of urban micro-systems that produce entropy either through land use or activities that impact air pollution, electromagnetic noise, water use, etc. Furthermore, he argues that this entropy production is transmitted in a kind of chain reaction towards the other systems of the city. In order to guarantee sustainability, it is therefore reasonable to reduce levels of urban entropy.

Pedro Cabral (Cabral et al., 2013) states that urban systems need to meet two requirements to survive: (i) they must efficiently supply the material and cultural goods that assure the quality of life of a city´s inhabitants, (ii) the system must be flexible enough to guarantee its capacity to absorb internal or external impacts. These requirements imply a territorial order and an organization of human action. Therefore, the management of entropy assumes two orientations: while systems such as mobility, communications, public services and their availability in the different areas of the city need the lowest levels of entropy.

Urban geography requires a certain redundancy and diversity, i.e. entropy, in order to improve the city's capacity to resist potential impacts such as natural catastrophes or man-made crises.

Although somewhat ambiguous, the concept of entropy is useful for describing a macro-state, taking into account the behavior of its micro-states. It establishes a relationship between chaos and organization, order and disorder, uniformity and diversity. The following table presents the synthesis of the concepts applied by the present study.

Table 2
Some entropy concepts useful to study

Area	Definition of entropy	Observations	Author
Thermodynamics	Transformational energy content that cannot produce work.	Experimental definition of entropy.	R. Clausius (1876) [340]
Statistical Mechanics	Measurement of disorder or tendency to chaos. Measurement of uncertainty or blend of a mix of gases.	Definition of the concept of entropy.	Ludwig Boltzmann (1898) [422] Max Planck (1900) J. Gibbs (1875) [423]
Information Theory	Absolute limit of the best lossless coding of the digital message.	Amount of information needed to specify a microstate of the system without the need to describe the macrostate.	C. Shannon (1948) [424]
Economy	Relative Entropy: is the measure of redundancy or proportion of uncertainty and establishes economic inequality, division or dispersion.	Proportion of the possible maximum dispersion in which a variable is distributed over several states.	H. Theil (1972) [433]
	According to Thermoeconomics: A measure of quality between the energy that enters a system and the energy that exits, quality of exergy.	The greater the entropy, the less efficient the management of resources, goods and services.	S. Sieniutycz P. Salom (1990) [430]

Social Sciences	Entropy in Culture: Extent to which high interaction homogenizes cultures. Negentropy in Culture: Extent to which cultures ignore (especially physical) borders and features that differentiate and recompose them, generating new territorialities and affirming their differences.	Unidirectionality of the changes and unidimensionality of the forms that these changes adopt. The greater the entropic or negentropic forces, the greater the socio-cultural difference, resulting in a globalized but highly individualized society.	José Sánchez-Parga (1997) [225]
	From the point of view of Development: the diversity of social parameters and opposes social structuring	If a group of similar individuals are equitably found in the different social parameters, entropy is lower and therefore there is greater well-being.	K. Bailey (1990) [428]
Urbanistic	Anthropogenic Entropy, caused by human activity or land use, is antagonistic to the sustainable use of natural resources.	Territorial order: it is necessary to maintain a minimum level of entropy (redundancy, diversity) that guarantees the system's capacity to resist exogenous or endogenous crises. Organization of Human activity: it is necessary to maintain the lowest levels of entropy that guarantee the sustainability of the system.	I. Prigogine (1979) [241] R. Fistola (2012) [431] P. Cabral G. August M. Tewolde Y. Araya (2013) [432]

Elaboration: Salgado-Guerrero, J. P.

Paradox of Entropy and Sustainability in the Ecosystem University

Based on control, the systematic organization that must evade chaos, obeys a rationalist vision; justified by the entropic tendency of the universe towards a state of total dissipation, loss of energy and consequently its death, the linearity of rationalist thought could only understand chaos as the state preceding order; from the laws of thermodynamics, it was meritorious that reason be imposed on chaos.

However, the notion that chaos and disorder lead to death changed in the middle of the 20th century, when experiments were made with natural (living) systems that prefer the increase of entropy, and, what is more, use it as a generator of life. The *Chaos Theory* and its theorists argue today that *chaos makes order possible* (I. Prigogine & Stengers, 2017). The notion that life arises against entropic dissipative processes (Rísquez, 2002) seems to be misleading, as this happens rather within them.

Open systems are extremely complex, interact with their sustaining environment to which they return their products. They are composed of dynamic hierarchies, interacting groups, organized and self-organized structures and above all, they produce non-linear results. Their complexity increases considerably if one takes into account that these systems serve one or more purposes.

Contrary to the disjunction and reduction that entails the paradigm of simplification, the University today faces a paradigm of complexity, conjunction, distinction and implication (Edgar Morin et al., 1994). These are the principles that sustain a *unity in complexity*, *a culture of creativity and innovation and pertinent knowledge*; the complex interaction with its territory turn it into a *product and producer of social innovation*.

In the middle of this complex system emerges the concept of entropy, which, in the case of the Ecosystem University, needs to be analyzed with a twofold approach: on the one hand, the second principle of thermodynamics indicates that matter has a tendency to disorder and disorganization; on the other hand, the growing complexity means the intervention of indeterminacy, disorder and chance so that life is re-configured and the system is self-organized (Von Neumann et al., 1966).

The Ecosystem is a complex and dissipative open system[64]. The horizontality of its structure, the need for independent interactions between its

64 They are called *dissipative structures* because they are maintained by continuous "dissipation" (or consumption) of energy.

components demand a vision of its macrostate in correlation with its microstates. On the other hand, we also need to understand it as a living system and combine it with the notions of a system of matter that allows us to establish some fundamental principles for analysis.

For Prigogine "*dissipative structures are islands of order in an ocean of disorder*" (I Prigogine, 1997). He points out that nature is creative, has the capacity to generate new structures beyond the simple sum of its components, and is capable of reinventing itself. The explanation of *dissipative structures* (García Velarde & Fairén Le Lay, 1980), in addition to winning him the Nobel Prize, allows us to conceive the way in which disorder generates order. New complex organizations are built from chaos and far from equilibrium. From this point of view, entropy known as degradation and tendency towards thermal death, would be linked to dynamism and the creation of the new. It happens that in situations of non-equilibrium the principle is non-linearity, which means that there are many possible probabilities.

From the perspective of Information Theory and entropy as an agent of chaos as the potential for restructuring and recreation from uncertainty, the possibilities of new state structures are also a potential for self-organization, and this self-construction ensures self-regulation. "S*elf-organization evidences the adaptive capacity of the system, which 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).

Because entropy cannot decline but only stay the same or increase, the system can only self-organize, self-construct, and evolve into a new and higher state.

Heylighen (Heylighen & others, 2001)argues that in order to evolve, dissipative systems need to maintain heterogeneities. Without evolution, systems degenerate and homogenize until they are destroyed. Hence, what is needed is *sustainability* with certain open *vulnerability* to the changes of the economic, social and environmental conditions of the setting to guarantee evolution and generational survival. This way, the different evolutionary states reduce entropic tendencies.

The paradox seems to arise from a misconception of entropy, as stated by Candel Rosell (Candel Rosell et al., 1984) in his review of the concept of Chaos; if a thermodynamic macrostate is characterized by the spatial and energetic distribution of molecules, and a system evolves, its molecules can be redistributed both spatially and energetically, that is, in the process of evolution, the increasing entropy is the result of *organizational* and *thermal* entropy.

Vulnerable sustainability[65] implies understanding sustainability from the dimension of entropy as an admissible maximum and minimum: a lower limit is maintained in the organization under which it becomes rigid or homogenized and loses its potential and the capacity to reconstruct itself in order to evolve; the maximum limit is respected before the system becomes unsustainable due to the amount of resources it requires for production and turns against the organization itself.

If the organization´s objective is production itself, it will require as many resources as necessary, compete for them and create two phenomena: extreme individualism, which breaks the bonds of cooperation and therefore compromises production; and the irreversibility of the system due to the depletion of resources that collapses the Ecosystem.

On the other hand, excessive or imposed organization will limit the production and innovation capacity of the ecosystem, because uniform attitudes and processes of knowledge production tend to suffocate productive energy. This usually happens in organizations with bureaucratic control structures.

The zone between maximum and minimum entropy denotes the *vulnerable sustainability* of the University. This maximizes production, always taking into account the critical objective of the organization of the Ecosystem, which lies in objectively combining the individuality and interest of people with the interest of the organization they depend on, and their interactions within and outside the academic community, including the relationship with the territory of which they are also part.

The management of the Ecosystem and the management of entropy levels is therefore a *Political Management of the Economy* rather than an *Economic Management of Policies*. From this point of view, it makes sense that the

65 Sustainability is often linked to efficiency and equity, but when the risk increases significantly due to the search for opportunities, that search implies a greater waste of resources and, therefore, less efficiency. However, even with lower efficiency, the possibility of innovating increases, even more in a situation of risk. While the efficiency in global terms may be lower, the efficiency with which the search for innovation is carried out in situations of risk will consistently be at its maximum. Therefore the aim for sustainability is essential, one must always bear in mind that such sustainability is vulnerable and positive for innovation considering the context in which such vulnerability appears.

control of the organization is governed by the results that the *digesters* of the system feed back into the life cycle of the Ecosystem. The Ecosystem *digester* must provide useful information for *Knowledge Management* of the Ecosystem.

According to Heinz von Foerster (Von Foerster, 2003), a system can self-organize and survive if it deliberately introduces *noise*[66], i.e. the increase in uncertainty increases the options for action because there is more information (expectation or novelty). In his dissipative systems theory, Prigogine refers to this as *order from chaos*. Therefore, contrary to what is thought in planning, a greater entropy and consequently uncertainty and complexity increases the number of options for self-organization and self-creation of the system. "*The imagination of the possible, the speculation about what might have been, is one of the fundamental features of human intelligence* (Ilya Prigogine & others, 1996).

Entropy is zero not only in highly individualized diffuse systems with zero interactions between actors, but also in highly organized and ordered structures. These extremes can cause the irreversibility of the system. On the other hand, there is also an organization whose order is unstable and which stays between maximum and minimum entropy levels.

An Ecosystem is a dissipative system in which the exchanges of energy produced by its dynamics at the same time create it. It is like the wind that turns in a whirlwind or a hurricane and at the same time creates it. The stars, including the sun, are examples of dissipative systems; fluctuations and the move from one stationary state to another generate order in disorder.

The complex Ecosystem produces non-linear results. Depending on the dynamics of its hierarchies-heterarchies,[67] its multiple purposes, its capacities and knowledge, the Ecosystem will interact with the environment by receiving supplies and delivering products. Let us bear in mind that the Ecosys-

66 Prigogine establishes the notion of noise directly related to entropy for the fluctuations that cause the passage from one stationary state to another, generating an order from these fluctuations.

67 Studying the variation of individual preferences, McCulloch showed that there is an inconsistency between the hierarchy of values that are assigned to them, e.g.: if someone prefers A to B, B to C and C to A, this "inconsistency" cannot be explained by a theory that assumes a simple hierarchy of values. However, it is consistent with a more complex system that has superior orders, but does not allow the construction of a scale of values. Although McCulloch did not define the term "heterarchy", he did use it in a paper on psychology. (McCulloch, 1945)

tem produces knowledge from research and innovation, and at the same time promotes the individual development of the people who live in it. In addition, these people self-organize into groups according to their shared interests. The following considerations are, therefore, crucial:

With regard to groups:

- The variable relationship of individual work and network[68] (*variable cooperation*).
- The variability of its orientation between hierarchical and flat (McCulloch, 1945) (*variable heterarchy*).

With respect to the Ecosystem:

- The results that require different forms or channels for each type of production (*states of production*).
- The probabilities and interaction are multiple, and these probabilities will help us establish the entropy relationships and their whole as total entropy.

With respect to knowledge:

The presence of novelty implies the potential for the creation of new states of knowledge production. Monitoring their variance is an indicator of the behavior of the group that produces knowledge; this is possible since the data that form the basis for modeling refer to the results of events that we call *states* that are cognitive in nature. In other words, they are all related to knowledge production processes.

The presence of novelty cannot by itself measure information, and certainly does not have an exact mathematical relationship with the knowledge that can be produced; the concept of novelty is linked to uncertainty and this, in turn, to the entropy of the Ecosystem. The latter contains a great potential descriptor of what happens in the Ecosystem. As will be seen below, its dynamics are related to the processes of self-organization, resilience capacity, development zones, knowledge production, innovation and sustainability.

An Ecosystem is not subject to immutable determinism and identically reproducible laws, but can rather be described as creative because it is in-

68 In his review of the concept of Chaos, Candel Rosell states that in the process of evolution, the increasing entropy is the result of an organizational and a thermal entropy. By analogy and for the effect of the present work, we could assume the cooperation variable as thermal or energetic entropy (Candel Rosell et al., 1984)

vented and reinvented and therefore its temporal dimension is far from exhausted (I Prigogine, 1997). The presence of novelty and entropy is fundamental as creativity would not be possible without them.

Sense and organization can exist in disorder, as shown by codes of Genetic information (contained in the form of structures), for example, or by the states of equilibrium of ecosystems which are far from being static but show a dynamic complexity.

In another part of his work, Campbell emphasizes that information *"exploits the uncertainty inherent in the entropy principle to generate new structures and shape the world in new ways"* (Campbell, 1989).

Thus, the potential for novelty makes it possible to monitor uncertainty or entropy (in Information Theory) to make decisions and devise strategies that lead to evolutionary leaps in the organization of groups or Knowledge Management actions, thereby using *the partially predictable* aspects of the Information to strengthen the cognitive capacities of the individuals that act in the Ecosystem.

Knowledge Management is, thus, possible if one can determine the moments of high possibility of novelty to influence the dynamics of transformation of the tacit-explicit continuum (Ikujiro Nonaka & Takeuchi, 1995), i.e. to understand and manage the relationships that exist between *data, information and knowledge*[69]:

The concept of information and its relationship with entropy links the world of data and the production of knowledge, which is why it is important to understand its dynamics in the Ecosystem. For this purpose we will use the Information Theory; differently to what Campbell (Campbell, 1989) says, it is not possible to standardize its concept. Thus, from the scientific definition of Information with respect to the mathematics of probability, Campbell goes as far as even declaring that information *"specifies the peculiar character of living forms and even helps to determine models of human thought by means of special codes"* (Campbell, 1989).

69 The issue of knowledge management, the differences between data, information and knowledge will be addressed in greater depth below: For the time being, suffice it to allude to the differentiation between the concepts of tacit and explicit given by Michael Polanyi (M. Polanyi, 2009) with a simple phrase *"we know more than we can say"*.

Resilience: The Capacity for Creative Self-Organization

Why and What Resilience at the University?

The term *resilience* has been widely used for some decades in various fields, notably in connection with natural disasters. Although approximations can be found in economics, sociology, ecology, climate change, urbanism, engineering, organizations, etc., its etymology can be understood from the Latin word *resiliens*, which combines *re* (intensity, reiteration) and *salire* (rise, jump) (Anders, n. d.). The many academic interpretations of resilience take different approaches, many of them only address the complexity of its definition, perhaps because quantifying it seems even more complex depending on the area of science from which we approach it. However, people seem to agree on its usefulness. In this section we will not only try to define it as a tool that provides useful clues for the definition of policies within the Ecosystem, but also to provide a vision regarding the dynamic nature of resilience.

Conceiving the University from an eco-systemic point of view fundamentally entails a culture that endows the community with the capacity for *self-organization;* this implies understanding resilience as the *potential creator of sovereignty*, *self-definition*. In a nutshell, it is the impulse that gives energy to the Ecosystem to prepare it to face not only adverse situations, but also *make an evolutionary leap each time it closes the development cycle.*

It is not a simple question of adapting to the changing conditions of the environment, but the *capacity to give a pro-active response that produces, imagines, devises and acts the characteristics of the university identity.*

By way of dialogue, the eco-systemic principle[70] mixes individual and group resilience; its two-way relationship triggers individual resilient response and collective resilient behaviors.

Not only the University but many other organizations today replace pyramidal and rigid structures with complex and dynamic systems. The concepts of democratic, innovative networks, endowed with relative autonomy and based on common values, are increasingly accepted not only in the business world but in every human organization.

70 There is a complex relationship of indivudal and group resilient elements that can be better understood in relation with the systemic principles of Morin (Edgar Morin et al., 1994).

Table 3
Some definitions of resilience

Area	Definition of resilience	Observations	Author
Ecosystems	The system's ability to respond to disturbances through adaptation and change, through which it can respond to impacts and disturbances, absorb disruption, maintain self-organization, and avoid thresholds of noncompliance and irreversible change.	Linkage with the stability criterion as the system's capacity to return to equilibrium after the crisis, although resilience is not the same as stability. Ability to resist impacts and shocks.	Holling, 1973
	The measure of a disturbance that can be absorbed before a system changes the variables and processes involved in its behavior.	Multi-balance. From this perspective an adaptive ecology and ecosystem can have multiple stable states, each of which maintains internal forces that model micro states. Capacity to adapt (through self-organization of structures and relationships) [212] to circumstances as a principle of survival. Ecological resilience analyses focus on the tenacity of the ecosystem rather than on its stability. Thus, resilience could be interpreted as a degree of tolerance for absorbing change and disturbance while maintaining its main structure, functionality, and identity characteristics of the ecosystem. An ecosystem can change into a new state of equilibrium as long as its structure and function do not change.	(Holling, 1996)
	The ability to adapt, learn, and self-organize, as well as the general ability to resist disruption.	Socio-ecological systems can have continuous changes without the need to return to their previous state of equilibrium. The key lies in the adaptability of the system, which requires the ability to maintain the integrity of the system (character, function and structure) by suffering the impact, resisting and absorbing it; the ability to self-organize to accommodate the imposed changes, the ability to learn from the crisis and use it as an opportunity for self-improvement and, at the same time, the ability to cope with crises.	(Folke, 2006)

Organization	The inherent ability of a business to maintain or recover its stationary status that facilitate the continuation of normal operations after an incident.	Ability to recover from crises.	(Sheffi *et al.*, 2005)
	An organization's ability to absorb stress and improve its performance despite adversity	Ability to respond to rapid changes in a business environment.	(Vogus & Sutcliffe, 2007)
	The ability to adapt to changes with sufficient robustness in order to act as economic organizations in the context of global markets.	Capabilities that allow them to lead their own development processes.	(Merino, 2014)
Climate Change	Society's buffering capacity to withstand disasters.	Introduces the concept of vulnerability (the degree to which a system is susceptible and cannot cope with adverse events).	(Timmermanm 1981)
Disasters	The ability of a system, community or society exposed to risks to resist, absorb, accommodate and recover from the effects of damage in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.	Depends directly on the amount of resources needed and the organizational capacity before, during and after an incident.	(ONU, 2005)
	The ability of a system to react to disruptions according to their severity (flexibility to avoid collapse) and to recover from at least one adequate post-traumatic condition or improve it, or increase its operational capacity.	Although catastrophes are inevitable, the possibility that people, governments, structures and any type of organization are reasonably prepared can mitigate the damage.	(Brigadier en Elran, 2010)
Social Resilience	The ability of community members to take meaningful, deliberate, and collective action to remedy the effect of a problem, including the ability to understand the environment, intervene, and move forward.	This process involves putting in place a set of adaptive capacities to create a positive outlook after the crisis. In general, social resilience analyses deal with the resilience capacities of individuals, groups, communities and the environment.	(Pfefferbaum *et al.*, 2008)
	The capacity to handle crises, the capacity to adapt, the capacity to transform a reality. Capacity for social transformation in the face of global change.		(Keck & Sakdapolrak, 2013)
	The combination of the capacities to absorb, to adapt and to transform.		(Béné *et al.*, 2014)
	The ability of a group or community to cope with external stresses and disruptions that result from social, political and environmental change.		(Adger, 2003)

	The social capacity that goes beyond a shared vision is the capacity to cooperate productively	This capacity can allow groups to internalize learning and problem-solving processes, and can give them the confidence and flexibility to collaborate with external partners and to gain access to external sources of support.	(WRI, 2008) (Elran, 2010)
Economy	An economy that responds to an external impact by remaining stable or growing.	A quick return to initial economic equilibrium after a recession.	(Xiao & Drucker, 2013)
	The ability to reorganize, i.e. adapt their structure (companies, industries, technologies, institutions) to maintain a path of acceptable growth in production, employment and wealth over time.		(Martin, 2011)
	The ability of an entity or system to continue its functionality and production in the face of a severe impact.	Based on economic dynamics, how fast a system recovers from a severe shock to achieve a stationary state.	(Rose, 2007)
	The inherent capacity for adaptive response that allows companies and regions to avoid major losses.		(Rose & Liao, 2005)
Engineering	How fast a variable resumes its equilibrium after a disturbance. The ability of a body to regain its initial state after the impact of a deforming force. The ability of a system to withstand external and internal disruptions without disrupting the functionality of the system, or in the event it has lost functionality, then regain it as quickly as possible.	Can be estimated by the time the movement returns to the initial state or a fraction of it. Applies only to linear systems. This concept mostly applies to objects capable of recovering their original state after bending, compression or other types of deformation. The relationship between force and deformation, before the body is permanently deformed. Adopts a rigid approach to risk management and emphasizes the importance of improving the strength and robustness of vital infrastructure. Return to a stationary state.	(Pimm, 1991) (Cutter *et al.*, 2010) ASME (ASME 2009)
Urbanism	Resilience is the opposite of vulnerability.	Mitigating social vulnerability to urban hazards and integrating these activities into economic development and social justice will shape a resilient system.	(Godschalk, 2003)
	The ability of a community to recover and offset its vulnerability.	Community resilience	(Simpson & Katirai, 2006)
	The ability to plan to absorb, recover from a disturbance and adapt to new circumstances.	Energy resilience; its most important principles include: efficiency, diversity, adaptability and redundancy.	(Sharifi & Yamagata, 2016)

Elaboration: Salgado-Guerrero, J. P.

The paradigm of machine control is cautiously replaced by that of networks (Kelly, 1994)We should point out that these networks are not static (Bak, 2013) but transform over time, develop and when they mature they need to make an evolutionary leap to remain productive. This will require resilience, which becomes the primary concern from an ecological point of view.

When university groups mature, they need to mobilize their efforts to respond to the need for evolution. Evolution implies complexifying structures, turning into a group of groups, reorganizing itself topologically in a fractal or star-shaped structure. It requires efforts and resources to overcome the forces of inertia caused by the need to give a broader response and maintain interdependent relationships with other groups that emerge from the first one.

This re-organization or self-organization leads to a second increase of entropy that marks the beginning of a new development cycle. As the urgency of evolutionary change decreases and the groups adapt, efficiency will gradually begin to increase and entropy will decrease.

The moment of evolution is characterized low entropy that increases to boost transformation. That very moment, high efficiency begins to decline; the necessary higher entropy paradoxically leads to an increase in vulnerability that implies less resilience. Achieving a balance between efficiency, resilience and entropy is the challenge we face when it comes to analyzing the Ecosystem; we are talking about the *capacity for response and recovery*.

We must bear in mind that this system is complex and is neither predictable nor represents a mechanical development; we are rather faced with independent organic processes that feed on multiple scales (those previously defined as states) that allow the Ecosystem to self-organize (John Henry Holland, 1995).

For Levin (Levin, 1998), complex ecosystems can emerge from disorder with minor regulations that become simple rules but organize behavior with well-defined patterns, i.e. organization with disorder; in his study of complex adaptive systems, Levin establishes three fundamental principles[71]: (i) constant diversity and individual identity of the components[72]: (ii) specific relationships between those components; (iii) an autonomous selection pro-

71 The principles of Levin have been translated by the author for the Spanish version.

72 Here Levin refers to Gell-Mann M (Man, 1994).

cess among the components, based on the results of the localized interactions between them, and consequent replication or improvement.

Diversity and identity guarantee heterogeneous relationships in specific meeting places. These autonomous relations constantly evolve and modify, not only adapting to the circumstances, but creating shared behaviors and interests; these, in turn, reorganize the ecosystem transversally in a simple way, albeit with high impact. Therefore, innovation and creativity depend on the diversity and particular identity of each group, as well as on its capacity for autonomous action and the number and type of established relationships. In other words, they are directly related to the entropy caused in the Ecosystem.

The non-linearity of processes and the diversity of flows through which actors add value to their projects, change as they develop. Levin concludes that the multiple meeting places result precisely from these dynamics. In addition, the environment easily conditions the limits and qualitative changes of the Ecosystem, which is why a complex system becomes uncontrollable. The alternative is to modify the environment as much as possible to influence self-organizing dynamics.

Managing these eco-systems requires "*… experience, intuition, improvisation, expecting the unexpected, examining preconceptions, thinking outside the box, and taking advantage of fortuitous events. Each feature is complementary, and is like a double-edged sword*" (Hollnagel et al., 2008).

From the above, we can identify three keys to *university resilience* according to its mission in society:

- *Resilience for evolutionary leaps of the groups of the Ecosystem*. According to Folke (Folke, 2006), whenever an Ecosystem group approaches the zone of minimal entropy and maximum efficiency, it increases its individuality and puts at risk its resilient capacity, thus compromising equity and its potential to establish new relationships. When it makes this evolutionary leap, the Ecosystem must make use of its capacity for adaptation, learning and self-organization and initiate the process of socialization and externalization of the group's knowledge, which expands its networks and reproduces more groups dependent on the first. As a result, the structure topology turns from a complex network to a bio-organized fractal rhizome or a star rhizome.
- *Individual and group resilience for self-organization.* Ecosystem groups are exposed to constant dynamics. Their production strategies, project

management, organizational structure, etc. keep changing. In this context it is essential for them to develop a capacity that copes with and manages the tensions that may arise from the social, political and environmental changes (Adger, 2003). The group´s resilience results from the capacity of resilience of its member. The development of their capacities to internalize learning processes, solve problems, the support they receive from the group to open themselves to new possibilities and the flexibility to collaborate around shared interests, results in resilience that allows them to work productively and go beyond a shared vision (World Resources Institute (WRI), 2008). According to Sastre (Merino, 2014), in this dynamic journey of continuous learning, the capacity to adapt with sufficient robustness to evolving changes depends directly on their capacities to lead their own development processes. Maintaining the developmental trajectory and the acceptable growth of their production (results as organizational knowledge) depends on the ability to establish their own responses through the reorganization and self-organization of their structures (Martin, 2011). Sharifi and others (Sharifi & Yamagata, 2016) deduce that the sustainability of these groups depends directly on their ability to combine *flexibility, efficiency, diversity, adaptability and redundancy.* However, by increasing *efficiency,* entropy decreases and thus affects equity as reflected in their *diversity*. Furthermore, the *flexibility*, *adaptability* of its organization and *redundancy* depend on the group's capability to substitute functions between its members. In other words, they must have the capacity to change in order to minimize external impacts. This has a twofold relationship with efficiency; on the one hand, they are a basic condition of its operation; and if the capacity to minimize impacts through *redundancy* is high, the sustainability of the group's efficiency is positive. Replacing functions and the possibility to do so can also have a negative impact on efficiency. The challenge for the groups is therefore to maintain the balance of all these factors and to be an indicator of the group's maturity and, therefore, be an asset of resilience.

- *University Resilience to allow for contributing Relevant Knowledge to a changing environment*. The University is faced with multiple demands. This paper approaches some of them: combining critical thinking and instrumental reason the continuous questioning of positive thinking and the inclusion of knowledge; the production of pertinent and transforming knowledge, the role of research and pedagogical innovation in terms of the development of the person, overcoming caste bureaucracy and research, as well as overcoming specialization[73]; an environment that enhances people's capacities and produces social responsibility and response to context. If we add the speed of the social dynamics to which the University is exposed (understood as a product and producer of society), then we clearly see the need for a University of *flexibility* rather than one of hierarchy; of *adaptability* rather than effective command/control; of *self-organization* rather than centralism; of *redundancy* rather than specializations that mutilate capacities; and *efficiency* (Sharifi & Yamagata, 2016) that teams up with and balances the necessary entropy caused by the actors (students and professors) who have multiple capacities and are open to change.

The eco-systemic conception of the University leads us to contemplate multiple groups with individual interests that must be catalyzed through multiple alternative projects for the production of knowledge, that is, a University composed of what Holling (Crawford Stanley Holling, 1996) would call *multiple states*. Governed by internal forces that model their micro-states and at the same time complement each other with other groups, each of the above guides the University to a *multi-equilibrium.* The challenge lies in how to take advantage of the human capacity of *multi-relation* (Bohm, 2008) that allows connecting the most diverse phenomena that facilitate the *act of knowing and learning to learn*. The university´s resilience capacity, which includes the *integrity of the eco-system*, not only depends on adapting and *responding-learning-taking advantage* (Vogus & Sutcliffe, 2007) of crises and the context, but also depends on the very capacity for *self-organization of the structures and relations of groups* (Folke, 2006).

Only when it recognizes the multicultural, hybrid, plural, multipolar, democratic and heterogeneous, can the University become that organization again that can reduce its *vulnerability* in the face of adverse events (Timmerman, 1981). Mitigating the vulnerability of the community (Godschalk, 2003) with respect to the relations of knowledge production (tacit - explicit (Ikujiro Nonaka & Takeuchi, 1995)) will help building *a resilient university* that is capable of planning, absorbing, recovering and adapting to new circumstances (Sharifi & Yamagata, 2016).

The permanent flow and transformation makes the University an open, flexible, self-regulated and self-organized organization, based on the produc-

73 The development of scientific knowledge through investigation must not be related to the specialization of science, but to its interdisciplinary complexization.

tion of knowledge and its corresponding socialization, externalization, transfer and diffusion; these dynamics provide the University with knowledge that will be saved in virtual deposits for those who need it.

The University identity lies in the knowledge and creativity that can be shared in communities with common and interdependent interests; the development of people does not lie in their degrees or careers, but in their ability to produce and reproduce knowledge. Their business card therefore is the Portfolio that contains the results of their most valuable contributions and the result of the trust placed in them by the actors of the Ecosystem.

The production of knowledge, whether organizational or research-based, follows different *states* and forms of production that are in permanent reconstruction. Multiple connections with diverse agents form networks to which they contribute part of their own wisdom, appropriating part of that of others: a *meeting place* (Cf. Figure 33,) where people and groups organize themselves as complex systems adapting to diversity and developing capacities in an organized environment, interacting and recreating dynamic learning spaces.

It is thanks to the above that an eco-systemic University, whose development lies in *Knowledge Management*, is able to act in this way. *Resilience* assumes a leading role in this process and for the balance it keeps with other factors such as entropy, sustainability and efficiency that roots in its *social integration* and its double function of producer of knowledge and builder of citizenship.

The diversity of actors as well as of *states* of knowledge production multiply the possibilities of learning. What is important is not the project itself, but the group and the actors that make it up. They have the capacity to solve and raise problems, while at the same time developing resilient capacities of self-organization that allow them to *unite knowledge and make sense* of it (Edgar Morin, 2000). That is to say, to *study working* in a kind of *non-linear education* that values *diversity, uncertainty* and *complexity* and that facilitates making responses from the *eco-systemic* perspective of the environment.

However, the diversity of states does not imply multiple specialized compartments but, on the contrary, the freedom to take on the production of results of a certain type, for which we have expertise, and, at the same time, to combine disciplines and groups in a constructive way that provokes *redundancy*. It is not a question of opening borders, but one of eliminating anything that generates them. Understanding the complex, points to the opposite, which is not only antagonistic but also complementary. Reduction and compartmentalization diminish *resilience* and promote hegemonic *"pre-tensions"*. In a nutshell, we could define *University Resilience* 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 pro-active response that imagines, conceives, creates and performs the characteristics of its own identity.

The fundamental objective of University resilience is not to create a fail-safe but a robust and resistant Ecosystem that, if necessary, organizes itself or makes evolutionary leaps; in other words, one that has its own response to change to avoid having to change by imposition.

Characteristics of the Environment That Develops University Resilience

According to Carpenter (Carpenter & Gunderson, 2001), resilience is a capacity that must be developed in a complex system. The capacity for self-organization should go beyond an organization that is imposed by an adverse environment. This is possible only if the system is capable of learning and creating systemic knowledge(Gunderson, 2001). The environment that enhances these capacities is characterized by:

1. Diversity. According to Levin (Levin, 1998), respect for individuality and valuing constant diversity are essential in an Ecosystem since they imply a constant tendency to novelty and dynamics that is far from inactive equilibrium. The specific relations between actors and groups establish exchanges that strengthen learning and the consequent replication or improvement of the production of knowledge. Moreover, the capacity for self-organization and regeneration of complex adaptive systems depends directly on diversity, complementarity and interaction of the actors (Folke et al., 2004).

The diversity of responses that groups and actors can provide in the Ecosystem directly influences its resilience (Chapin et al., 1997). The wide range of groups, projects and response mechanisms[74] ensures the capacity for regeneration, renewal of organizational structures and cross-pollination processes[75].

74 That we have called *states* in connection with entropy.

75 For the text that this refers to, this concept has been metaphorically used to denote a mutual interchange that benefits both sides. According to the FAO, cross-pollinization is

On the other hand, the dynamics of the Ecosystem furthers the emergence of new states based on the interdependence of their actors. The complexity of the context increases the possibilities for evolution; as the diversity of the system increases, transformations are generated from stable and homogeneous states to other heterogeneous and dynamic ones (S. Kauffman, 1995). This allows the organization not only to adapt to the conditions of the environment, but also to the possibility of transformation and modifying its environment, i.e. to increase its resilience.

This perspective requires perceiving the organization as being far from controlling behaviors but rather as favoring interaction that allows the net groups to flourish; in other words to perceive the organization from a point of view of heterarchy that favors the diversity and the corresponding autonomy and self-organization. A diverse system is robust and capable of adapting to change. In certain states and actors there may be a level of *redundancy* that allows adaptation to changing conditions. Furthermore, interdependent cooperation and competitive relations paradoxically facilitate the transfer of resources and ensure *redundancy* (Reap et al., 2005).

2. Uncertainty. The emergence of new and unforeseen conditions plus the multiple interactions in the system make it impossible to predict future states (John H Holland, 2000).

We must learn to change and not just to react. In this sense, the role of diversity and multiplicity of actors and groups is key, since complementarity and *redundancy* allow the organization to adapt to the dynamics of velocities and conditions. The number and robustness of the relations between groups and actors (microstates) is more important for the stability of the macrostate than the simple number of groups or actors (McCann, 2000). If these are strong, a group or actor of the Ecosystem can fail or produce knowledge at a slower rate without interrupting the functioning of the entire Ecosystem; in other words, it is essential to learn to live in the midst of uncertainty (Carpenter & Gunderson, 2001).

Perceiving the ecosystem from the stability of the states becomes more difficult as entropy increases. Due to the complex dynamics of the Ecosystem, we must take into account the multiplicity of states of knowledge production and establishing thresholds for monitoring group development.

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the transport of pollen from one plant to another generally carried out by insects and that directly affects the quantity and quality of the harvest (FAO, 2005).

Ecosystem governance requires adaptability to changes imposed by groups and actors. Therefore, eco-systemic knowledge and vision are essential. The continuous learning allows us to interpret, respond and give feedback to the dynamics of the ecosystem facilitating the evolutionary leaps of the groups: in other words, understanding entropy, resilience and sustainability, plus the implication of a multi-level system of governance (Folke et al., 2005).

The implications on structures and processes caused by complexity and uncertainty provide dynamics and distance regarding equilibrium. We are talking about an organization that learns, is creative, and capable of transforming itself from within. Constant individual and team learning, reflection and shared visions empowers the organization to cope with the uncertainties of the future (Senge, 1990).

On the other hand, Shannon's (Shannon, 1948)analysis of entropy in information theory makes it look like a new type of subjective statistical inference for establishing probabilistic distributions based on partial knowledge (Jaynes, 1957). The proximity of this concept to quantum theory and the distance to mechanics made it necessary to redefine entropy as uncertainty.

3. Complexity. Uncertainty and diversity call for dialogue between the different forms of knowledge. This produces a step from tacit to explicit knowledge and vice versa. If we add the diverse ways of knowing, the multiplicity of states of knowledge production and the dynamics of groups and actors, the Ecosystem is evidently very complex.

From the point of view of action, Morín (Edgar Morin, 1999b) defines the paradigm of complexity as a model of *life* that finds *responsibility* in *freedom* and *community* as the *projection towards globality*. All this requires a capacity for self-organization; Kauffman S. Kauffman, 1995)has emphasized that systems tend towards chaos[76], and it is precisely this critical state that generates creativity. Simon(Herbert A Simon, 1962)argues that, far from equilibrium, this internal dynamics of the Ecosystem provides an *"evolutionary explanation of hierarchy"*. The equilibrium or control of a system seals it off, which increases the risk since even a minor change would produce the destruction of the ecosystem; the possibility of adapting or evolving is practi-

76 This book sees the tendency toward disorder as entropy.

cally null. Taking into account subjectivity and complexity, the University can create an ecosystem capable of extracting and cultivating capacities.

As a social organization, the University must seek to extend people´s freedom of self-promotion and self-realization since these constitute the basis for self-organization. Capacities are substantial liberties, a set of opportunities to choose from and use [383], which any person can initiate through multiple combinations of actions that s/he is capable of performing (Amartya Sen et al., 1991).

If knowledge management is related to developing the capacities of the people who act in the Ecosystem, it does not diminish its importance, but puts the *"metrics of the results obtained by the political leaders"* on the back burner, considering of greater relevancy the added value provided by the actors capable of living and acting in a complex way (Patera et al., 2016).

To promote knowledge management, the University - like nature - uses inert and inorganic elements such as information to create ecosystems of the living organization, whose interactions produce knowledge and skills validated by society. Far from believing that the system is more productive the stricter it is controlled, one must start from objectivity as the sum of the subjectivities of the actors that interact within it, and find new ways of producing (multi-state) knowledge. Knowledge Management is based on potential and possible synergies.

4. Redundancy. If the resilience of ecosystems is the system´s capacity to absorb disruption, maintain self-organization and avoid the thresholds of irreversible change, then – according to Holling (Crawford S Holling, 1973), - we must differentiate it from the concept of stability (the capacity of a system to quickly return to a state of equilibrium with the least fluctuation after a temporary perturbation) given that highly unstable ecosystems – as demonstrated in this paper - can continue to have a capacity for resilience.

The redundancy of a system must be seen in connection with fluctuations and changes over time and the role of diversity. Holling's vision implies an evolutionary understanding of the system's response to any change produced by the relationship with the environment. Dynamics are fundamental to the survival of an ecosystem. Its capacity to adapt depends on its capacity to self-organize and learn (Crawford Stanley Holling & Gunderson, 2002), and diversity and overlapping of actions (redundancy) are fundamental for it (Holling et al., 1997).

Since individuals remain unique, redundancy must be understood as the overlapping or duplication of *states* or relationships between actors. A network with a greater number of interactions will be stronger and will have a greater capacity for adaptation and response. In his theory of change, Holling argues that redundancy is an accumulated "capital" in response to a growth phase. Section 2.3.1. describes redundancy in relation to Information Theory.

University Resilience Management

The purpose of analyzing university resilience management is to establish possible actions that can devise strategies for policy managers that cannot ignore the constant dynamics to which an Ecosystem is exposed.

Based on how this paper defines university resilience, we can make out two fundamental parts: the *capacity of evolutionary self-organization* and the *capacity of production of relevant knowledge*. On the other hand, the characteristics of resilience are diversity, uncertainty, complexity, and redundancy; combining them we obtain the strategies as exposed in Table 4.

Addressing the complexity of Ecosystems and their constant dynamics requires a framework of action different to that of control and a focus on efficiency. If we lean towards heterarchies, independence and self-organization, redundancy and diversity, efficiency is affected and will also be subject to such dynamics. *Development zones* using the concept of efficiency will be discussed further down. To understand the complexity of economic, ecological and social systems [336], we must take into account the criteria put forward by Holling (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 connected to policies, actions and the consideration of different futures.
- Accept uncertainty and unpredictability. Surprise and structural change are inevitable in social and natural systems.

Table 4
Criteria for Managing Resilience at the University

	Resilience for self-organization and the evolutionary leap	**Resilience for the production of relevant knowledge**
Diversity (nurture diversity and redundancy for renewal and reorganization)	Encourage respect for individuality.	
	Promote interdependence in cooperation.	Register the memory of production as a resource for the continuous creation of knowledge.
	Register the memory of social interactions as a resource for innovation and novelty.	Nourish the diversity of actors to respond to change.
	Nourish the diversity of groups to respond to change.	Promote Redundancy.
	Seek spaces for political decision open to experimentation.	
Uncertainty (learning from change and uncertainty).	Encourage learning how to live with change.	
	Encourage learning how to respond to crises.	Promote the replicability of good practices.
	Promote training of skills for project management from the perspective of flexibility.	Promote dialogue for the communication of results, good practices and guarantee feedback with respect to changes of context.
	Encourage innovation in moments of weak control, of high potential for great uncertainty	Accompany successful innovations and take detailed records of those that fail.
	Create a culture that resists temptation to create rigid rules as these precipitate crises in the Eco-systemic organization.	Develop strategies to merge research projects.
Complexity (combining different types of knowledge, creating opportunities for self-organization).	Favor multi-level government strategies and participative government.	

	Develop capacities for monitoring the environment.	Promote dialogue of knowledge.
	Build bridges between actors and decision-makers.	Create cross-pollination mechanisms to share knowledge.
	Encourage learning for conflict management.	Establish institutions within the framework of learning and creativity that generate historical memory.
	Support self-organization for equity in access to and allocation of resources.	Promote the combination of local knowledge and scientific knowledge produced by the University.
	Promote self-organization mechanisms that facilitate quick and effective responses to external collaborations.	
	Directly connect the levels of the Ecosystem and university governance.	
Redundancy (overlapping of states of knowledge production)	Monitor fluctuation and changes of groups over time.	
	Encourage encounters between diverse peers that can propose new projects and consequently new states of knowledge production.	Provide spaces of encounter that facilitate feedback to and socially validate results.
	Freedom in the choice of the states of knowledge production.	Avoid meritocracy in the evaluation of the states of the groups.

Prepared by author based on the current situation (Sep. 2020) of the UPS Ecosystem and the writings of Folke (Folke *et al.*, 2003) and Holling (Crawford S Holling, 2001)

Knowledge Management: The Dissipative Hurricane

The thermodynamic metaphor may be one of the best ways to demonstrate the connection between the Ecosystem University and society. The second law of thermodynamics, the law of entropy, may be the best example; in a simplified way one could say that under the second law, any change that takes place in an isolated system will increase entropy in the system, which means that things tend to wear out or move towards death. With each change, closed systems lose potential, develop disorderly and random structures and dissipate energy. Finally, the system reaches "thermodynamic equilibrium," where entropy becomes the rule and nothing else can happen.

A long time ago, people wrongly thought that living systems were beyond the second law as they were gradually increasing their functional complexity and structural mass. All systems are subject to the same processes of entropic decay. This question can be solved when we recognize that all living systems, from the smallest organisms to entire ecosystems such as the exosphere (Edgar Morin et al., 1994) are open systems that exchange energy and matter with their environment.

Thus, contrary to a closed system subjected to disjunction and reduction that belonging to the paradigm of simplification, the University finds an equivalent in an open system because it faces a paradigm of complexity, conjunction, distinction and implication. These are the principles that sustain unity in complexity, the culture of creativity and innovation, pertinent knowledge. This complex interaction with the context turns University into a product and producer of social innovation.

The Ecosystem University is like a *dissipative Ecosystem*[77], something like a hurricane, whose movement absorbs the hot airs that cause its very movement; energy and the resources that are exchanged with the environment and are produced by university dynamics, also create the society that sustains the university.

Exchange of the "hurricane" with the environment

This is an open or dissipative system (i.e. it works thanks to the dissipation of energy and the exchange with the environment), extremely complex systems that interact with their environment, from which they receive supplies and to which they deliver their products; they are composed of dynamic hierarchies,

77 They are called "dissipative structures" because all self-organizing systems survive by continuously degrading and dissipating the available energy and matter (I Prigogine, 1997). They are maintained by continuous "dissipation" (or consumption) of energy. Their characteristics are: self-organization: the spontaneous emergence of order; irreversibility: the system, once it has taken a bifurcation, cannot go back any further 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 a pseudo-zone (García Velarde & Fairén Le Lay, 1980).

interactive groups, organized and self-organized structures and above all they produce non-linear results. The complexity of these systems increases considerably when we take into account that they serve one or more purposes.

The Ecosystem University is self-organized and far from closed systems; here we have open, growing and context-dependent systems. Thermodynamic theory, far from equilibrium, provides a simple criterion for understanding the relationship of systemic organization and the university's interaction with its environment. The university that produces knowledge and resources for the evolution of the social context cannot ignore what it receives from it; it is a question of the search for a dynamic balance between the context and the university. Since the exchange of resources and development capacities to sustain the Ecosystem University (common pool resource) depends directly on the market of society. Self-sufficiency indicates the existence of a flow of internal exchange relatively independent of changes from the outside that can ensure reproduction of the community and its subsystems.

The society in which the university - recognized as an external medium as the real base of the ecosystem - is embedded is directly related to the basic science of university knowledge production. In other words, the university is a product and producer of society, and any knowledge generated depends on and is relevant to the society of which the university forms part; at the same time, any knowledge is worth nothing if it is not in dialogue with society and able to transform it.

Similarly, with regard to resources, the economic cycle of the university and society implies an exchange of resources and development capacities for both, the university and society. The production of resources and capacities within the university is the result of the *economic know-how* of the communal university commune;[78] in other words, the balance between economy, politics and society must prevail when we take all these complexities together. Therefore, the *economic action* of the university commune must focus on the production of relevant knowledge that is able to transform society, as well as on the formation of citizens who perform these changes; failure to do so could lead the society, in which the university is immersed, to ignore its value and turn its back on it, causing its gradual decline and eventual death.

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

Prigogine argues that *"dissipative structures are islands of order in an ocean of disorder"*(I Prigogine, 1997), and points out that nature is creative, has the capacity to generate new structures beyond the simple sum of its components, and is able to reinvent itself. The explanation of *dissipative structures*, in addition to having earned its author the Nobel Prize, allows us to understand the way in which disorder generates order; new complex organizations are built from chaos and far from equilibrium; from this point of view, entropy known as degradation and tendency towards thermal death, would be linked to dynamism and the creation of the new. In non-equilibrium situations, equations are not linear, which is why there are many possible probabilities.

In the middle of this complex system emerges the concept of entropy, which in the case of the Ecosystem of Research and Innovation must be analyzed from a double approach: on the one hand, the second principle of thermodynamics indicates that matter has a tendency to disorder and disorganization, but on the other hand, life tends toward organization and growing complexity (Von Neumann et al., 1966). For Neumann the growing complexity means the intervention of the indeterminacy of disorder and chance for life to reconfigure and for the system to organize itself.

Internal "Hurricane" Movement: Organization-Knowledge

This way, the dissipative university ecosystem constantly discovers a new order. This continuous spiral develops all patterns of the complex organization. For Prigogine, the "emergence of a new order" implies that the system is always organized in a different way, either in the functional dimension or in its time-space structure (Ilya Prigogine & Stengers, 1979). He speaks of bifurcation with reference to the point at which a new order emerges and is characterized by the moment when random fluctuations are amplified by the constant flow of matter and energy resulting from their interaction with the environment.

Originating in the complex living systems, this vision opens the doors to a new perspective of the organization whose guidelines originate in the analysis of open systems; it is about an Ecosystem University that is able to maintain the dynamics of its organization while adapting to a society of growing entropy. In fact, this constitutes the "thermodynamic" price as it loses efficiency due to the lack of equilibrium and growing entropy. However, it facilitates the generation of a new order that is increasingly developed by the same creative possibility that entropy production offers.

Kauffman mentions two characteristics in which the new order emerges: [1] According to the Boolean networks, order emerges at the edge of chaos; [2] in a biological context, the system is led to the limit of chaos by the propensity to evolve in the search for new niches, the mechanisms of survival or any other form of protecting life to foster development and individual and collective propagation (S. A. Kauffman, 2000).

Circumstances of crisis, whether internal or external, and processes of self-organization are possible only against the backdrop of dialogue between the subsystems that favors individual development negotiated with group development. Here knowledge gets involved in each relation and also grows (because this is how it is created), weaves a complex system by interconnecting people who move from the individual to the group, from the group to the collective (or group of groups) and subsequently from the collective to the organizational, where instituted identity is created that permeates everything top down.

The organization that produces knowledge (Nonaka & Takeuchi, 1995) is the result of an autopoietic process[79], where the whole is neither the result of the addition of its parts, nor an analysis of the subordination of the same, but where autonomy controls all changes that occur within the organization.

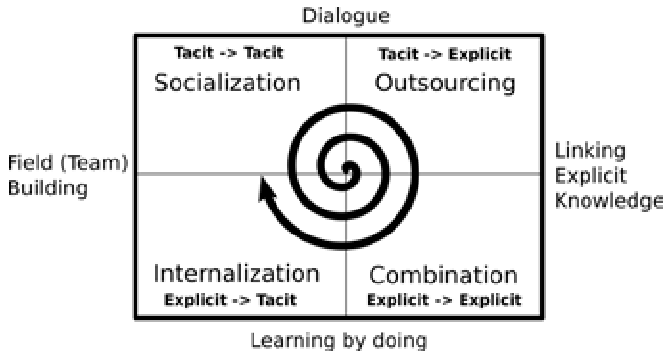
The basis of any organization is knowledge-created and used within the organization itself (Leonard, 2011) (Nelson, 1991) (Sveiby, 1997); this permits organizations to adapt to new circumstances, respond to the environment from which they receive energy-knowledge and resources to recreate themselves through innovation and the creation of knowledge.

Michael Polanyi distinguishes between tacit and explicit knowledge, noting that what I know (tacit) is more than what I say (explicit). Still, anything that has been said becomes part of the listener´s tacit knowledge. This distinction and the dynamics of exchange between the two types of knowledge were applied in the fundamental theory of the creation of organization-

79 *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).

al knowledge developed by the theoreticians of the Japanese organization Nonaka and Takeuchi. They proposed a SECI model for knowledge creation (Figure 9) that shows the conversion of tacit and explicit knowledge into organizational learning (Ikujiro Nonaka et al., 2000).

Figure 9
SECI Knowledge Spiral

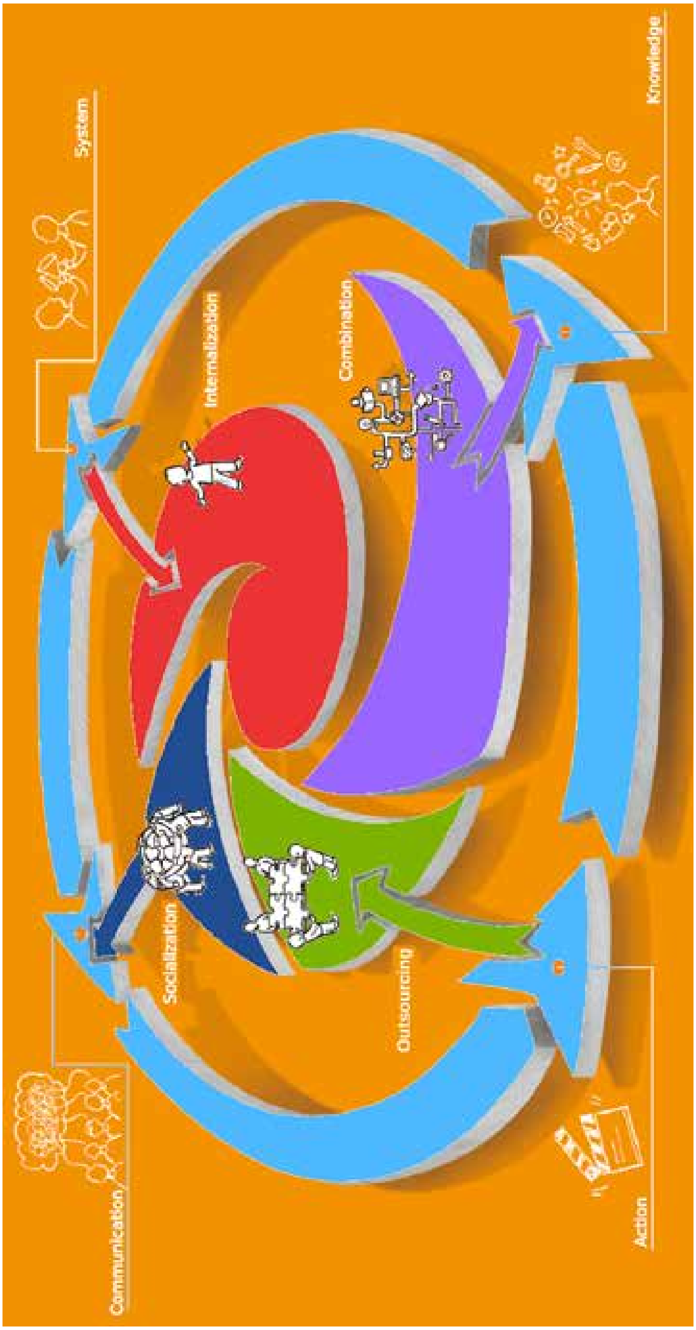


Source (Nonaka & Takeuchi, 1995). Prepared: Salgado-Guerrero, J. P.

The SECI process (I. Nonaka & Takeuchi, 1995) explains the conversion of tacit knowledge into explicit knowledge and vice versa. This process is also called the spiral of knowledge conversion and distinguishes four knowledge dimensions: Tacit to Tacit (Socialization); Tacit to Explicit (Externalization); Explicit to Explicit (Combination); Explicit to Tacit (Internalization). The same chart shows how knowledge changes from individual to group and then organizational. In this dynamic, individuals question the premises and contrast visions and points of view, exchange information, etc., giving meaning to their experiences and the knowledge produced.

The creation of knowledge is considered to be a self-transcending and continuous process, which results in new knowledge (Prigogine & Hiebert, 1982) and, therefore, a new state of organization. Knowledge is "deeply rooted in the action and experience of an individual, as well as in the ideals, values or emotions that he or she embraces" (I. Nonaka & Takeuchi, 1995, p. 9). For Nonaka and Takeuchi, experience is the key to the acquisition of knowledge (I. Nonaka & Takeuchi, 1995, p. 63), as this is specific, context-related and socially constructed.

Figure 10
Hurricane of Knowledge-Organization



Elaboration: Salgado-Guerrero, J. P.

Figure 10 below shows the hurricane of knowledge-organization of the Ecosystem University, displaying the internal level of hurricane 1 composed by spiral SECI and the respective construction of organization, and the relation of exchange 2. with the environment 3., composed by the cycle action-communication-knowledge (J. P. Salgado, 2017).

The Thermodynamic Metaphor

Michael Polanyi (M. Polanyi, 2009) describes the differences between tacit and explicit knowledge in a simple phrase: *"we know more than we can say"*. Nonaka and Takeuchi (Ikujiro Nonaka & Takeuchi, 1995) have identified in Japanese culture the notion of the explicit and tacit by citing the value of tacit knowledge regarding the capacity for innovation and creativity. According to these authors, knowledge is created at an individual level and then amplified and structured until it is systematized into a culture. The cycle then repeats in a spiral way, always increasing the level of knowledge. Schiuma (Schiuma, 2009) maintains that an organization can be analyzed as a system made up of interdependent elements of knowledge. In other words, 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, p. 9). Therefore, according to the Japanese authors, tacit knowledge is highly subjective and specific and has two dimensions, a technical and a cognitive one.

For Morín (Edgar Morin, 2017), the *anthropology of knowledge* obeys a *living computation* carried out in our brain and combines the *being, the individual, and the subject*; hence, it is necessary to understand that the sources of knowledge are complex and non-linear. According to Morín, one must put *computation* before *information*, and focus on "*self-eco-organization*" rather than a "*genetic program*". The *complex organizer* is the cause of the *living computation;* information, the symbol, the computation create each other and emerge simultaneously. Computing creates the symbol that creates computing, information creates the symbol that creates information. Thus, the difficulty in handling the term *knowledge* arises at the same time as our brain is processing knowledge to produce new knowledge.

Lakoff and Johnson (Lakoff & Johnson, 2008) summarized the characteristics of cognitive science in three basic findings:

- The mind is inherently embodied.
- Abstract concepts are largely metaphorical.
- Thinking mostly happens unconsciously.

Thus, the way in which we conceptualize is fundamentally metaphorical. We construct the tangible from the world of the intangible through metaphors (Fauconnier & Turner, 2008). Analogous reasoning helps to project the domain of the source by creating the objective domain (Moser, 2004); this also brings up the semantic aspect[80] of information.

It is therefore a question of rationalizing the imagination (Lakoff & Johnson, 2008), even though we are talking about an ambiguous field. It is this very lack of clarity that strengthens the capacity to extend the semantic field.

The need for metaphor arises because knowledge is subjective. Andriessen (Andriessen, 2006) carried out a study on research related to knowledge and identified 22 different metaphors. By analyzing their definitions, he concluded that most of the time the word knowledge is found next to a verb or noun, and instances where the basic meaning of verbs refers to building, creating or acquiring something; while nouns refer to storage, maps, resources or characteristics. Verbs and nouns alike refer to knowledge as something abstract.

Thus, the metaphor is on the one hand fundamental when talking about knowledge, and on the other, it will be the tool we use to understand the relationship of knowledge with the ecosystem organization. The present analysis aims first of all to understand the metaphor of knowledge as a flow, as suggested by Nissen (Nissen, 2005) and its relationship with the Newtonian linear model. This metaphor is relevant for the approach of the knowledge-energy analogy. Bratianu (Bratianu, 2011) later questions this metaphor by assuming Newtonian linearity and introduces a thermodynamic metaphor for knowledge. Finally, he proposes to extend the thermodynamic metaphor using a thermodynamic state function of a system to understand the function of knowledge within a university ecosystem.

In a more recent paper, Andriessen (Andriessen, 2011) includes an analysis of metaphors and, this time, relates them to knowledge management and describes the thermodynamic metaphor developed by Bratianu (Bratia-

80 Although the semantic fields are known as groups of words whose meaning has something in common although each word has its own meaning, in the context of this paper we shall use the defintiion of *Gunther Ipsen* and understand the word as a sign/symbol (Ipsen, 1924, p 224].

nu, 2011), whose work relates to knowledge management as the model and the transformation of knowledge in the tacit-explicit-tacit continuum of Nonaka's and Takeuchi's SECI[81] model (Bratianu, 2011),. After challenging the *energy-knowledge* metaphor from the Newtonian perspective, Andriessen introduces metaphors about *thermodynamic knowledge*, highlighting cognitive and emotional knowledge.

Further down, we will deal with the relationship between the organization and its knowledge with at greater length, using the spiral developed by Nonaka-Takeuchi as knowledge. For the present analysis it shall suffice to take into account the following:

- The codification of knowledge proposed by the authors is: tacit knowledge and explicit knowledge.
- The spiral proposes four conversion processes: internalization, socialization, externalization and combination.
- The epistemological dimension describes the transformations in the tacit-explicit continuum and vice versa.
- The ontological dimension describes the transformation of knowledge from individual knowledge to group knowledge and, eventually, to organizational knowledge.
- Internalization is an individual process of assimilation of tacit and explicit knowledge, continuous learning to learning by doing, and it is a process integrated in the systemic structure of the knowledge of the organization or, if necessary, it can also restructure tacit knowledge.
- Socialization is based on the transfer of tacit knowledge, which according to the actors, is personal, part of the individual experience involving intangibles such as beliefs, values and perspectives, depends on the context and the field of meanings that are shared and created through specific interactions (Ichijo & Nonaka, 2006).
- Externalization implies transforming tacit knowledge to explicit knowledge, so it can be transferred, disseminated, and therefore made explicit in languages such as grammatical statements, mathematical models, etc.
- Combination results from creating structures or systemically integrating the individual explicit knowledge to the organization, and therefore it is a social process based on the communication of knowledge.

81 SECI is the acronym that stands for the spiral proposed by Nonaka Takeuchi: Socialization, Externalization, Combination and Internalization. Further down, this model will be studied at greater length.

From the Newtonian perspective and the classical definition of energy as the capacity to generate movement or transformation - whose traditional composition is: kinetic energy and potential energy --, metaphors such as that proposed by Hey (Hey, 2004), who after analyzing the existing relationships between data, information and knowledge, concludes that the metaphor for conceptualizing knowledge is to understand it as *solid or liquid*. On the other hand, Nissen (Nissen, 2005) proposes a metaphor known as *Knowledge Flows*, i.e. to imagine knowledge as fluid and organization as a field of forces; Nissen proposes four simple metaphors:

- *Fluid Knowledge*: knowledge is similar to any fluid that possesses continuous movement.
- *Tacit knowledge as potential energy*: understanding tacit knowledge as a potential for socialization and externalization processes. An analogy can be made with potential energy; tacit knowledge is the invisible part of integral knowledge[82].
- *Explicit knowledge as kinetic energy*: if explicit knowledge is the part of knowledge that can be transferred or communicated and also stored, then it can be compared with the kinetic energy that can produce effective work through the movement of fluids or matter (Bratianu & Andriessen, 2008).
- *Dynamics of knowledge, energetic dynamics*: the analogy occurs in relation to the transformation process between tacit and explicit knowledge and the transformation between potential and kinetic energy: On the one hand the externalization as transformation of potential to kinetic energy; by analogy, these can be used in communication just as kinetic energy can be used in the production of mechanical work. On the other hand, we have the internalization as transformation from kinetic to potential, where, by analogy, the experience of personal enrichment can correspond to the conversion of kinetic energy into potential energy.

Bratianu (Bratianu, 2011) pictures the dynamics of the metaphor of *knowledge as flow* in Figure 11, and questions the Newtonian model used for the metaphor with the following argument:

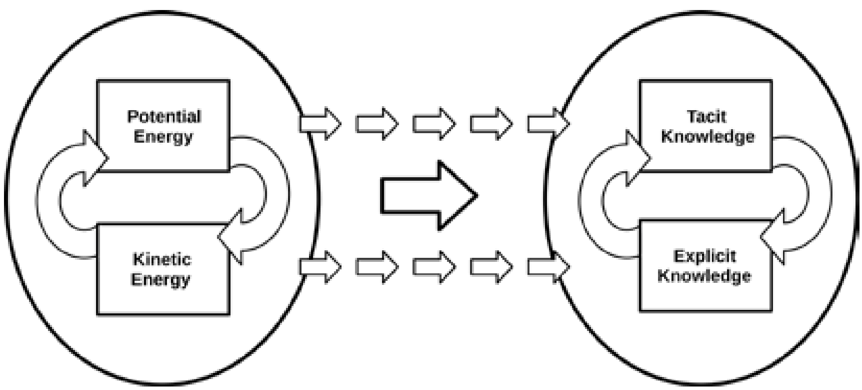
- *The law of conservation does not correspond to the logic of knowledge*: according to the law of energy transformation, energy cannot be destroyed, but is only transformed, so that total energy is the aggregate of

82 This concept was introduced by Barry and Osborne (Barry & Osborne, 2013, pp. 75-82).

power and kinetic energy, implying that the positive variation in one must cause the negative variation of the other in order to maintain the energetic balance. This is not analogous to knowledge since it can be created or forgotten and not only this, but the sum of tacit and explicit knowledge cannot be understood as organizational knowledge; that is to say, knowledge can be shared without any losses for those who share it.

- *The linearity property does not correspond to knowledge*: According to Bratianu [304], the paradigm of linearity is the biggest inconvenience for applying this metaphor. Linearity is the result of algebraic operations of addition and multiplication and these properties do not apply in the field of knowledge. Regarding organizational knowledge and intellectual capital, non-linearity is the main property (Bratianu, 2008).
- *The tacit-explicit pair ignores emotional intelligence:* although Nonaka argues that tacit knowledge implies emotions, he fails to explain the relationship between emotions and knowledge in the spiral model. According to Bratianu (Gourlay, 2004), organizational knowledge is by its very nature different from cognitive knowledge and does not fit into the Newtonian summation of knowledge.

Figure 11
Metaphor of knowledge based on the dynamic paradigm



Source: Bratianu (Bratianu, 2011, p. 164

Bratianu (Bratianu, 2011) suggests a *thermodynamic metaphor* that links heat with emotions. Throughout his work he argues that the dynamics of knowledge can be better understood from the thermodynamic paradigm since:

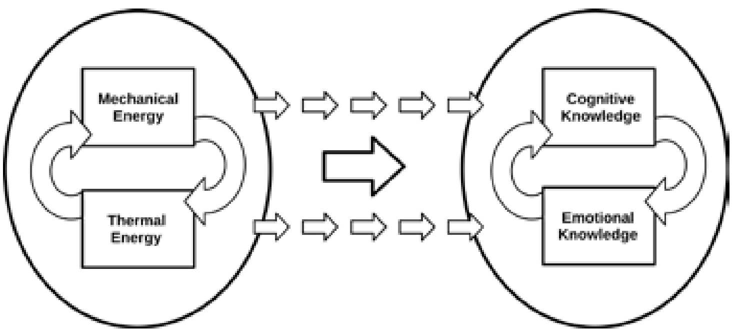
- Knowledge management can incorporate emotional knowledge and emotional intelligence.
- The dynamics of organizational knowledge can be explained from the cognitive and emotional nature of knowledge and the process of decision-making can be better understood in terms of rationality and emotionality.

The thermodynamic metaphor of knowledge developed by Bratianu (Bratianu, 2011) (Figure 12) suggests the following four metaphors:

- *Knowledge as energy* (Bratianu & Andriessen, 2008)*:* a fluid is mechanical matter and energy is its fundamental property as a result of movement. This is the difference with the previous metaphor, the analogous relation is better understood by imagining a gravitational or electromagnetic field; this field is free of mass by nature and has a continuous domain in space; it is not uniform and it is not linear.
- *Cognitive knowledge as mechanical energy:* cognitive knowledge implies rational and non-rational knowledge (Brătianu & Orzea, 2009). Simon (Herbert A Simon, 1977) states that the production of knowledge has an empirical component related to psychological and sociological processes, and a formal component which, in turn, is related to the definition and logical nature of the knowledge produced and which is, thus, related to the rationalization of knowledge. This metaphor can be understood as the compendium of metaphors 2 and 3 of *knowledge as flow* (Nissen, 2005).
- *Emotional knowledge as thermal energy:* thermal energy is different from kinetic and potential energy because it has two dimensions: one that allows quantitative measurements similar to mechanical energy and another intensive dimension measured by the temperature scale that implies that the higher the temperature of the object, the greater the intensity of the heat source. Emotional knowledge is characterized by content and intensity. We can have different levels of intensities for the same emotional content, which is really the main difference to cognitive knowledge. Peirce (Charles Sanders Peirce, 1998) defines as *abduction* the process through which the receiver through his own logic (which is unique) constructs his own hypotheses to explain what he has perceived as novelty (intensity). This process begins simply by receiving the signal (content) of data that carries a novelty that needs explanation. In search of this explanation, the person generates, classifies, selects and connects information to give meaning to a new assumption - all this as a result of the surprise caused by a novelty.

- *The dynamics of knowledge as thermodynamics of energy:* in a dissipative system, the total energy of the system is represented by interactions with the environment such as mechanical work and heat transfer; i.e. transformation from mechanical energy to heat and vice versa. In his analogy, Bratianu argues that the same can happen between cognitive and emotional knowledge through cognitive work and emotional warmth. *Cognitive work* can be understood as the transition from a thought, belief or knowledge to a physical sensation that triggers an emotion. By summarizing cognitive work on motivation, Boekaerts (UNICEF & others, 2016, pp. 84-101) establishes four principles: (i) if the person feels competent[83] to face a challenge, (ii) if he understands the purpose of what he is willing to do, (iii) if he understands his environment as conducive[84] to learning, (iv) if people experience positive emotions that motivate learning, they can use cognitive resources when they have control over the intensity, duration and expression of their emotions.

Figure 12
Metaphor of knowledge based on the thermodynamic paradigm



Source: Bratianu Bratianu & Andriessen, 2008

Emotional warmth can be understood as the transition from a feeling or emotion to the generation of information and/or knowledge. Hill (Hill, 2010, p.

83 To feel competent does not imply to know everything about a certain topic, but ratherto feel capable of undergoing a learning process, which implies to accept one's ignorance about the topic, but to be sufficiently motivated to take up the challenge.

84 Even crises can be a favorable environment for learning.

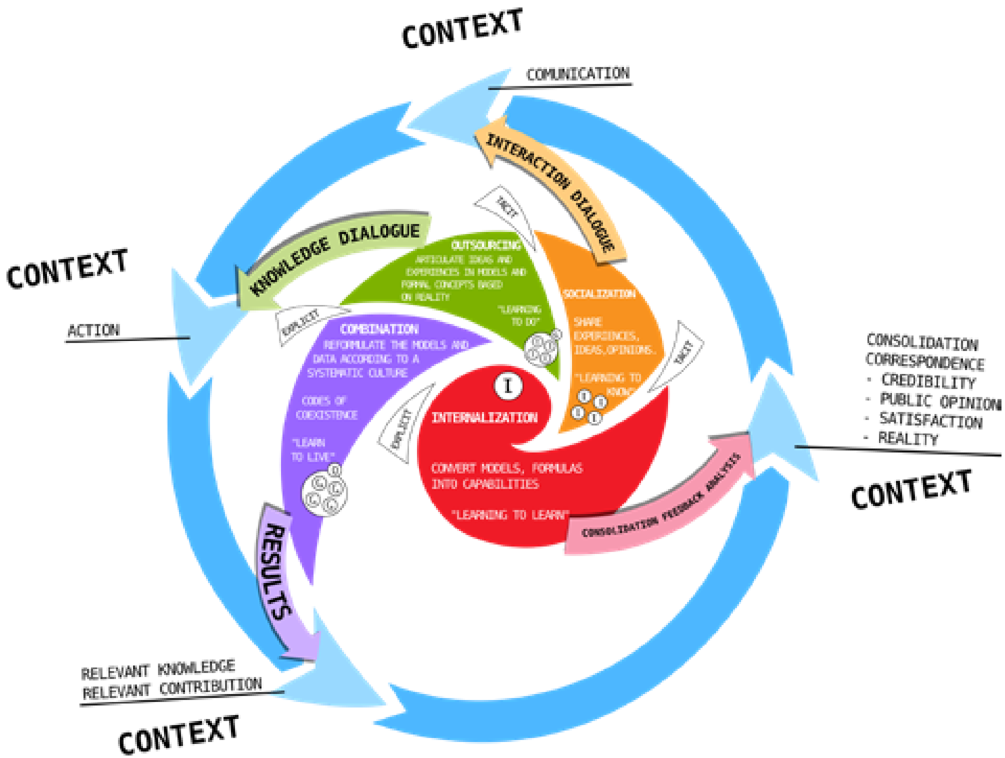
24) that "feelings provide us with information. We usually ask ourselves, 'How do I feel about this or that?' Feelings also have an impact on how we process information. More and more researchers corroborate the cognitive nature of emotions. Alessandrini (Alessandrini, 2017)states that emotions are *not* only the fuel that feeds the psychological mechanism of a human being who reasons but also form a constitutive part of a subject's reasoning capacity. In other words, it is through emotions that the human being gives meaning to what surrounds him, creates values and valuations, endows knowledge with meaning and value; for Ellerani (Ellerani, 2017) it means being able to develop emotions to imagine, understand, be empathic, be conscious and discern. In other words, emotional integrity is a sine qua non for learning. Analyzing Nussbaum's *capability approach,* Moschini (Moschini, 2017) concludes that individuals have feelings, sensations, emotions, the desire for happiness and is eager to protect his own environment and the future of his loved ones. Abbate (Abbate, 2017) agrees with this principle and further argues that positive or negative emotions (piety, compassion, love, pleasure, or fear, anger, disgust, or neutral emotions such as shame) give meaning to existence. The same author maintains that recognizing the *cognitive content* of emotions means not only abandoning the concept of irrationality, but also understanding that mere intellectual activity may not have the sensitivity to capture or communicate these emotions.

Another important consideration is that emotions are the main factor for taking action. Costa M. Costa, 2017) comments that emotions sustain the processes of *agency*[85], while the *telos*[86] of an action establishes a directionality of values constituted by a system of principles that might go unnoticed by the cold intellect. Emotions such as motivation favor or overthrow the decision to act according to principles, which is why they can be considered a constitutive part of the system of ethical reasoning, the basis of each participatory social innovation process.

85 The term agency can be understood in terms of pedagogical or social development as the capacity to do or act, which is directly related to autopoiesis and for Aristotle means productive action (poiesis) that focuses on results (Aristóteles et al., 1970). Plato defines the term poiesis as "*the cause that converts anything we consider not-being into being*" (Crespo Güemes, 2007). Sen "refers to what a person can desire - since he places value on it - to do, to be" (Amartya Sen, 2014). The value of "activation" (agency) implies the concept of freedom to act, the agency inherent in the action starts from the subject, but it is generated within social and learning contexts (Massimiliano Costa, 2014).

86 Telos from the Greek τέλος is a Latin word referring to an "end", "purpose" or "objective" used in philosophy.

Figure 13
Hurricane of Knowledge-Organization. This figure provides a better explanation of the relationship between the thermodynamic analogy and the knowledge model



Elaboration: Salgado-Guerrero, J. P.

Recognizing the *cognitive role of emotions* is to be aware of the validity not only of what is true but also of what is right; it is to recognize an intelligence of complexity, of a science with conscience (Edgar Morin, 1984) (as Morin elegantly put it); it is to let ourselves be disrupted by thinking, following the path outlined by Nussbaum (Martha C Nussbaum, 2003).

The thermodynamic metaphor is much more coherent with the approach of this book since it allows us to understand a relationship between the *explicit-tacit transformation process* (*cf*. figure 13) that is linked to *emotional warmth,* which in the suggested *hurricane of knowledge management*, is related to the cycle of *transformer knowledge - social validation* (consolidation, credibility, social opinion, satisfaction of needs).

The same metaphor also links the *tacit-explicit transformation* relationship to *cognitive work*, which in the *hurricane of knowledge-organization* (*cf*. figure 13) is related to the cycle of *communication-action* produced in society and based on the dialogue of know-how and knowledge.

Metaphor of Thermodynamic Potential or State Function for the Ecosystem University

Another contribution of the thermodynamic perspective is that it helps to conceive the University as a dissipative system connected to the environment. The metaphor of ecosystem, which we will discuss below, allows us to understand the University as a *social community* and also as a *dissipative Ecosystem,* that generates the exchange of energy with the environment by its dynamics and, at the same time, creates it like, for example, a hurricane or the stars, including the sun.

The thermodynamic metaphor draws an analogy between knowledge and energy. In this section we will see that the exchanges of knowledge-energy of the University with society at the same time create it, comparable to the case of the hurricane. Although this example also awakens interest because of the chaos that can be produced by the same flow and exchange of energy, we must remember that in natural (living) systems *order is produced from chaos* (I Prigogine, 1997). Therefore, contrary to what is thought in organizational planning, greater entropy and, consequently, uncertainty and complexity, increases the number of options for self-organization and self-creation of the Ecosystem. "*Imagining the possible, speculating about what* *might have been, is one of the fundamental features of human intelligence"* (I Prigogine, 1997).

Natural (living) systems prefer the increase of entropy and even use it as a generator of life. The *Chaos Theory* and its authors have argued that *out of chaos comes order* (I. Prigogine & Stengers, 2017), so the notion that life is born against dissipative entropic processes seems false, as life is rather born within them (Rísquez, 2002).

We could say that one finds the hurricane of university knowledge in the context of the society with which it interacts and that the flow of knowledge-energy makes it possible for the university to be a product and a producer of society at the same time.

Therefore, when interaction ceases, the University ceases to exist metaphorically; although it could continue, the knowledge it produces is not relevant and less transformative.

A (dissipative) ecosystemic organization cannot be separated from its context and be without interaction and interdependence with its environment; that is to say, the lack of flows of knowledge-energy would produce what the university world calls endogamy, and this would be harmful not only from the ecosystemic point of view, since the University becomes self-referenced and therefore useless for society. Using the metaphor of an ecosystem, a closed system prevents the entry of energy making it delicate like glass - hard but also fragile. To ensure the evolution and existence of an ecosystem, we must narrow the gap between the University and its environment; this gap becomes evident when one analyzes what the University must and can do, or what the University must know and what it really knows (Zack, 1999).

Knowledge Management strategies work in two ways: on the one hand, they seek to close the gap with society by producing relevant and transforming knowledge, and on the other hand, they promote the dynamics of the internal tacit-explicit-tacit continuum to ensure the spiral of organizational knowledge and personal development of groups and individuals of Academia by using strategies linked to:

- *The explicit-tacit transformation* related to *emotional warmth* (Bratianu, 2011, p. 164), *which* in the *proposed ecosystem model of knowledge management (*Figure 13) is related to the cycle of transformative

knowledge-social validation (consolidation, credibility, social opinion, satisfaction of needs).
- *Tacit-explicit transformation* is linked to *cognitive work* (Bratianu, 2011, p. 164), which in the *hurricane of knowledge-organization* (Figure 13) is related to the cycle of *communication-action-construction of relevant knowledge* based on the dialogue of know-how and knowledge.

The production of knowledge in 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. Far from exercising control, the administration only has to monitor and stimulate the development of people, their groups, and watch over shared agreements and responsibilities.

Bratianu (Bratianu, 2011) establishes an analogy between organizational knowledge and energy, which in the author's opinion shows constant exchanges, acquisitions and external flows of knowledge with the environment. Hence:

- On the one hand, one can partially understand the fields of knowledge in the groups and the knowledge codified in the organizational culture through an elaborate semantic construction within the University, using the information of the states of knowledge production, as well as in the products and results of those states (Davenport & Prusak, 1998).
- On the other hand, the University itself must be in a *dynamic equilibrium* (which does not imply order) with its context, which enables it to respond to changes and to assimilate the knowledge it draws from the environment.

In other words, the knowledge of the University depends on the flow of knowledge from society towards its interior, the creation of pertinent knowledge and the flows of knowledge shared with the exterior.

A social system interconnected with a larger one, such as the community of the University and the society to which it belongs, requires a metaphor that helps describe the exchange of knowledge with the environment. We shall then seek to draw a descriptive model among the characteristics of the university as a society that produces knowledge using an analogy with concepts of thermodynamics. We use this analogy as a starting point for building a more quantitative scheme to describe the social system in the University.

Before we continue to develop the thermodynamic metaphor, we should clarify a few things regarding the University, social systems and thermodynamic model:

- Although we generally study social communities (the University has an academic community) in fields such as philosophy, politics, sociology, according to Parsons (Parsons, 1991) we consider that *"the social system is a mode of organization of acting elements that are relative to processes of change (whether by imposition or organization) that transform patterns used by various individual actors to interact"*.
- Social systems may differ in size, structure and influence and involve different levels of knowledge development, use different systems of communication among their actors, and may function in different types of hierarchies and networks.[87] Within social systems, we find different formal laws and informal rules. [88].
- Social systems are permanent entities of human development with dynamic structures of their own, evolve with logics of self-organization (Von Neumann et al., 1966) and may even disappear (Ritzer & Yagatich, 1992).
- The Universidad Politécnica Salesiana has developed indicators of cognitive results, and we can attribute a range of attainable values to each of the characteristic features of the system.
- The principles governing the development of Ecosystem knowledge are set out in the development of the *hurricane of knowledge-organization* model (Figure 13). The combination of an estimation of the indicators of cognitive results and the logics of the knowledge management model maximizes as far as possible the reliability of the model based on the thermodynamic metaphor.
- The present metaphorical model does not seek to provide a complete description of all social systems and does not restrict the possible extension of thermodynamic formalism.

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87 To analyze the behavior of the ecosystem organization, this paper uses the concept of heterarchies, understood as a reconciliation between networks and hierarchies since the network does not necessarily imply a flat hierarchy and, therefore, the hierarchy does not necessarily imply a vertical organization that eliminates the network. This will be explained in more detail further on.

88 The principle of emergence and self-organization requires flexibility regarding laws and rules, in order to understand to what extent and at what levels these can be made more flexible.

- The conditions for the thermodynamic model correspond to the dynamics of systems with many levels of freedom, to the analysis of complex systems taking into account the principles of evolutionary biology[89] (Arévalo & Espinosa, 2015) (S. Kauffman, 1995) (Folke et al., 2005) (Folke et al., 1996) (G. S. Cumming, 2016) (Scheffer & Westley, 2007) (Bascompte et al., 2006) (Hausman, 1993), modelling of ecosystems (Müller, 2010) (Elmqvist et al., 2003) (Folke et al., 1996) (Chapin et al., 1997) (Crawford S. Holling, 1992) (Ulanowicz, 2000) (Salgado-Guerrero et al., 2017) (G. S. Cumming et al., 2014) (Herbert A Simon, 1962) (Levin, 1998) (Carpenter & Gunderson, 2001) (Holling et al., 1997) and their biomimetic relationships (European Commission, 2017) (Dostal et al., 2005) (Biomimicry Guild, 2009) (Riechmann, 2014) (Benyus, 2002) (Schmitt, 1969) with other dissipative systems; although these models have not been extensively used or evaluated in social systems, they have been rigorously applied in physics; still, there is need for future research to analyze these metaphorical analogies in greater depth.

Although initially abstract, the model described in the metaphor provides better understanding of at least one of the variables necessary for knowledge management, such as entropy; useful deployments will be analyzed in a separate paper.

According to the first law of thermodynamics (Clausius, 1867, p. 357), the first analogy for organizational knowledge is to compare it with the internal energy of a system. Generally speaking one can say that internal energy depends on the existence of kinetic and potential energy, that kinetic energy is associated with movement, and that potential energy is stored in the system and can be used to produce work. We can assume that any system has these internal energies in its interior - as chemical energy through the union between atoms and connections between molecules or as thermal energy due to translation, rotation and vibration of particles.

Analyzing an open or dissipative system that generates or absorbs heat exchange by a reaction, we need to note that there are agents in chemical energy that produce products; we can therefore assume that there is excess energy when the energy of the agent is greater than the total internal energy

89 Portugali analyzes the interactions and their relations with self-organization, and draws an analogy to the city as a complex system in (Portugali, 2012).

of the products. That energy comes out as heat and we then speak of an exothermic reaction; if the total energy of the agents is inferior to that of the products, there is not enough energy for the reaction to happen. Energy is thus absorbed in the form of heat, which is called an endothermic reaction.

Total energy after and before the reaction are identical; based on the first law of thermodynamics, energy cannot be created or destroyed but can only transform. The same amount of internal energy lost by molecules in a chemical reaction is gained in the form of heat and/or work.

Most thermodynamic processes (transformation or evolution of states (Gladyshev, 1999) (Ilya Prigogine, 1978)) take place when the system interacts with its surroundings. This is why we will look for a thermodynamic state function (thermodynamic potential such as the internal energy U, Helmholtz free energy F, enthalpy H, and Gibbs' potential G, as well as grand-canonical potential Ω for the metaphor, which, as a macroscopic physical quantity, can characterize the state of a system and does not depend on how the system reached that state. On the other hand, the condition of being in contact with an environment leads to some fixed intensive property[90] (as a consequence of a system in contact with the atmosphere, the intensive temperature variable is fixed); therefore, it is interesting to have state functions that do not depend on extensive variables[91] (generally these are Thermodynamic Coordinates as entropy S, number of particles N, volume of gas and other quantities such as magnetization or polarization of the sample x_i), but of intensive (generally Thermodynamic Forces such as temperature T, the chemical potential μ, gas pressure, and other external quantities such as the magnetic or electric field f_i).

Let us imagine that we have the necessary energy to create a system from nothing (and hence with zero temperature) in the middle of an environment with a fixed temperature (because it is large enough to remain constant despite disturbances). It requires less energy than we have, because there is a difference in temperature with the environment and there will be a flow of spontaneous energy, namely heat, to the system we are creating. Hence, the

90 An intensive property is one that does not depend on the mass or size of a body; hence the value remains unchanged when the initial system is divided into several subsystems, which is why they are not additive properties (Soriano & González, 2015).

91 An extensive property is one that depends on the mass or size of a body. These are magnitudes whose value is proportional to the size of the system it describes. These magnitudes can be expressed as the subtraction of the magnitudes of a set of subsystems that form the original system of each matter (Soriano & González, 2015).

energy needed is internal energy minus an amount that enters spontaneously; in a reversible process, heat is a function of temperature and entropy, and therefore:

$$F = U - TS$$

Equation 4: Heat subject to entropy and temperature

This equation is called Helmholtz free energy (Cohen et al., 2007). This state function is particularly interesting for the thermodynamic metaphor, and will help us understand the dynamics of exchange of knowledge between the Ecosystem University and the environment-society. Moreover, since it is a function of state, it does not depend on the process it went through during its transformation but on the initial and final states of the system.

According to Bratianu's first metaphor (Bratianu & Andriessen, 2008), internal energy can be understood as knowledge. In the same way, we could say that there is a quantity of knowledge-energy for each actor of the Ecosystem. Nevertheless, we shall have to take into account that the sum of those individual knowledges is not equal to the knowledge-energy of the Ecosystem, since some energy pertains to the interactions between the actors.

From Equation 4 we derive:

$$U = F + TS$$

Equation 5: Ecosystem energy function

Where F, known as Helmholtz free energy, is the energy needed to create the Ecosystem, i.e. the knowledge-energy needed for the creation of the structure-organization,[92] plus the knowledge produced by synergies and interactions in which temperature T and entropy S come into play, where the value of entropy is of singular importance to this work.

The entropy of the Social Ecosystem of the University is determined by the *number of possible states in which the system may exist depending on*

92 Understanding the institution of University as an organization and the relations in a cultural structure for the dynamics of knowledge.

the probability that this state occurs. In general, the number of possible states grows in relation to the development of the Ecosystem.

The greater the possibilities of the state occurring, the less information emits the signal of the state, and the smaller the possibility that this happens to the state, the greater the information and potential for novelty and consequently the production of knowledge.

One must not forget that one of the most motivating factors for the thermodynamic analogy is the complexity of the system. A thermodynamic function of state depends on what happens before and after the reaction, which comes in handy for explaining the macro-states without having to establish the reactions and interactions of the micro-states. However, some approaches relate complexity to entropy because of the tendency toward disorder, while uncertainty (Delahaye & Zenil, 2012)in turn is related to information (Bar-Yam, 1997). Although there is a relationship, one cannot maintain that they are the same, just as chaos must not be confused with complexity [347]. Excessive entropy, i.e. too many changes, may break patterns of complexity, and, conversely, insufficient entropy, i.e. poor dynamics, will prevent the emergence of complex patterns such as self-organization and self-determination.

Complexity can be seen as a complementary factor between order and disorder, thus matching analyses from the perspective of representatives of so-called hard sciences such as Kauffman (S. A. Kauffman, 1992), López-Ruiz (Lopez-Ruiz et al., 1995) or Langton (Langton, 1990) with philosophical authors such as Morín [80] [350] for example.

The number of states depends on the number of actors, their capacity to produce knowledge, social interactions, etc. Section 2.1 shows the characteristics N_i, in which different states may occur; these characteristics may be influenced by external situations f_i that depend on the interaction of the Ecosystem with the culture of society (Ruiz-Mirazo & Moreno, 2004). The sense derived from the environment, the stakeholders, or investors in knowledge production processes - these influences can be caused by a feedback (positive or negative) that illustrates that knowledge shared with the environment, correspondence, credibility, public opinion, satisfaction of needs, consolidation of processes, etc., is relevant.

With respect to temperature T, we could say that from the logics of a social system, it represents the difference between what is usable or convenient to build the states. This will depend on the potential of novelty that makes the characteristics of the system's structure attractive, since the fact that it is possible to realize a state does not necessarily imply that it has to be implemented. This means that in a system with high temperature the great majority of the options are carried out and vice versa.

The variables entropy and temperature are related by the potential of novelty, i.e. the increase of entropy linked to the probability of producing novelty makes the concretion of certain states attractive.

The magnitude of internal energy or the knowledge of the organization is very difficult to determine given the existence of knowledge-energy transfer with the environment. The equivalent of this type of social system is an open thermodynamic system, but for this case study, all we need is to understand that the organization-university knowledge-energy is equal to the sum of knowledge-energy necessary to create the system and the knowledge-energy resulting from internal transformations.

The growing spiral of knowledge exists as long as the organization-university maintains relations with the environment. Figure 14 shows the interactions according to the knowledge management model.

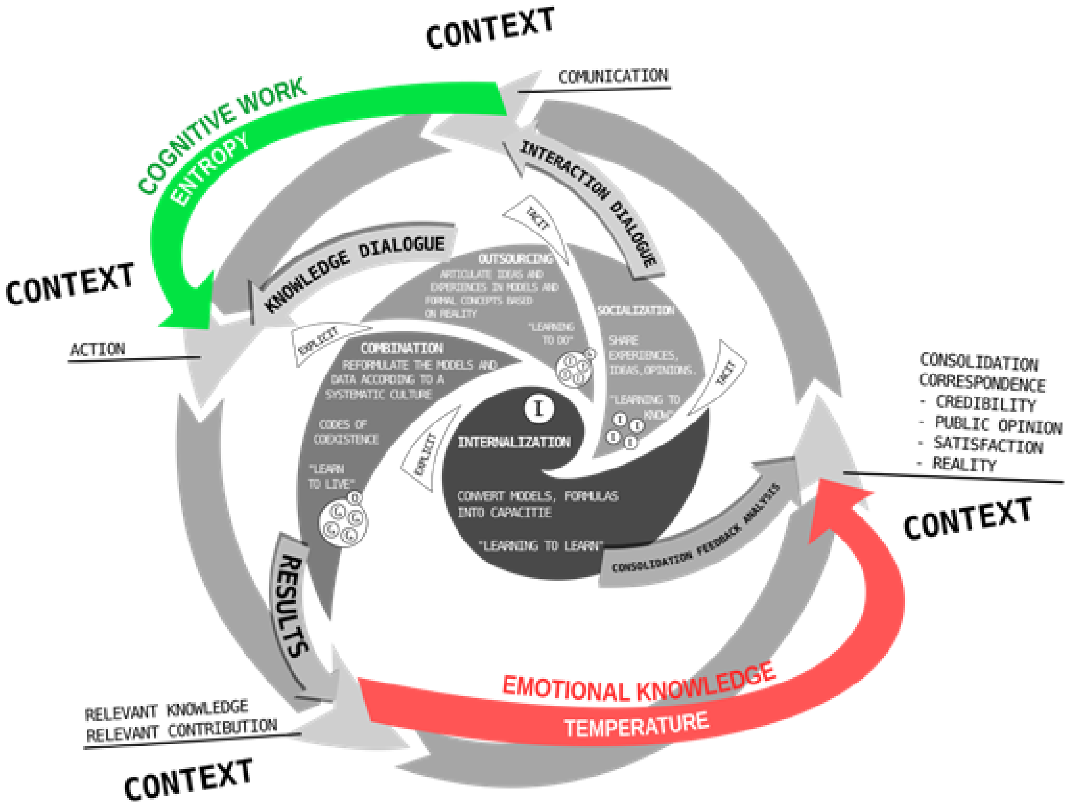
The free energy of Helmholtz, which – as we said before - is the energy-knowledge necessary to create the Ecosystem in an open system with limitations caused by the influences of the environment, will be equal to the energy-knowledge that can be transformed into social action to produce knowledge, plus the interactions of the surroundings represented by the influences on the characteristics of the system; thus

$$F = G + \sum f_i N_i$$

Equation 6: Knowledge-energy function

G is the free energy of Gibbs, or for our case the knowledge-energy available to realize the states of production of knowledge. It is irrelevant and would be very difficult to measure the quantities of energy, but it is of interest to understand the logical relation between the variation of the energy of Gibbs and the spontaneity or no-spontaneity of knowledge-energy transfer in a reaction of the ecosystem.

Figure 14
Relation between thermodynamic analogy and knowledge model



Elaboration: Salgado-Guerrero, J. P.

If we consider a system (analogous to social), with a chemical reaction where we transit from assets to products (of knowledge), we will have increases of energy (knowledge). The reaction is facilitated by a negative variation of enthalpy[93] (exothermic reaction); when entropy increases, we speak of a spontaneous reaction. Therefore, the free energy variation of a reaction is equal to the enthalpy variation minus the temperature resultant from the variation of entropy. This relation is defined as free energy of Gibbs, which is a function of extensive state, and represents the free or available energy to carry out a work (in this case the chemical reaction); this variation explains why a relation is spontaneous or not. If the variation of Gibbs is positive the relation is not spontaneous, and energy must be provided. If the variation of the free energy of Gibbs is zero, the relation is in equilibrium, and if the variation of Gibbs is negative, the reaction is spontaneous. The following table specifies the relationships between Gibbs' energy variation and spontaneity or non-spontaneity.

Table 5
Relationship between available knowledge-energy and knowledge transfer-reaction strategies.

Δh	Δs	Δg	Knowledge-energy flow reaction management
$\Delta H < 0$ Exothermic reaction	$\Delta S > 0$ Products more disordered than reagents	$\Delta G < 0$ Spontaneous Reaction	Reaction monitoring
$\Delta H > 0$ Endothermic reaction	$\Delta S < 0$ Products less disordered than reagents	$\Delta G > 0$ Non-Spontaneous Reaction, requires continuous energy input	Need for implementation of strategies that favor increase of knowledge-energy of the system
$\Delta H < 0$ Exothermic reaction	$\Delta S < 0$ Products less disordered than reagents	If $\Delta H > \|TS\| \therefore \Delta G < 0$ Spontaneous reaction, if low temperature, it favors spontaneity If $\Delta H < \|TS\| \therefore \Delta G > 0$ Non-spontaneous reaction if temperature is high, and requires continuous energy input	If the explicit knowledge produced is greater than the tacit knowledge that is being developed, the transfer of knowledge-energy is spontaneous.

93 The definition of entropy for the metaphor corresponds to the knowledge (absorbed or transfered) when a product of knowloedge is formed based on the elements of explicit knowledge.

$\Delta H > 0$ Endothermic reaction	$\Delta S > 0$ Products more disordered than reagents	If $\Delta H < \lvert TS \rvert \therefore \Delta G < 0$ Spontaneous reaction, high temperature favor a reaction If $\Delta H > \lvert TS \rvert \therefore \Delta G > 0$ No spontaneous reaction, if the temperature is low	If the tacit knowledge produced is greater than the explicit knowledge that is communicated, there is no incentive to execute more states of knowledge production with the characteristics of the system; therefore it becomes necessary to execute strategies to increase the incentive.

Elaboration: Salgado-Guerrero, J. P.

Beyond trying to measure the variables of thermodynamic models, this paper aims to understand the logic of relationships between them. A potential investigation project could seek to determine the other variables as well as to clarify some related analogies: is the system in equilibrium or is it not; what variables can be considered as constants; and what fluctuations depend on the function of state; what is the impact of a system´s size?

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. Kauffman'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-system[95] 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 Morín 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 untrodden paths, and to allow the individual to twist the rules, manage and create own spaces of freedom (Vignaux, 2013).

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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 politics[98] must not be confused with production and exchange.
- To what extent is the condition of the shared and collective commons[99] 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-

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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 ownerhsip.

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.

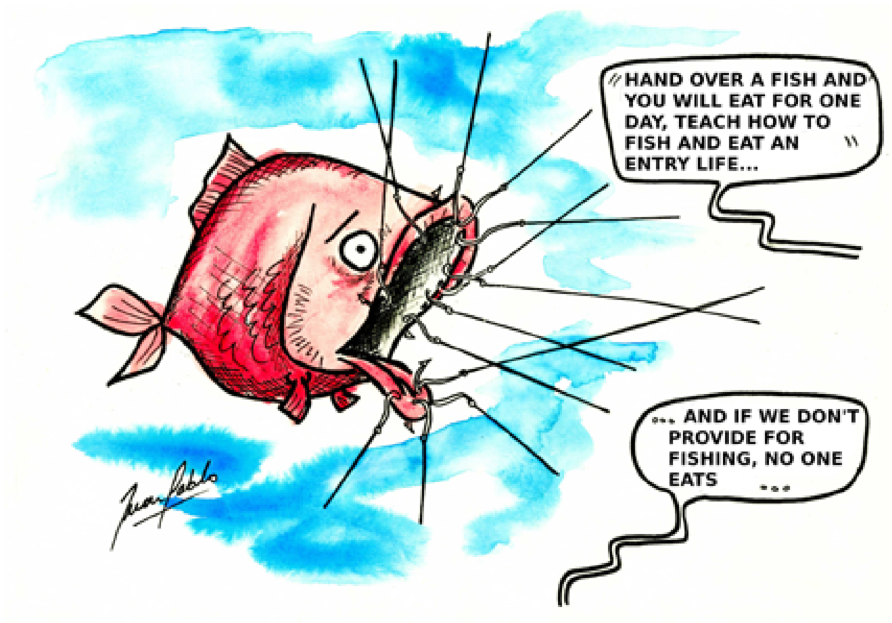
101 Schumpeter shows that economic thinking can become confusing when it ignores the abyss by conceiving that maximum performance is incompatible with maximum profit and proves that the second implies the first. Schumpeter: Capitalism, socialism, and democracy.

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 rationaliyes 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 dilemma[105] 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.

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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 themselves[109] 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]

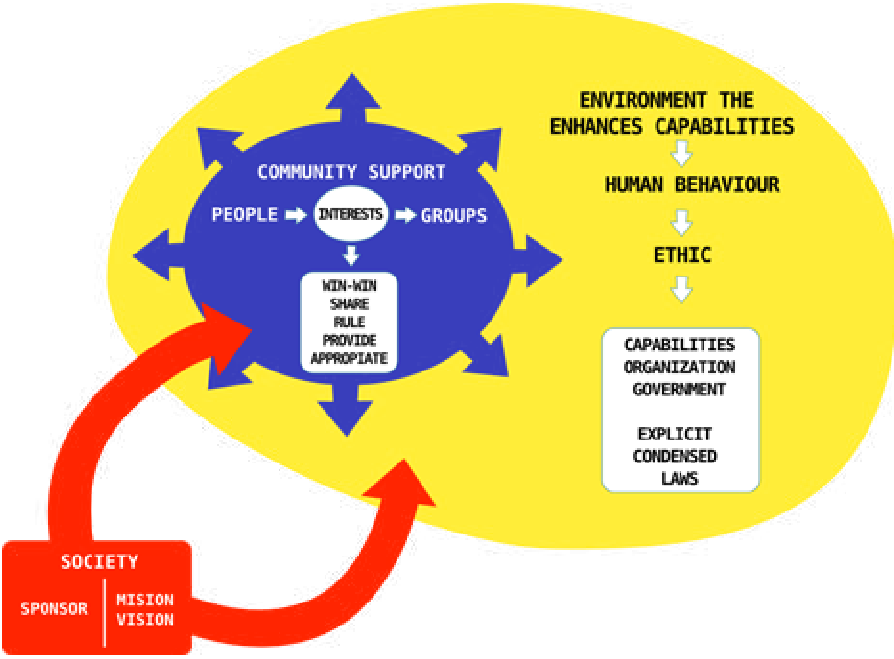
The effects of the very diverse ways of assigning responsibility for building, restoring or maintaining the Ecosystem University (Common Pool Resource) that provides resources. If the actors provide independently, their contribution may be less than optimal for the construction and maintenance of the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

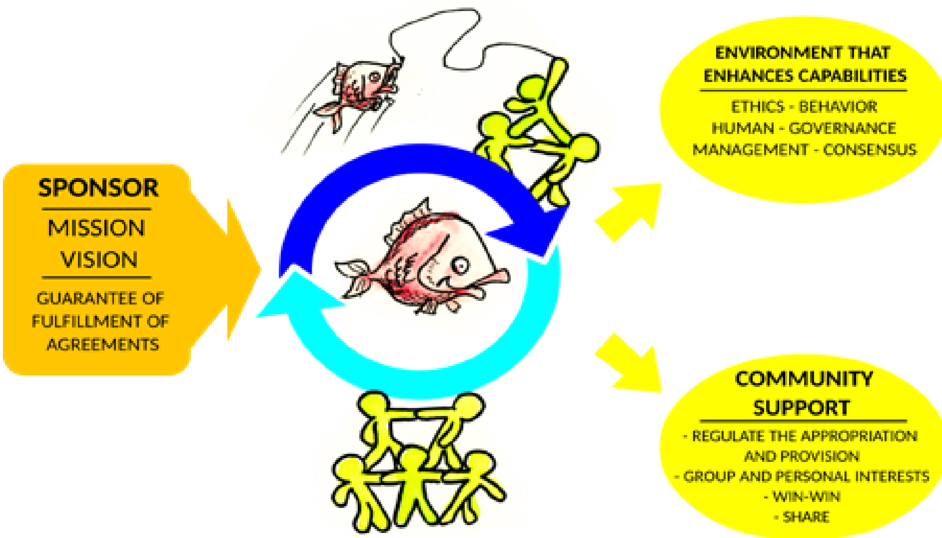


Elaboration: Salgado-Guerrero, J. P.

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	*Constitutions* Board Monitor (Promoters)	*Collective Choice* Councils of Institutional Governance (Collegiate Governance Bodies)	*Operatives* 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]

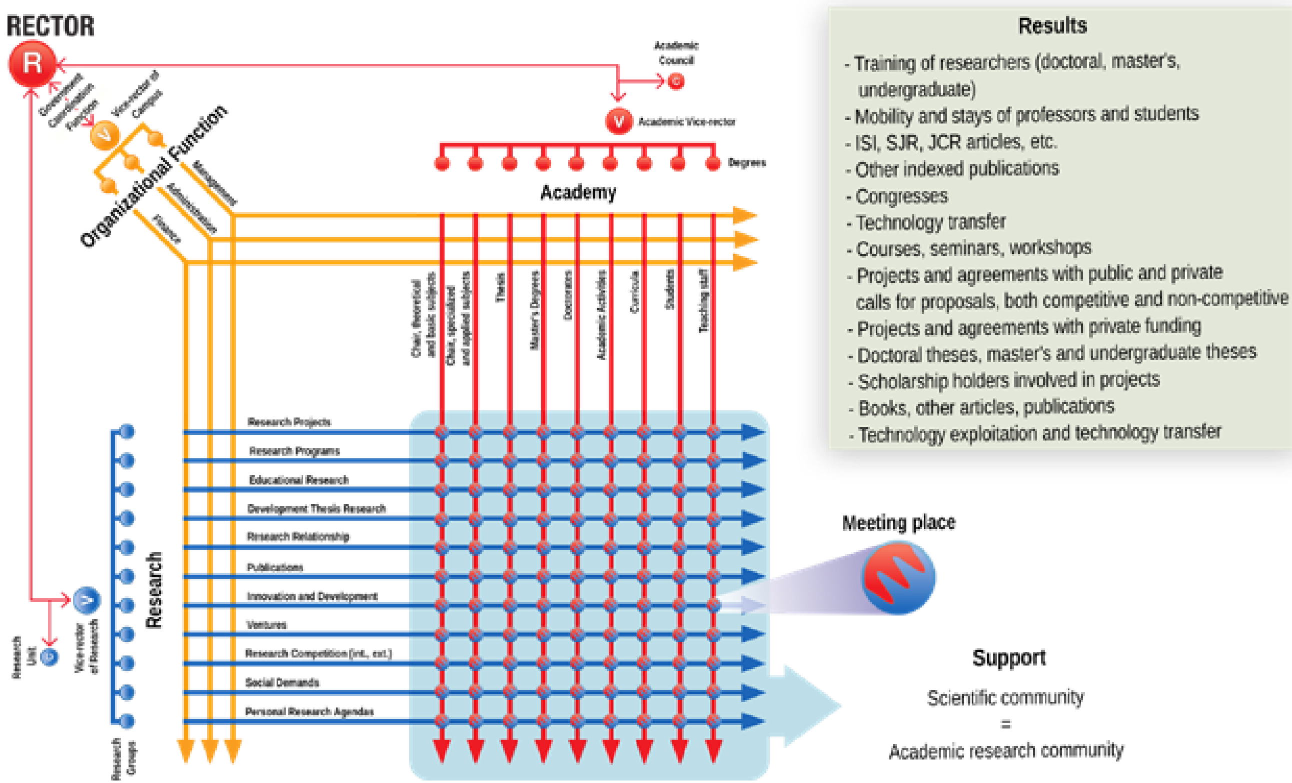
University governance takes place in what we shall define as *meeting places* (Figure 18), where the multiple flows of research and teaching functions intervene; we need a model of university governing bodies that interact in an uncontrolled rhizome, and that plans from below through action (Cazorla 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 autonomy[115] 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 (Comeliau, 2002) by inventing and creating new forms.

> The only mercantile transactional logics[117] can render the university commune anachronistic because they threaten social links by strengthening individualism. Such logics must be superseded by the contractual sense[118] 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.

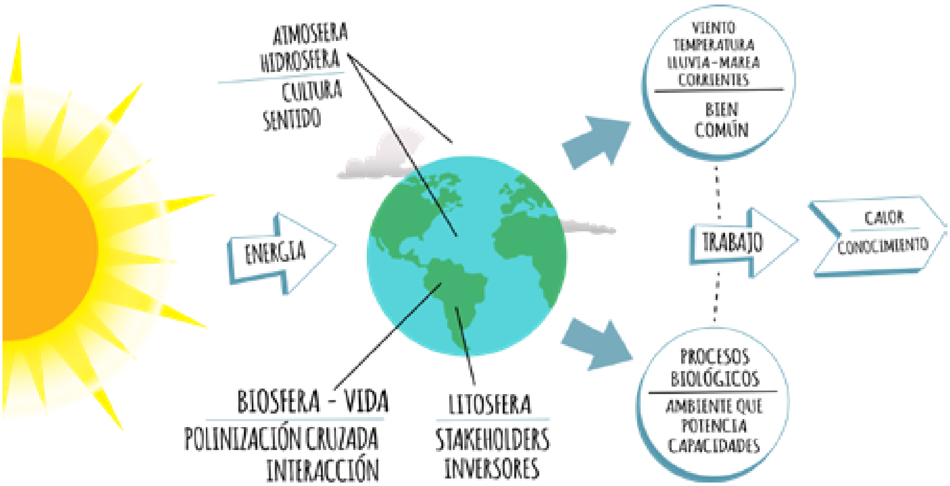
The ultimate goal of the Ecosystem University is to develop individuals into free and responsible citizens, i.e. people who can live a full and creative life by developing their potentials. If the real challenge of development is the human BEING,[119] one would have to think of development *for, through 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 educaiton 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 understand *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 (Amaryta 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 objectives[122] 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

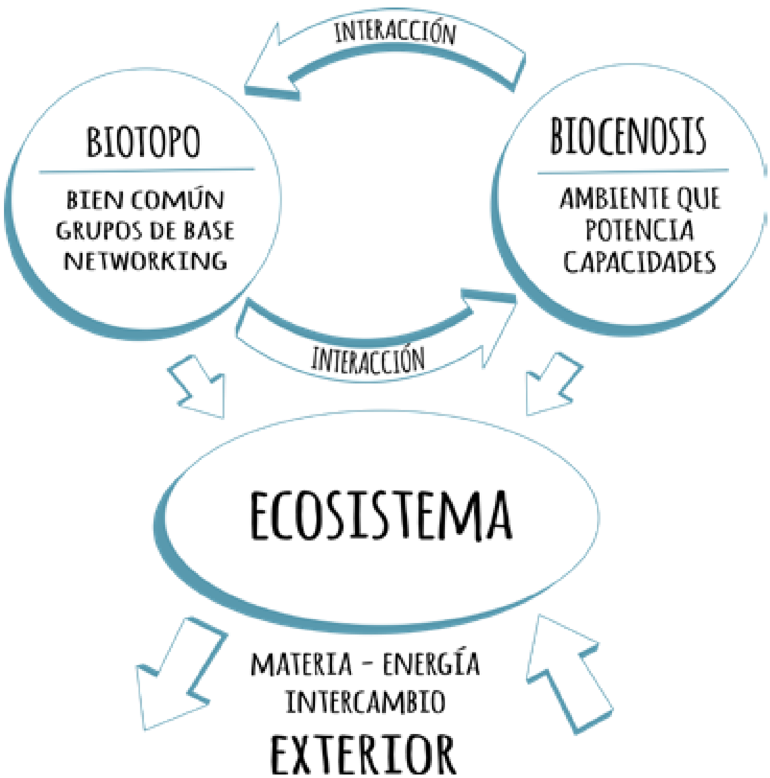
Elaboration: Salgado-Guerrero, J. P.

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 chose 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 characteristics[123]:

- 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 belwo 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.

  Nussbaum[128] 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.

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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 emulation[131] 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 Senge[133] 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 traitions 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 (lkujiro 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 economicist 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.

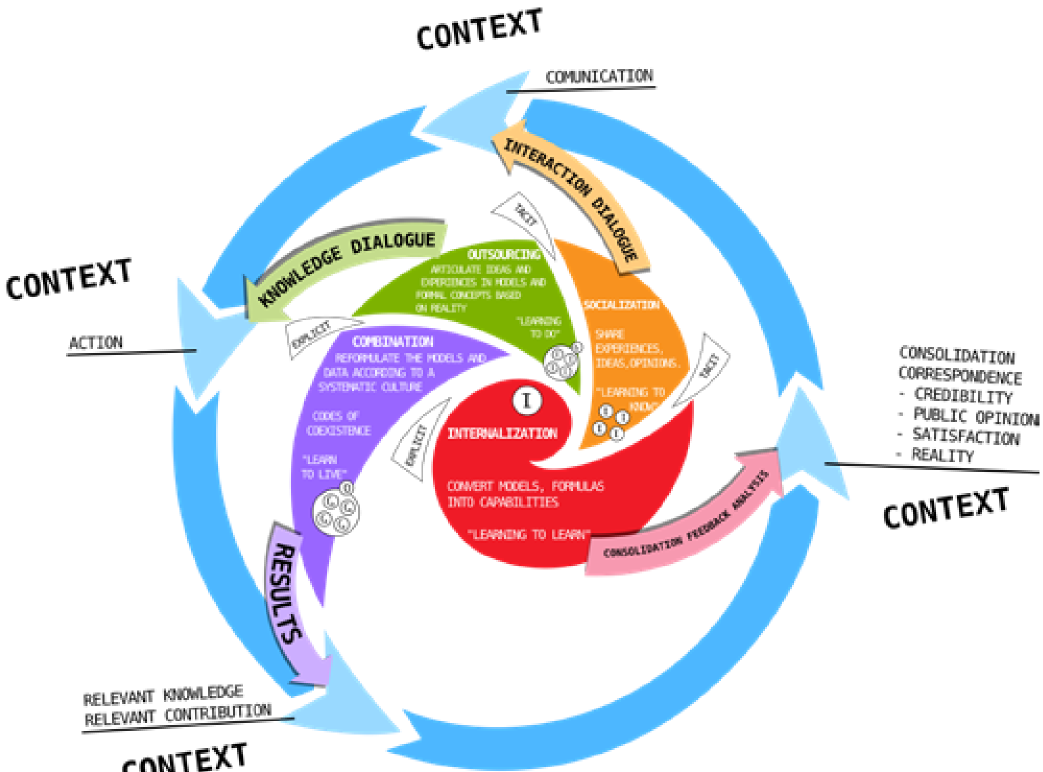
Communication-action with the environment allows us to project reality without generating a gap between theory and practice, it permits us to articulate ideas and experiences in formal models and concepts according to reality, that is to say, externalization, achieving tacit - explicit transformation.

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 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 transversalize 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 commune[143] 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 Communality 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 Councils[144].

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.

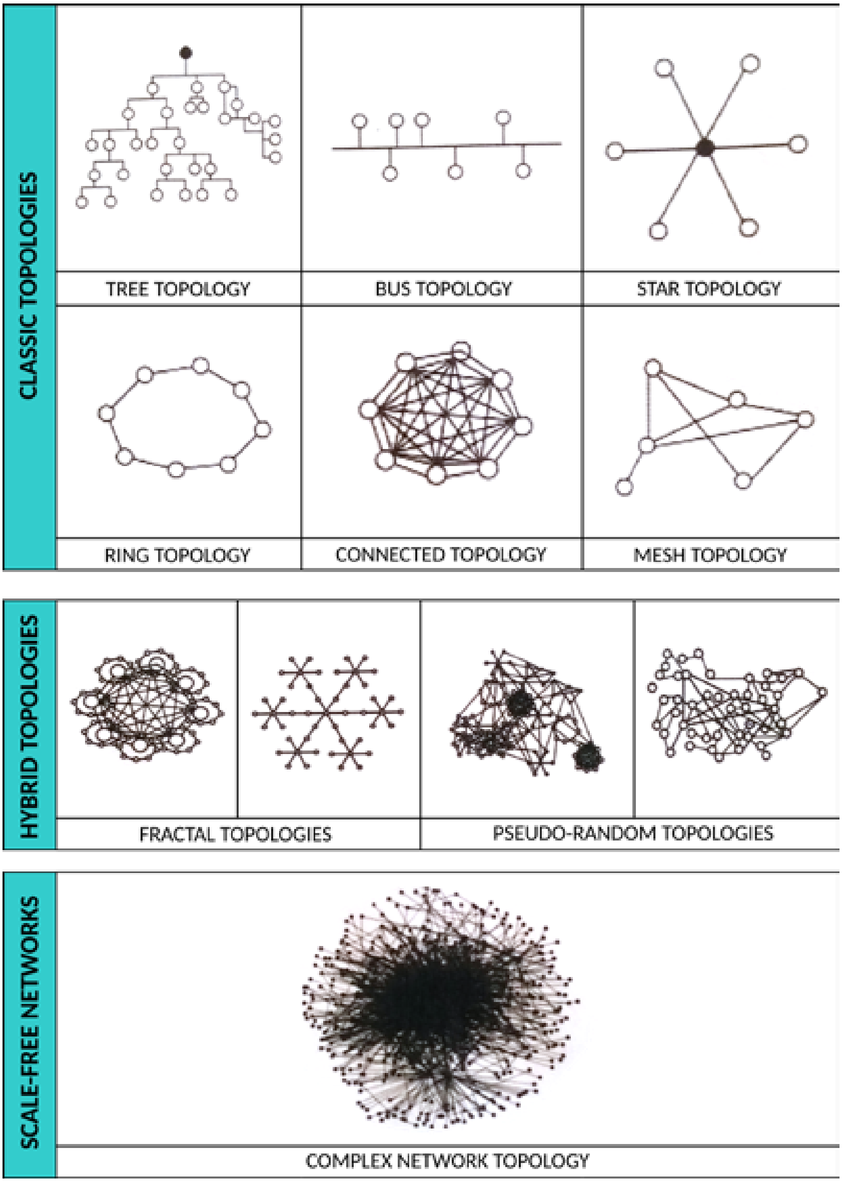
The Ecosystem needs to have a range of possible topologies of structures that are sufficiently diverse to allow the groups to operate as rhizomes in complex environments or make use of that complexity. These topologies must be in accordance with the behavior of the actors, groups, social systems and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

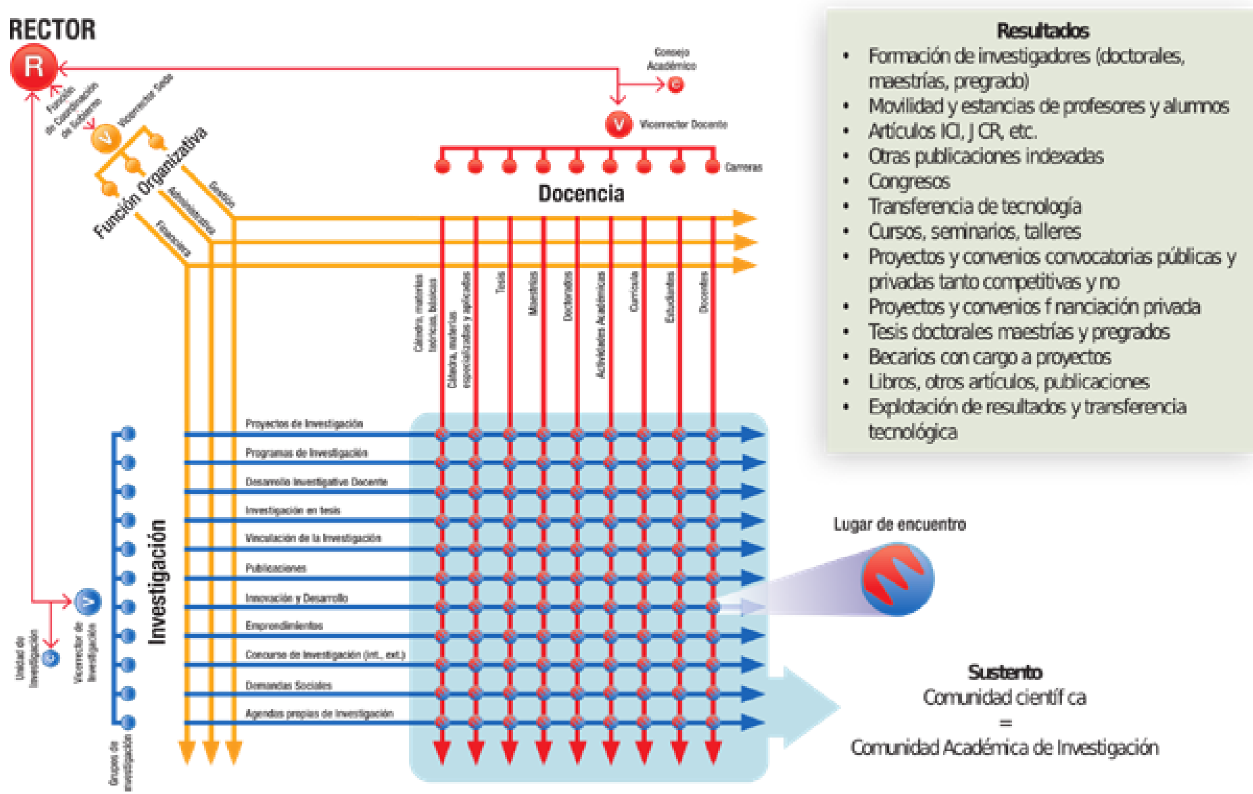
If we consider the Base Group (Research, Innovation, etc.) as the driving force of the Ecosystem, we need to put all university bodies at its service and give priority to the Teaching-Research relationship. This implies talking about a University that abandons the concept of the classroom, leaves its 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 characteristics[148]:

- 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 sensitivity[149]. 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 relationships[150] 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.

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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).

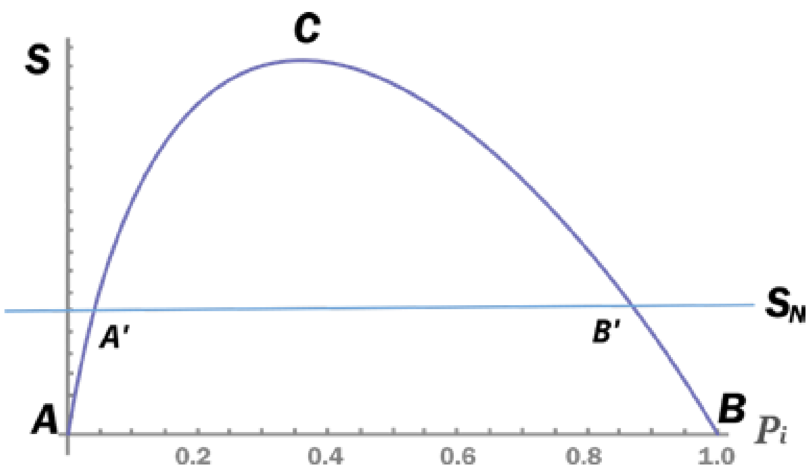
Efficiency and equity are related to entropy. When the value of entropy is too high, the community has more possible states or behavioral trends, i.e., more disorder, but at the same time it increases its capacity to satisfy needs and develop potential.

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 approaches 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



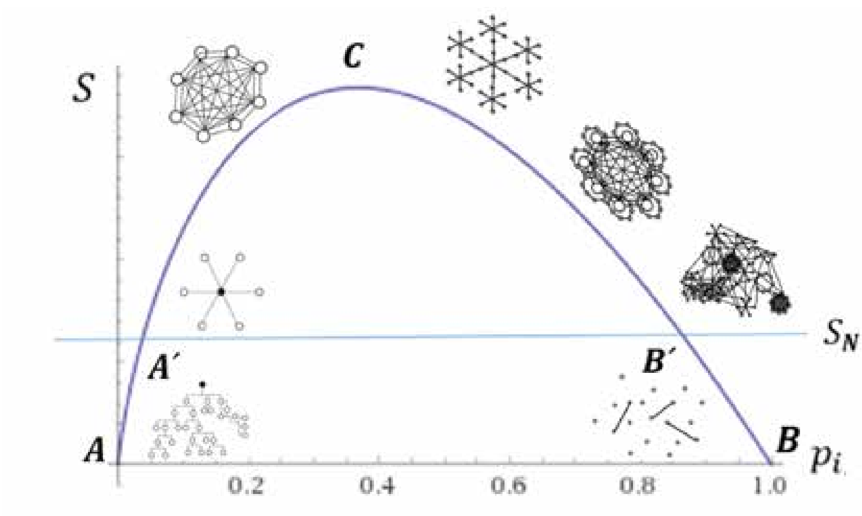
Elaboration: Salgado-Guerrero, J. P.

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



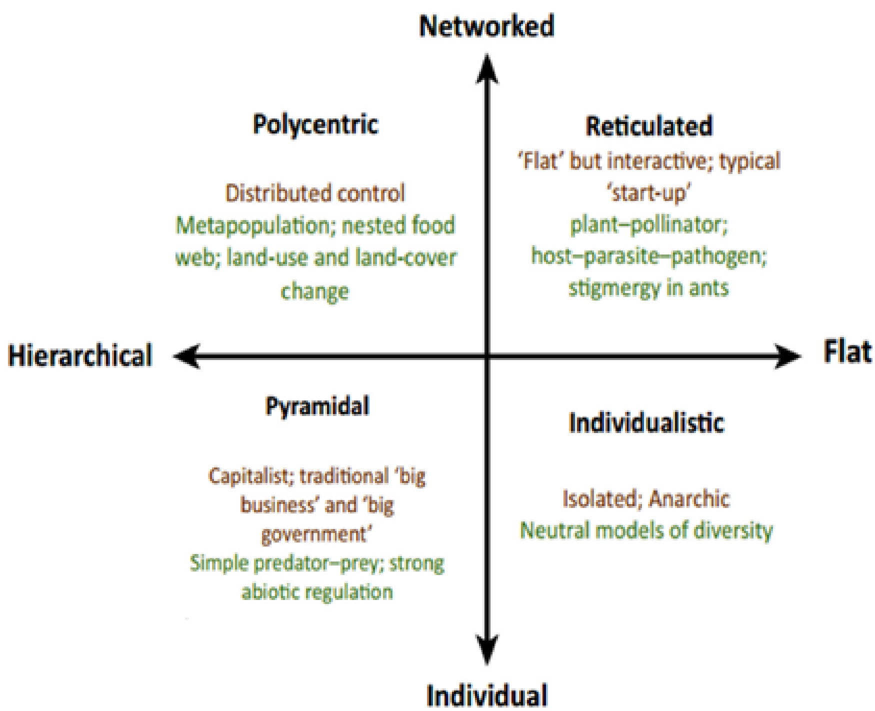
Elaboration: Salgado-Guerrero, J. P.

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.

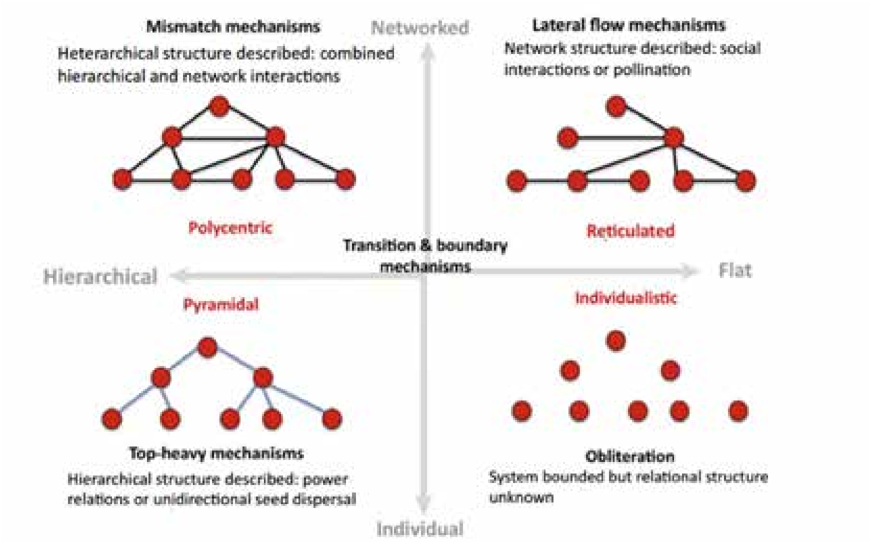
Figure 30 shows nodes, relationships and levels of interaction between the organizational structures corresponding to the four Cumming quadrants (G. S. Cumming & Peterson, 2017).

Figure 29
Classification of Networks and Hierarchy



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

Figure 30
Networks and Hierarchy by Cumming

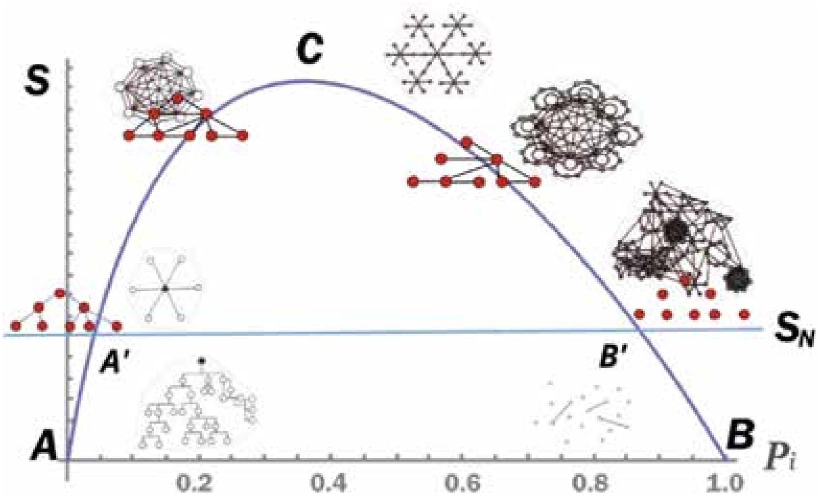


Source: Cumming (G. S. Cumming & Peterson, 2017). Prepared: Salgado-Guerrero, J. P.

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 figure. 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 resource[153] 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

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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.

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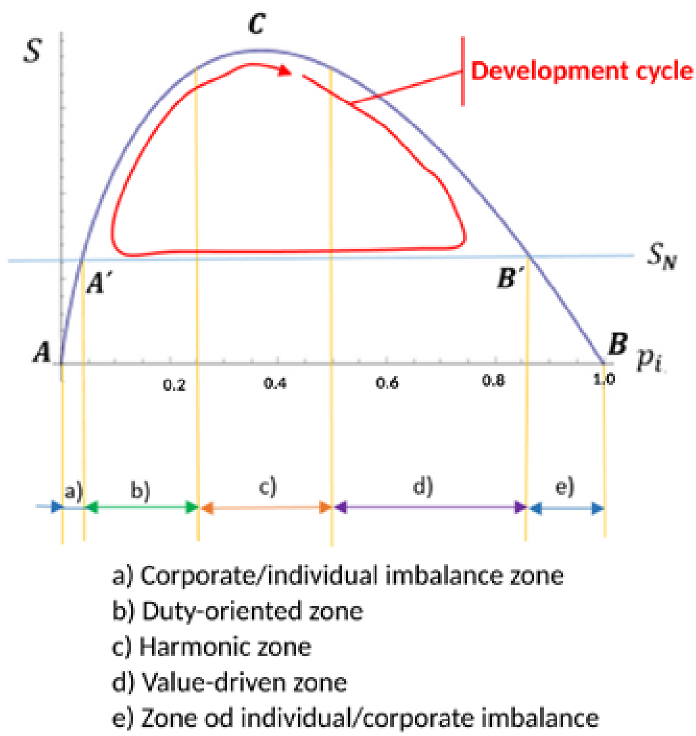
of the actors in the university. These consensual rules defend the actors, they are flexible since they can be easily modified, but without concessions to accomplishment.

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-organize. 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 cycles[156]. 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 resource[157] 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]

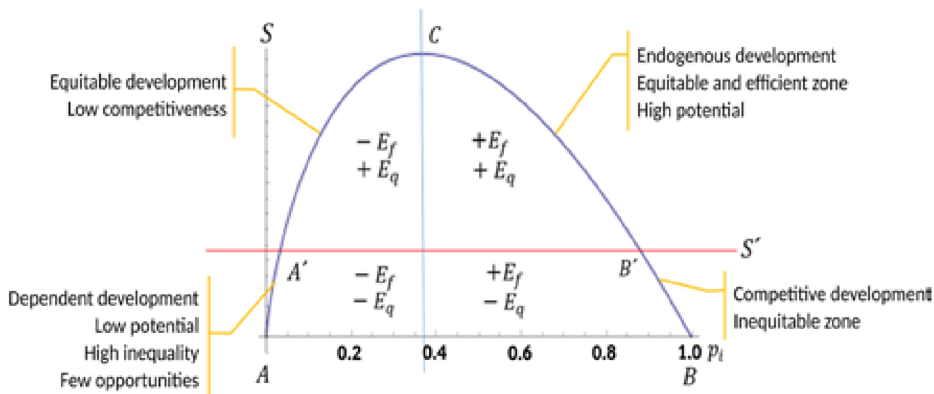
According to Miguel-Velazco [505], the regions of development can be classified as (cf. Figure 27):

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_f): 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*.

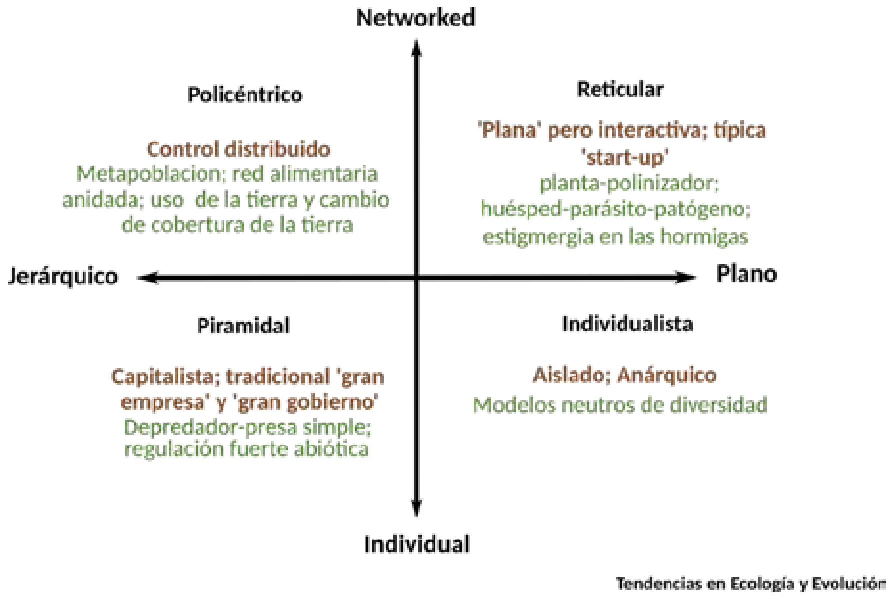
Cumming suggests that "hierarchy versus heterarchy" or "hierarchy versus network" are false dichotomies. His study, which condenses the works of some other authors (Bodin & Crona, 2009) (Bell & Hindmoor, 2009) (Wilson & Hölldobler, 1988) suggests a vision of a *Network vs. Hierarchy* dichotomy that is 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 rom, 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.)

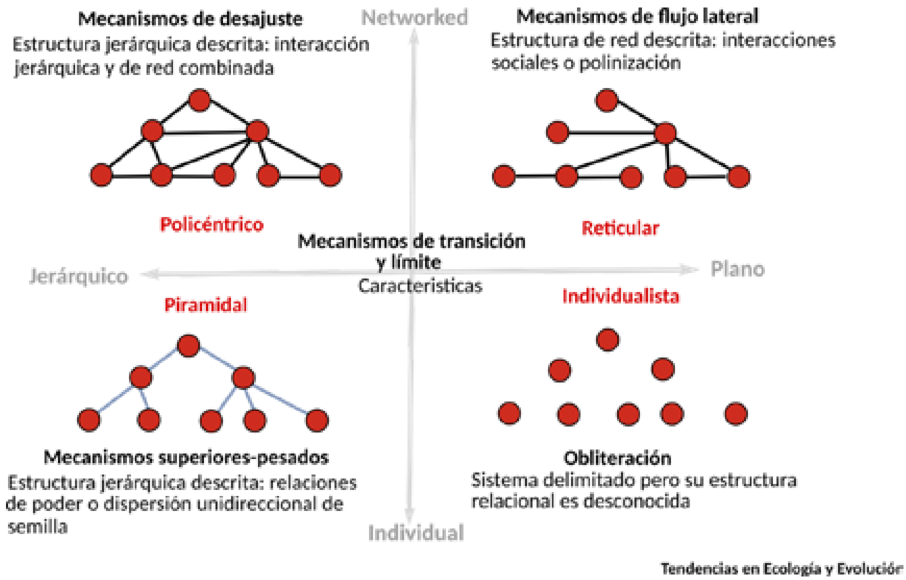
Cumming describes four basic types of heterarchies that can be seen in Figure 34. The author has assigned a name to each quadrant, and below describes an example of social structures and an example of nature.

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.

Figure 35
Organizational structures according to Cumming quadrants



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 control[161].

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 epistomology, 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 cannot 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).

PART II

Toward a University for the Person

Introduction

The University's ultimate goal is the search for truth. The knowledge created in the University will free human beings as it highlights what they want; yet, such resolve is not based on a compendium of partial truths but on the meaning that we attach to this search for truth, i.e. the things that contribute to the improvement of the human BEING and the answers that we can find for the ontological rather than epistemological discovery of that truth.

The strength that comes from the search for truth is the result of the simple acquisition of professional skills. While this is something, we need to go beyond it - as Pope Francis says - *"at the heart of this ambitious project... was confidence in man, not so much as a citizen or an economic agent, but in man, in men and women persons endowed with transcendent dignity"* (Bergoglio, 2014). This is a liberating vision of the individual. We must conceive University from the perspective of the formation of individuals who are responsible for their dignity and the path to the transcendence of their BEING; university must provide an environment that sustains intelligence and the development of our capacities, but also the necessary formation for the development of our will.

In the university for the person, knowledge is a tool that enables the individuals in community to forge their own path in life. It provides people with moral judgment rooted in dialogical reflection on different points of view. The centrality of the person encourages the university to think about how to create environments that permit individuals to live their freedom, not *as they please* but with autonomy in their conquest of being. In this freedom, values reaffirm the individual as a member of a community with virtues based on respect, reciprocity and co-responsibility with others. The development of intelligence and wisdom gives content and meaning to the person, the progressive understanding of meaning opens people's spirit and life.

The University centered on the person aims to constitute a community for all that produces and is a product of social innovation, a new culture where people can build meanings and interweave relationships with a new ethic, an environment in accordance with our times and demands, characterized by the promotion of values. At the same time, it is a place where people can develop their life projects.

If sense (understood as raison d'être and therefore as direction) is not explained but understood from experience, will the scientific method be sufficient for understanding? How is understanding possible? What elements are necessary to understand meaning? Biology, for example, can explain the factors that make up the reality of life, but is not sufficient to explain the meaning of life.

The university does not merely teach competencies or the mastery of scientific know-how; understanding science goes hand in hand with reflective and critical training and autonomous judgment building.

Weber (Weber et al., 1982) defines explication as an intelligence and understanding as a connection of meanings of facts. For Weber, scientific understanding therefore must include: the why; the how; in what context; with what epistemological resources; how the contents of a science are produced, reproduced or developed in order to establish all the relationships of meaning.

The close relationship that Weber proposes between explication and understanding not only questions the positivist meaning that has always been attributed to explication, but also to the modern scientific model on the objective of understanding the phenomena of science.

Thus, there is no counter-position with the postulates of training by competencies, but we should be aware that this is eventually not the objective of a university. Moreover, the university cannot be expected to provide analytical plans and fragments of knowledge, but, in the light of truth, it must aim to give unity and meaning to knowledge through reflection and synthesis from a transdisciplinary logic of the sciences.

Teaching, research and outreach are a unique opportunity in the hands of the University to make a contribution to society through meaning and relevance and help people recover their identity built from recognition and identification with the other; in everyday life we can explore love as the most elementary form of recognition, and diversity is not a reality that we must "tolerate" or eliminate, but a source of enrichment.

The centrality of the individual in the University can be determined by two clearly marked dynamics with society:

1. The dynamics of knowledge production: a University capable of responding to social demands, able to raise new issues and question itself. Research is not only conditioned by instrumental reason, i. e. solving problems for and meeting demands of the business sector or the government, but is above all the result of the capacity to question oneself, and therefore of critical thinking. Thus, we must maintain in the University the dynamic relationship of conflictive but fruitful dialogue between critical thinking (meaning, justification, questioning) and instrumental reason. Research imprints dynamics on university management and determines its style and type; it is capable of combining the efficiency imposed by the environment with the freedom of proposal.

The relationship between research and ethics is a focal point that combines the transformation of the world from science and its logic of rationality and effectiveness, with the logic of critical behavior of the researcher faithful to the truth in the production of knowledge.

This model envisions an academic community that is committed to the values of reciprocity and co-responsibility to overcome difficulties and limitations, where the search for truth is a dimension that permeates the University and is present in all its areas. A Scientific Community is built as members contribute knowledge and efforts from every field and area to advance the common good called University.

The Academic Research Community's recognition that the dialogue between research results and society is an objective guarantee of its nature and raison d'être and is above any university rankings or any system for measuring quality or excellence.

The university cannot entirely disregard such indicators for quality or excellence such as the rankings, but can take them for what they are: necessary input for University management but not as an end in itself, which have to be the *individual people*. It is not the comparative indicator that provides feedback to what the university does, but the validation of its knowledge for society as significant and relevant.

2. Dynamics in the education of citizens. University education is understood around a student's life project and even that of the teacher. This project is socially responsible, where it is made to BE a main actor capable of asking questions and providing critical solutions based on ideas and knowledge.

University education goes beyond the acquisition of competences and the transfer of knowledge and aims to teach students how to do science, boost their critical and reflective capacities that pave the way for scientific feats and show the democratic way toward autonomy for building knowledge.

In the University for the individual, students not only learn and replicates knowledge, but also discover the dynamics of how knowledge is generated from the investigation of its causes, circumstances, epistemological resources and the establishment of all the connections of meaning.

Research develops people's critical and creative capacity to establish a distance from knowledge, giving way to the formation of moral judgment, which is the basis of free citizens, both at work and in people's private and community life. The search for truth plays a crucial role for building personality and developing students' capabilities.

Finally, a University for the person must combine people's work and life; one that seeks the truth of life by living it with resolution making and projecting itself in multiple ways. Such university will not renounce the capacity to manage itself in dynamic, diverse, collective, and multiple ways, abandoning its comfort zone and seeking new paths.

Different from others, a university with an identity of service to the people implies a responsible degree of autonomy to shield it against homogenization with respect to the production of knowledge. Openness to particular characteristics and paradoxes will produce innumerous developments in the Academic Community, whose diversity will enrich the University and its social environment, opening it to an unimagined and unparalleled world that recreates the search for truth.

This is what the Ecosystem University aims for - put life at the center of university activity. Ecosystem aspects, virtuous cycles and human relations entail experiences that help to place things in their context and connect practice with theory, i.e. the real with the ideal. It is clear that results will be unpredictable once the Ecosystem University uses experience as the basis of all learning. Although such uncertainty may upset pragmatists, it is the essence of the mixture between adventure and work, or rather between emotional knowledge and cognitive knowledge, the basis of creativity.

Chapter 1

University: Between Critical Sense and Instrumental Reason

In philosophy, the concept of *instrumental reason* denotes an action or a process marked by the search for efficiency, by a rational adjustment between means and ends. Weber (Weber et al., 1982) defines it as the methodical achievement of a certain end in a concrete and proactive way, through optimizing the use of the appropriate means. However, the very nature of research and teaching tasks – *learning science by doing science* – leads to another form of reason: critical reason.

The university is the place par excellence for building the - conflictive albeit fruitful - relationship between *instrumental reason* (the effective transformation of the world, nourished, in this case, by science and guided by the search for efficacy and rationality) and *critical sense*.

Faced with the challenge of establishing a connection between the means and ends[166] of an "effective" transformation of the world, the University gears science toward the search for efficacy and strengthens its rationality, but at the same time feels the urge to prevent the rigorously instrumental thought of rationality from governing the ethical capacity to make its own choices. The very nature of research and education involves justification and questioning, which opens the way to a critical meaning.[167]

Jean Ladrière [56] argues that what is at stake in the university is the relationship between instrumental reason[168] and ethics (Ladrière, 1986); as

166 The university is capable of acting in society through the two types of action defined by Aristotle: *productive action* (poiesis) focused on results and *practical action* (praxis) focused on the means (Aristóteles et al., 1970).

167 The links between epistemology and pragmatics call us to consider how science leads us to reflect on our actions and transform them, as well as to conceive that scientific productions picture the complexity of the world as we perceive it. These links absolutely require a cycle of action-research-decision-social regulation (Morín & Le Moigne, 2006).

168 Max Weber refers to the achievement of a certain end through a clear and practical method instrumental reason, using an increasingly precise calculation of the means, of the

we know, ethics is the product of the moral choices that individuals have for themselves and for others.

Therefore, it is a question of sense (understood as direction and meaning) expressed by openly cultural objectives, as well as by solidarity-based political objectives, both of which are the product of the University's capacity to transform society through reflective knowledge.

Similarly, the university also faces the challenge of effectively responding to the solution of economic, educational and social problems, which is referred to as instrumental reason.

The dialogue between critical sense and instrumental reason in the Ecosystem University implies taking into account, from the paradigm of complexity, that at certain moments, these are not only opposed to university life, but, more importantly, are also complementary. The lack of critical sense implies banalizing and standardizing University, even though it may be effective. However, giving up instrumental reason would be a sign of infertility and inability to relate to society.

The supremacy of instrumental reason can lead to an "effective" University that has a reputation in many areas but has also lost its identity, uniqueness, and therefore, its true usefulness to society.

When critical sense seeks to turn into an objective and instrumental science, it loses its philosophical angle.[169] On the other hand, when it is considered an end in itself, it loses its reason for being, limiting itself to the problematization of the problem and to speculative reflection. Reflection and speculation must dialogue with objectivity and utility in a way that avoids losing sight of the objectivity of speculation and the reflection of utility.

Knowledge production combines the university's two transforming branches, the formation of citizens capable of transforming the world through their action*, praxis and poiesis*, and the production of knowledge that is relevant and pertinent to society. The search for truth is the funda-

supremacy of the quantitative over the qualitative that is characterized by the scientific-instrumental rationality that justifies the relationship between means and ends (Weber-Gesamtausgabe, 2016).

169 Which happened with the emergence of the Vienna Circle, which advocated a cientific conception of the world, demanding from philosophy the distinction of what is science and what is not (Hahn et al., 2002).

mental driving force for any personal training and the reasonableness of valid knowledge for society. However, the fundamental question is how the University knows the knowledge it produces. The search for answers produces more questions, which motivates us to go beyond epistemology and confront ourselves ontologically with why the University exists.

Modernity dominated by efficiency and utility seems to pervade the University, conditioning its action as an instrument to achieve the ends imposed from outside, underestimating that one cannot change reality by being unaware of it or refusing to think about it. The Ecosystem University will seek to define and disseminate a model that favors dialogue between the efficiency demanded by the environment and its capacity to choose how and why to respond to challenges, even though not everything will be clear. To understand it as an open and complex system similar to a hurricane, which determines the movement of the air from its environment. As this same air feeds its movement, we can speak of a continuous cycle that ends only when the exchange with the environment is severed. The Ecosystem University guarantees its life by being a constant product and producer of society.

The autonomy of the Ecosystem University lies precisely in the fact that the production of transformative knowledge is based on the dialogue between critical sense, - i.e. meaning, questioning, and justification – and the transformation of society based on efficiency and rationality, that is, instrumental reason. Through the same movement, students and teachers will keep a critical distance that produces moral judgment, fundamental for socially responsible citizens.

The search for the root of the crisis that increasingly separates reasonable from instrumental reason, which Aristotle called theoretical reason (*dianoia epistemonikon*) and practical reason (*dianoia logistikon*[170]), and which we could distinguish as thinking and action,[171] or knowledge and information,[172]

170 *Logistikon* "experience" does not refer to actual experiencia (Erleben) but to experience of the mind (Erfahren) that is able to create new knowledge (Vernon, 2008).

171 According to Aristotle ther are two kinds of action: *productive action (poiesis) with a focus on results and practical action (praxis) with a focus on the means* (Aristóteles et al., 1970).

172 Information is neutral, rational and useful, according to Morín (Edgar Morin, 2017): "*...it is that which, for an observer in a situation with at least two possible options, puts an end to an uncertainty or resolves an alternative, i.e., substitutes the unknown for the known, the uncertain for the certain. A program involves a set of information that takes the form of imperative instructions for the execution of operations...*" and this through logic. Knowledge, on

requires a generous spirit that is open to the multidimensionality of the characters of knowledge and the complexity of the problem. We will find an answer only through the very dialogue between critical sense and instrumental reason.

People do not seek the meaning, direction and reason for being, but build[173] it in community based on history, scientific (*true*) and cultural (*real*) knowledge, from personal experiences and from relations and communication with peers in society. It is a guarantee of a University that pertains to its context and is relevant because of its capacity for social transformation.

Sense cannot be explained by the rationality of scientific thought alone. While biology, for example, can describe all the functions of a living organism, it cannot explain the meaning of life. A disadvantage of the development of ever more scientific disciplines is, however, the over-specialization of each field of knowledge. Knowledge remains in the hands of a small group of people, unattainable by society at large and accessible only through a process of specific training, and will produce individuals with a high level of expertise, but without a relevant global vision.

In Spain, the University 2000 report opened a discussion on the concept of university on the eve of a possible reform. It argues that "*the emerging information society*" highlights the urgent need for transforming Spanish universities, citing other reasons such as the transformation of labor and production organization; the phenomenon of globalization that affects the possibilities of job creation; and the technological revolution that raises ethical and social questions (M. Bricall, 2000). However, it is one thing for the University to respond instrumentally to the demands from society and another thing for generating its own knowledge (which is based on critical reason for science) to respond to social needs.

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the other hand, is generated and appropriated in the context with the complexity and multidimensionality that this implies, as Morin himself said (Edgar Morin, 1999b):"... *to organize knowledge and thus recognize and know the problems of the world, we need a reform of thought... that is paradigmatic and not programmatic...*)

173 According to José de Souza Silva it is necessary to move from the rational and natural paradigm where the search for meaning and happiness lies in the possession of material goods, access to services, i.e., *a civilization of having and a consumer society*, to a contextual paradigm of creation of happiness and inclusive welfare, generating goods and services and building cultural and spiritual meanings that give meaning to existence, i.e. the *civilization of being* (De Souza Silva, 2008).

Research as a transforming axis in the comprehension-production of knowledge and feedback from the scientific career agendas encourages the university community to create, criticize and transmit knowledge for the development of society. This implies a *Culture of Innovation* understood as a set of assumptions, values, and behaviors that pave the way for innovation without major resistance.

Research is what differentiates university education from any other. It needs to develop intelligence and logical thinking from comparing knowledge, organizing and explaining it, thinking about it and not simply learning it. Teaching is, therefore, not limited to passing on knowledge, but rather develops the faculty of understanding and therefore explaining it. Once students are able to explain it, they will simultaneously develop critical reason, the power to question other ideas and make judgments about their own reason.

Based on this premise, the student and the teacher - the two researchers - will try to question paradigms, abandon the routines that prevent understanding reality differently and therefore develop critical reasoning that will allow them to break with the purely instrumental and rationalist sense of scientific knowledge. Interpreting reality is not a simple extrapolation of a normalized present.

Academic and university research agendas must always remain autonomous to guarantee the scientific nature of their production, the enrichment of knowledge, the constant scientific relationship and a transformative connection with society.

The university currently faces the challenge of being useful to the demands of society that governments and industry impose, and avoid being instrumentalized by political decision-makers, state logic or market forces. This is not a new dilemma, because the university is a product of society and each era has made its claims on it.

The Legacy of the Napoleonic University: Professionalization and Empire Expansion

The impact of the changes in 17th century French society transcended the country's borders and also those of university organization. The medieval-era regulations regarding the fields of medicine, jurisprudence, philosophy, theology and the arts, for example, imposed either by the academy, the guilds, the church or the state, were strongly criticized by liberal thinkers; but beyond liberating them from all regulation, the potential impact of the university for solving social problems through applying knowledge was useful for the expansionist interests of the empire.

Besides liberating the sciences from any regulation or censorship, the utilitarian identity given to knowledge led to the creation of *professions* destined to solve practical cases. For this purpose, *professionals*[174] needed to focus on *know-how*.

The logics of the medieval university were of little use to the French Revolution, that is, the vocation with which know-how was handled, based on the search for the meaning of the legal norm beyond the legal product, the meaning of health or body beyond the medical product.

Although one could say that the university began to serve the people, in reality it obeyed the emancipatory and expansionist interests of the empire. It then became necessary to assign new tasks to the functions of the university and *licenses* were granted to those who learned the trade of a certain skill. Schools of professions were created that carried the name of the trade that the *licenciados* or graduates performed. These schools prepared the curricula and the Faculties became administrative bodies.

One of the most notable changes was that the teachers, who administered the Schools, had to be empowered to teach, but not necessarily to do research. Their challenge was to enable the applicants for a license to learn to solve the problems that society demanded, while further developing the know-how was not necessary.

As far as research was concerned, specialized institutes were created that concentrated on scientific activity rather than teaching. Teaching was involved when professional expertise was needed, and therefore two types of institutes emerged: research institutes dedicated to pure science, and technological institutes dedicated to technical teaching.

In order to satisfy the demand for teachers, Normal Schools and Schools for Superior Studies were created for those who needed to continue their studies after having studied at a professional school.

174 *Professionals* were so called because they professed to keep the guild's secrets about a specific knowledge when they were *accepted as members*.

In some European countries, sciences were divided into arts and letters, and natural sciences into exact sciences or engineering; preparations for the basics of these sciences took place in pre-university lyceums. France maintained the generalist character of the Lycée.

Although it was not exactly the People's Assembly that made modifications to the University as it was then known, the Napoleonic State regarded education as a strategy to satisfy its expansionist interests.

The tension between the need for the university to serve the people and the university's devotion to the search for truth through developing knowledge is evident. Although the dialogue between critical sense and instrumental reason could have been productive, the university was subordinated to the highest spheres of power.

The legacy of the University of Humboldt: Scientific Rationality and Empire Cohesion

In the 19th century, a new model of university appeared in Europe, inspired by the ideas of a German academic, the Prussian liberal Wilhelm von Humboldt. His approach was based on a concept that combined teaching and research, which until then had been carried out in institutes, hospitals or academies. The German University was based on public institutions, its professors were civil servants with a strong focus on scientific knowledge, and high scientific education of the people was the basis of that concept of society.

The conception of a university was guided by research and production of pure science as an expression of rationality and a condition for the free development of the human spirit (G. W. F. Hegel, 2012), which implied important transformations in the organization of the university. Teachers were no longer simply transmitters of knowledge, but experts in the sciences and responsible for justifying their pure rationality, and thus they were grouped into Academies and Departments of their own disciplines.

The German model is based on a high level of self-education on the part of students through close relations with experts. Barely initiated in scientific skills, students needed places of exchange with their professors. According to Friedrich Schleiermacher, the professor must do everything in front of his students, who, in turn, must intuitively develop knowledge, "*the activity of reason in producing knowledge and copying intuition*" (Schleiermacher, 1959).

The Faculties offered the curricula for instructing students and requested from the Departments the professors necessary to meet scientific requirements. Departments in turn are sustained by the research carried out by their members.

The centrality of research makes it an end in itself, as Humboldt himself said:

> As soon as you stop researching... everything will be irreparably lost for science and for the State, and, if you go on for too long, leave nothing but an empty shell (Humboldt, 2002).

The logic of rationalist science admits as valid only what is duly justified, *"these centers can only achieve the purpose they propose as long as each of them deals with the pure idea of science as far as possible "* (Humboldt, 1943). The pure idea of science delegates to philosophy the free judgment of reason and the search for truth, whereby it regards as true what can reasonably be justified. Later, the Vienna Circle will demand that philosophy distinguish between what is science and what is not.

The German education of the 19th century is conditioned by an integrationist political motivation coming from the consolidation of Prussian[175] over Austrian and Bavarian military power, influenced by the philosophical current from the works of Kant, Fichte and Schleiermacher. The development of science is at the same time the cultivation of philosophy, i.e. developing knowledge that assesses unity and totality emerging from the spirit (Seville, 2009), hence the budding idea of a Hegelian rationality.

This is how the German University became the icon of *intellect or reason*, and its organization also depended on it, abandoning professionalization, which had to be taken care of by other institutions such as schools or technical institutes. Although this model seems to be functional, it should be noted that knowledge remains in the hands of a small group of people, unattainable by society at large, accessible only through a process of specific training, thus producing individuals with a high level of expertise, but without a relevant global vision.

175 Works of Hegel such as Philosophy of Right were used to "justify" or "legitimize" the Prussian State (Löwith, 1968).

Yet, the rationality of scientific thought cannot explain meaning. The science of biology, for example, can describe all the functions of a living organism, but is unable to explain the meaning of life.

Although philosophy in this university model may be considered to be the ultimate science, its objective rationalization acts against it by limiting philosophical problematization. Once again, it becomes a question of dialogue between instrumental reason and critical meaning.

Although the university's contribution to knowledge and education can take different forms, there is one consistent element: we cannot speak of university if it does not produce knowledge that has a critical meaning and is useful for society.

The Heritage of the University of Córdoba: Democracy and Autonomous Governance

Latin American universities were very similar to the Napoleonic model, focusing on the responses they could give to labor demands by maintaining well-defined professions without any interconnections. Their curricula hardly changed over time, and they had to impart the knowledge needed to carry out a profession. It was the professors' responsibility to ensure that students learned as much as possible of what they were taught.

However, neither the research-based model devised by Humboldt, nor the academies or institutes that were involved in research development in France were accepted in Latin America (Tünnermann, 1996).

The Córdoba Reform took place against the backdrop of a declining Europe, and its conception of the world took place in the 20th century, between the outbreak of World War I, the crisis of nationalism, the triumph of the Bolshevik Revolution (which incited youthful fantasies and ignited reactionary resistance), and the rise of the United States. The Córdoba movement raised social, political and ethical concerns, and saw the universities as the trenches of the oligarchic classes and the clergy, paving the way to a new social constitutionalism in Mexico – constitution of Querétaro, 1917 - and Germany - Weimar Constitution, 1919 (Ciria et al., 1983).

If the university aims to be an instrument for social change, it must educate the student in absolute freedom of political action and civic consciousness. For this purpose, the university had to be given the license to elect its own authorities that could act without government interference, and the professors the right to teach with academic freedom.

Autonomy meant to recover *sovereignty*. A small state within a state and a democratically elected government. The concept of democracy within the university derives from a concept of *university co-government* (de Córdoba, 1918). What began as a demand for student participation eventually integrated the student into the functioning and government of the University.

The reform of Córdoba basically involved the following (Ribeiro, 1971):

- Student co-government;
- Political, teaching and administrative autonomy for the university;
- The election of all university presidents by assemblies, incorporating professors, students and graduates.
- The selection of the teaching staff through public competitions that ensure broad freedom of access to the faculty;
- The establishment of mandates with a fixed term (generally five years) for teachers, renewable only through the assessment of the professor's efficiency and competence
- The assumption by the university of political responsibilities towards the nation and the defense of democracy;
- Academic freedom;
- The establishment of free chairs and the opportunity to teach courses parallel to the professorship, giving students the freedom of choice.
- Free attendance of classes.

For the middle class, a university degree was more than a requirement for practicing the liberal professions, but also meant social rise and would produce tensions between the middle classes and the elite (Vázquez & Alonso, 2007). One of the negative aspects of the Córdoba Reform is that it promoted a sort of stratification of the teaching staff, which had to belong to a certain elite to maintain its status.

The "*democratic*" transformation of the University was inspired by the social transformations of the time, which confirms that the University is a social product. Although it gained autonomy and academic freedom, the production of knowledge continued to be subordinated to the French model. Darcy Ribeiro (1971) concludes that "the model that inspired the Latin American universities of today was the French model of the Napoleonic university, which in reality was not a university but a conglomerate of autarchic schools" (Ribeiro, 1971).

A participatory, democratic and collegial *co-government* could, paradoxically, become a kind of *autarchy of a political community,*[176] which can ensure a representative democracy, although it might be tempted to reducing the reason of the university to a mere political entity, subordinating the fundamental interest of transforming society and people through the production of knowledge.

Democratic management should combine two definitions of the *power of university governance* from Max Weber's conception (Weber, 2014, p. 43) ("*the probability of imposing one's own will in a social relationship, even against all resistance and whatever the basis of that probability*") which is based on *political authority* and therefore is *representative* in line with the university reason. Based on the *way this produces knowledge* in addition to *the interactions of a community with shared responsibilities* based on organizations with both social and economic freedom and responsibility.[177]

It is therefore necessary to reflect on the possibility of founding *university autonomy* from the very sense of the management of an Academic Community, with representative collegiate bodies and others that are not subject to the political dynamics of representative democracy and that take care to sustain the identity of the University. A variant of *shared government* could emerge between the two.

A well-conceived democratic management within the University that is in continuous dialogue with the society in which it is immersed, will permit to uphold university autonomy understood as absolute independence from economic, political, religious and trade union powers, and above all with the sovereignty of instrumental reason and the critical sense with which it chooses to respond to society.

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176 A government of the University and for the University.

177 This means the freedom to act socially and also the possibility to manage (economic) resources based on how these assume their responsibility with the community to which they belong.

Chapter 2

Back to the Future: The Relevance of the University in the World of Today

Even though we may feel tempted to analyze the socio-cultural, economic, and political reality, the current context for responding to the relevance of the university to our times, it is important not to yield and, thus, avoid substituting with these data the ultimate reason for the university: *the individual*. It is not a question of providing an interpretation that seeks to explain the global situation, but rather of emphasizing the centrality of the individual as the axiological order in the university. The option for the centrality of the person should be present in the university, even if its form differs from traditional institutions; this sensitivity becomes transparent both in the management of its organization, which prioritizes human development, and in the ideological orientation of the university and its actions in society.

The university was originally a community but has changed over time. Today it must respond to new challenges but the same old hopes. It is essential to keep alive the historical debate about the human being and his development linked to knowledge, but recreating and imagining new ways of dialogue with and against the past, as well as promoting debates on issues that appear uncomfortable and irritating even to ourselves. From this perspective, the Ecosystem University and its option for the axiological vitality of the centrality of the person, is an approach for a society characterized by "efficiency" and reification. The Ecosystem University appears with the potential for vitality in the face of the predatory system, the erroneously named society of knowledge and the phantom of quality. The Ecosystem University brings to light the only option: Love in community, but from a perspective enlightened by the search for truth.

The future of which we speak extends its roots into the deep meaning with which the university was conceived. Therefore, it is not a question of a future as prophecy or prediction, but of building spirals by recovering the way the university was constituted but also fostering new ways. We have move beyond the illusion of the "good university" that is domesticated and that we see today, and venture into restless vortexes and spirals, which by returning to the future, will help us find answers to the question: What university for what person do we want?

Of course, our vision of the future does not imply renouncing criticism of the present and the past, but it seeks above all to refresh the flavor of the university that focuses on the person and reflects on itself in order to propose a future that is always diverse, open, unfinished, and under construction, a future that makes it possible to live the present, that is written in the very moment in which it is lived, and that is free of pre-established scripts. This is what the spiral, which has come up several times in this book, is all about: aiming to change what we have and do not like for that imagined university, but at the same time correcting the events that require new reflexive cycles. The future of our university for the people is built on the foundation of daily action, since it is the capacity to act today that enables us to dismantle present institutions, which is tantamount to using our autonomy to reinvent ourselves and thus also the university.

University and the Predator System

Societies have always had an economy and a market, social institutions that were conditioned by a model of society. However, what we are witnessing today is a global development of capital that conditions society as a market society and not as a society with a market. It seems that it has become a hegemonic institution and that the "market logic" organizes and runs through the social institutions; the university is one of them and therefore *capital, excellence* and *meritocracy* determine the conditions.

Excellence has become a sine qua non for the University: students, teachers, academic programs, etc. must be of excellence and be able to demonstrate it. Incidentally, the only way to demonstrate excellence is through comparing *equals* with indicators that are *equal for all* to make sure that "*competition is ethical.*" Paradoxically, the emerging concept of *meritocrac*y, although it starts from diversity, ends up homogenizing everyone competing behind the "best". The Ecosystem University, on the other hand, recognizes diversity as a value and potential that facilitates developing logics of exchange, reciprocity, cooperation, inter- and transdisciplinarity.

To avoid sounding fundamentalist, we should maybe say that we should and can be better, but not perfect. Therefore, the University needs the capacity to govern over excellence and seek to achieve it as long as it contributes to its fundamental reason for being, since otherwise the positive meaning of excellence would become an aberration.

If *Universitas* is related to the universality that embraces all types of knowledge and know-how, but not with a predominant knowledge considered universal, then the university community would talk about *diverse* rather than *equal*, which implies developing people's talents and putting them at the service of others.

The challenge of the Ecosystem University is to escape the trap of arrogance and selfish narcissism, that is to say that it is not important to arrive first but that even the last one can arrive on time.

It is true that some can be better than others, depending even on where and how they are measured, but in an Academic Community, members should act in freedom, with modesty regarding their potentials, without anxiety because of their vulnerability and putting their capacities to the common service, i.e. to serving the interests of sustainability of the Common Pool Resource.

The university's role in society runs the serious risk of being reduced to solving problems of production with *utilitarian* solutions, or to *extensionism*[178] which, being a solution to provide a one-way technical contribution to society, causes the university not to be touched by the community.

On the other hand, conditioned by capital, the *homo oeconomicus*[179] seems to forget that our species has survived thanks to its social instinct and the consequent social cohesion. Our society is characterized not only by the natural and biological rules of coexistence, but also by the elaboration of values that are the product of social organization that goes beyond the other species that populate the planet. To act in society through responsible citizenship requires creating other economic logics within the Ecosystem University

178 The university extension known as professional practice has increasingly ceased to be a "real world" element and has become an often mandatory requirement with no added value for the extensionist student.

179 *Homo œconomicus* is the concept used in the neoclassical school of economics to model human behavior. This theoretical representation would behave rationally in the face of economic stimuli being able to adequately process the information it knows, and act accordingly (Henrich et al., 2001).

that encourage people to create new values and valorizations to prevent mercantile logics from becoming a reference of a perverse ethics.

Competition and the resulting hunt for profit have been blamed for all of the current crises in the world: economic bubbles, unemployment, inequality, climate crisis, democratic crises, etc., but the structure and social cohesion, paradoxically, obey to opposite values such as solidarity, equity, cooperation, complementarity, etc.

Success as measured by the accumulation of wealth as a synonym of excellence is not only far from the humanist meaning of the University, but clashes with the University's mission to promote human development and its capacity to think of itself from its own *being*. A university student or professor who bases his ontological response on *being wealthy* rather denotes an attempt to *be* because he *is* not.

Once again, the Ecosystem University is challenged to define and disseminate a model that combines the search for efficiency (imposed by the environment) and its own way of choosing and defining its response (responsibility and true autonomy).

The Ecosystem University is home to a living organization, where people are not trained to do business and political affairs under the mercantile logics of profit-making and disregard of society. Ecosystem organization transcends mere administration and its "visible hand" that makes a pact with the "invisible hand" of the market, transcends it by empowering people's capacities according to their development and balancing their individual with common interests.

The option is not one in favor of the market or the State, but of understanding that the university organization sustains an asset on which a group of people depend, regardless of who owns the university. It is not a question of the individual contribution of work for the development of another institution, but of developing human dignity through work that together make up a communal organization[180] that is not so much an institution but is instituted by all.

The Ecosystem University refuses to give up its privileged place in which it forms people to act freely, to assume their capacity to choose and respond to society knowledgeably creatively. It establishes internal logics that permits it to preserve its identity and protect it against succumbing to rules

180 Communality involves decision making often in search of balance and often in crisis. Community implies a set of previously defined values.

set by forces linked to the market, but to dialogue with them on the basis of complete, true autonomy.

This university, and no other, is the place that cultivates *tacit* collective imagination and turns it *explicit* in words and deeds to allow society to reach the consciousness of our time. (Edgar Morin, 1984) If the commune of the Ecosystem University succeeds in capturing the precise moment in which we live, it will be able to explain it to everyone as a *Kairós,*[181] a moment of eternal presence that will flow forever.

Redundancy vs. Meritocracy

One could say that research is the atmosphere that enables the university to breathe; it is a precondition for the university's existence. Karl Jaspers (Jaspers, 1961) pointed out that research makes teaching possible and is therefore a requirement for teaching. A university that is not involved in research, has, therefore, nothing to teach.

Research is the fundamental function through which the university interacts closely with society and demonstrates the relevance of its work with the environment. It becomes evident through the responses that the institution provides to the technical-economic and socio-professional demands at the institutional, local and territorial levels; as well as nationally and internationally, through research activities and scientific-technical services, scientific production; and development and innovation, in close relationship with its research projects.

The lines of research, projects and systemic organization of research, development and innovation activities must respond to the demands of society and its scientific, technological and environmental development at the local, territorial and national levels. In addition, it requires openness and dialogue with the context to ensure correspondence with current international scientific and technological developments.

Consequently, the university must promote and implement strategies to understand the environment and its inherent relationship with society in the different scenarios.

181 *Kairós* (from ancient Greek καιρός) is a measure of time that represents an indeterminate period when something important happens. Its literal translation would be "right time" or "convenient".

Likewise, postgraduate courses must be structured from the knowledge produced and in close relation with the lines and projects of research, development and innovation. The themes of the papers for the final evaluation of the master's theses and dissertations must show adequate relevance and impact.

These dynamics also need to be recognized in the university environment and in the social environment for their scientific-methodological work and for their active participation in problem solving linked to the profile of university research. The results of national, territorial and local university science and technological innovation projects and programs must guarantee recognized and guaranteed economic, social, scientific-technological or environmental impacts. This will result in a recognized and visible image at the local, national and international levels, supported by the positive results of its research, development and innovation activities. It is worth highlighting the importance of indexed publications; however, we must bear in mind the difference between doing research to publish and publishing because a university does research.

Although the university's action in society and the capacity to process its demands must be relevant and significant, the evaluation of such must not be subject to instrumentalizing and homogenizing methods. A university's relevance should be measured by its relevance for society and not the merits set by certain standards. Societies are not equal and universities, as products and producers of society, are not equal either, and hence their merits cannot be homogenized.

The indicators used to evaluate scientific production of universities are not comparable, and their relevance will depend on the conditions of a given moment and their importance for the university and the society the university is a part of. Once again, knowledge production must find a balance between redundancy and efficiency.

The university must be able to process its interior and therefore respond to the neo-liberal individualistic myth of the *self-made man*[182] associated with merit; and also to the illusion of being the owner of its own resources, competencies and qualities. The narcissistic view of success over other universities minimizes the question of equal conditions and opportunities as being relevant to the society to which it belongs (Guglielmi & Koubi, 2000).

182 Self-Made Man

Merit is opposed to *privilege* and is a quality from which the university would benefit by legitimizing the criteria of equality and justice. However, today's competitive society has turned merit into a totally utilitarian concept and a mechanism for greater inequalities. Thus, what seemed to appear a question of equity and legitimacy, has become *"merit versus justice"* (Duru-Bellat, 2009). This has allowed meritocracy to become a mechanism of government and administration, as well as of resource management (including, unfortunately, human resources).

Thus, Universities compete and apply the same logic to evaluate the groups within them, immersed in competition and competitiveness, and make *merit* the objective benchmark of their competencies, in an effort to achieve efficiency and excellence, without making the least effort to question them.

If uniqueness, identity, experience and specific skills count for themselves, then why has the objectivity of merit-based evaluation made universities (and the groups within them) so homogeneous, banal and interchangeable? (Girardot, 2011) Because the ideology and technique of *merit*-based evaluation has reduced all activity that is rigorously human to merely utilitarian aspects and *reified* it.

The problem of meritocracy is that despite its contradictions and lack of theoretical and ethical foundation, it is extremely effective and therefore conditions the thinking and behavior of modern *homo oeconomicus* who eventually becomes a *homo inaequalis*. [183]

If knowledge production in the University is rooted in the dynamics of its transformation in the continuous tacit - explicit spiral, the latter requires dialogue and assimilation of this very same knowledge. To make this possible it is necessary to foster continuous interaction between individuals and groups. Because of their diversity, identity and the uncertainty in which they work, it is easy to generate *redundancy* (overlapping states) and *repetition* of knowledge. Generally considered inefficient from the Ecosystem perspective, these two terms become enormously important because of their role for knowledge production.

It is of great importance to seek a balance between the positive aspects that *redundancy* can have for responding to external complexity (resilience)

183 "The calculating individual of merit is indeed a variant of the homo economicus" (Girardot, 2011).

due to its internal diversity, and the possibility that *redundancy* produces excessive competition between individuals that could undermine the creativity of the network, which in turn is based on teamwork.

Nonaka-Takeuchi include *redundancy* among the five organizational mechanisms for enhancing knowledge creation (Ikujiro Nonaka & Takeuchi, 1995):

- Intention and commitment in the organization
- Autonomy at all levels[184]
- Fluctuation and creative chaos[185]
- Redundancy (superposition and competition)
- Diversity[186]

Diversity and *redundancy* (Low et al., 2003), enable the Ecosystem to respond[187] to complexity, as dependence diminishes because of increasing possibilities for producing knowledge (even if these are repetitive).

Since no group is identical, *redundancy* does not lie in diversity but in the overlapping, multiple ways of producing knowledge; i.e. the interaction between social actors, which makes it difficult to substitute or interchange institutions such as the University (the same logic applies to groups within it). Strictly speaking one should talk about possible combinations and interdependent organizations. The diversity of responses to external demands is fundamental for the resilience of the Ecosystem University (Chapin et al., 1997), as is the appearance of novelty and discontinuity in the processes of knowledge production.[188]

Such "system overload", as Ulanowicz calls it (Ulanowicz, 2000), effectively serves as a mechanism to maintain the integrity of the system and provide future support. In other words, *redundancy* is the price to guarantee the evolutionary leaps and therefore the development of societies.

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184 To guarantee autonomy, it is necessary to implement government systems that dynamically combine heptarchy and hierarchy.

185 Schön elaborates on *action-reflection* concepts and their relation with flexibility and the breaking of standards and patterns in his work (Schön, 1983).

186 Ashby proposes that internal diversity can satisfy external complexity, the value of heterogeneity (W Ross Ashby, 1961).

187 Elmqvist establishes a quality of ecosystems called "response diversity" (Elmqvist et al., 2003).

188 This argument could be expanded in an analogous way from the ecological perspective (Crawford S Holling, 1992).

Several studies refer to the concept of redundancy, identifying it as a basis for resilience capacity (Low et al., 2003) (B. H. Walker, 1992) (Muller, 2012). Although *redundancy i*s largely unusable, it is like a spring ready to release its energy when needed, thus ensuring stability and persistence.

High on the to-do list remains the search for new forms of evaluation that respect the diversity, identity and capacities of each individual or institution (the university) and that will not classify but promote development and growth. This book will subsequently use the concept of entropy to monitor redundancy and resilience and thus understand its balance and complementarity with other eco-system concepts.

University and the Phantom of Quality

The emergence and global spread of the term *quality* is related to industrial and production concepts of the 1980s that were reaffirmed with theories such as: Total Quality Control (TQC), Continuous Quality Improvement (CQI) or Total Quality Management (TQM) (Redon Pantoja, 2009).

In the world of higher education references to quality can be found in the UNESCO World Declaration on Higher Education for the Twenty-First Century, which mentions a multidimensional approach to quality including *"...all its functions and activities: teaching and academic programs, research and scholarships, staff, students, buildings, facilities, equipment and services to the community and the academic world"*(UNESCO, 1998).

Whatever concept of quality gets established, it will always be valued as positive and therefore be accepted. This concept implicitly relates to a product that satisfies a need; precisely there, it finds the key to quality analysis in the University, to what extent we can understand the actions of the University in terms of the production of goods or services that satisfy needs. Although the concept of quality may have a positive connotation, it is clear that we must ask ourselves what we apply quality to. After all, if we applied quality to an erroneous concept of University, we would get an *error of highest quality*.

There is a risk to confound the university's identitarian mission with that of a production machine, since it is all about the knowledge it can produce; knowledge that from the ecosystemic point of view, as we could see before, is the center of the hurricane that produces personal and communal developments. [189] We could not be more mistaken than to understand the university as a mere *educational service* of supply and demand that denatures knowledge by reducing it to a product and a commodity. The *academic supermarket* has had devastating consequences for how people deal with science and has confused and trivialized teaching and research.

Quality measured by how a product or service corresponds with its production and marketing costs, the "price-quality ratio," remains an important management factor, but it must remain equally clear that the *management-administration-financial* mission is none other than sustaining the functions of *teaching, research and engagement with society.*

On the other hand, quality measured by how a product or service responds to specific needs (i.e. that the characteristics of this product or service satisfy the needs of the clients), implies reinforcing the optimal production processes in the case of an inert product. Yet, can a professional with the capacity to transform society be a product or service? We need to look beyond University plans or curricula, since otherwise the rigidity of the processes would ruin the capacity to propose answers to the challenges of the University.

We run a major risk if we think about quality as a package of knowledge to be transmitted to empower students to achieve "success" in the working world by adapting to a system whose values are complacency, selfishness and triumphalism over losers. Not only is the range of values not the ultimate goal of the university, but also educating in scientific knowledge is more than merely passing on knowledge. It implies understanding of how science is produced and reproduced, so that we can explain its causes and reasons, the reasons why certain documents have been produced, the form of organization and development, to which logics of complexity and specialization certain sciences respond.

It is not a question of passing on but of explaining science, and the explanation must not reduce complex issues to simple matters where everything is "clear" and does not require any analysis. Quite the opposite, we can explain knowledge or reality only when we thoroughly understand and share it and new explanations become necessary to understand new degrees of complexity. Therefore, to educate is not to *pedagogically simplify* science to enable an alumnus *(without light)* to acquire the necessary products from the *supermarket of science* to build his "professional" profile; to educate implies using pedagogical

189 Communality involves decision making often in search of balance and often in crisis. Community implies a set of previously defined values.

expertise to *explain* how the results of certain scientific knowledge were obtained, how science raises and solves problems and produces knowledge that in turn allows us to understand the facts of science itself.

To educate is to liberate the person through the development of his own knowledge and not to subject him to an "instituted knowledge." To educate implies to provide the person with opportunities to allow him to become an *agent* of his own decisions, to *function* in a certain context, and develop his own capacities, something like what we had earlier discussed under the concept of biocenosis, an Environment that Enhances Capacities.

In any case, the university must ensure that it does not lose the sense of its mission in society, even if it feels forced to maintain a relationship with the demands of the environment, which means that the concept of quality is more linked to the identity of the university (and it is no small thing to say that a university has a distinct identity) than to the "quality" of its processes, the "quality" of its offer, the "quality" of its research products or the "quality" of its graduates.

A university that responds to the demands of its quality-identity because it is involved in research must not be confused with one that does research to comply with the quality indicators imposed from outside. In the second case, the subordination of university activities makes the university insipid and uses it for instrumental purposes that are alien to its nature since

> It not only converts the university into an institution to serve the market, but transforms its very function into a commodity, all of which eventually leads to the degradation of knowledge, the domestication of thought, and cultural and social inequality. (Hirtt, 2003).

It is therefore worthwhile defending the autonomy of the university against external entities that impose quality criteria such as states, which pursue a policy of quality assurance, and the market with the logical production of goods and services whose indicators become patent in university rankings.

With regard to quality, we can observe two trends: quality assurance and continuous improvement. Still, the University cannot analyze its options by simply instrumentalizing techniques, but must do so on the basis of its relationship with those that decide those trends, i.e. the State and the Market.

The need for the University to understand the demands of the State and the Market lies in the effort not to lose sight of political responsibilities regarding the direction of research and production of knowledge, university teaching and, first and foremost, its link with society. Also of significance is the correlation between supply and demand in terms of financing and the risk this implies in the way the university understands itself and its relationship with society.

The diversity of financing sources for the university is not problematic as long as it does not compromise the search for truth by substituting it for the search for opportunity, guaranteeing the scientific nature of its production, the enrichment of knowledge and constant scientific innovation.

The university's capacity to explain reality and criticize itself and its surroundings in the face of the dominant powers and discourses guarantees knowledge production. The need for spaces, places and venues for reflection becomes more and more prominent for building science with a conscience (Edgar Morin, 1984).

The university's task cannot be reduced to self-defense; it must understand the logics to which quality responds, whether or not there is a desire to impose models from the outside, and it must also understand the potential benefits of a process of continuous improvement and quality identity approach. This is not only in the responsibility of the University management but above all of an Academic Community that responds to the mission and vision of the University and goes beyond a mere working relationship.

Education is not a service for a client, but rather a process of emancipatory transformation of its actors in addition to generating social change through the production of relevant knowledge. Therefore, the definition of quality in a university should not only refer to physical changes, but also imply cognitive transcendence and social transformation (Universidad Politécnica Salesiana, 2018).

University Rankings: A Necessary Evil?

Indicators appear as necessary tools to analyze and monitor the development processes of a country or region. However, development policies and strategies are developed and implemented in different parts of society, and their effects and consequences are observed at different levels. This is why it is essential to select indicators according to these characteristics and to users' needs.

In a nutshell, dictators should help decision-makers assess missed opportunities and gains in relation to socio-economic, environmental and political needs.

Figure 36
University Ranking - a necessary evil

Elaboration: Salgado-Guerrero, J. P.

Sustainability indicators should also possess the following characteristics:

- Be sensitive to changes in time and space;
- Reflect the way society uses its resources;
- Evaluate trends with respect to a stationary state;
- Be useful for decision making and transcend the academic sphere;
- Be easy to gather and apply.

Indicators are a point between scientific accuracy and the demand for concise information to simplify the complex relationship between economic activities, human needs and the natural environment (Claude & Pizarro, 1995).

The main advantage of indicators is that they help to simplify a phenomenon by providing quantitative information that facilitates the analysis of behavior over time or with other reference parameters. Another important advantage is that it permits the analysis of policies or decisions and enables users to devise possible alternative policies. Furthermore, if a series of indicators are available to evaluate the behavior of a variable, it is possible to establish models that facilitate the ex-ante evaluation of a development policy to find the best option.

The main disadvantages lie in certain limitations and the use of indicators. With regard to the latter, decisions are sometimes made on the basis of a single indicator, leaving aside the complex and systemic relationship with others that are directly and indirectly related to the problem.

Limitations may have very different effects. Limited information may be scattered, inconsistent or even inexistent. This significantly reduces an indicator's effectiveness. Defining indicators must, therefore, always involve absolute clarity about related variables.

Any classification is controversial, and no classification is absolutely objective. However, university classifications have become popular in most major countries. The key question then is how to improve the classification systems and how to adequately use results. Ranking methodologies should always be examined carefully and results be used with caution.

Universities have a long history of competing with each other for students, teachers, donors and social support. For a long time, competition has been assessed by implicit reputation without any supporting data. However, increasing competition between universities and a growing market of institutes of international higher learning has meant that rankings need to be developed as a tool to measure the quality of universities. Institutional leaders and policy-makers often depend on rankings to implement their policies (Aguillo et al., 2010) (Saisana et al., 2011).

Ranking universities is a challenge as each institution has its own mission, focus and offer of academic programs. Institutions may also differ in size and available resources. In addition, each country has its own history and higher education system that can affect the structure of its colleges and universities and how they compare with others. Classifying entire universities based on the single benchmark of classification indicators, therefore, constitutes a major challenge (Teichler, 2011).

According to the analysis carried out by Shin and Toutkoushian (Shin & Toutkoushian, 2011), the following most commonly used indicators measure university rankings and are based on a combination of institutional performance and institutional characteristics:

- Quality of Teaching: Based on students' feedback through classroom assessments. Metrics obtained from students' performance, attitudes, and behaviors changed through their university education and correlate with academic performance (Marsh & Hattie, 2002). However, a controversy remains as measures do not guarantee the quality of teaching, but do provide better environments for its development (Dill & Soo, 2005).

- Quality of Research: Measured by the number of research publications or quotes produced by departments. The number of quotes is widely accepted as the best indicator of research quality. Therefore, most university rankings, especially at a global level, tend to emphasize quotes as a measure of research productivity by mainly looking at quantity rather than quality (Petruzzellis et al., 2006).
- Quality of Service: Among all the criteria, quality has received the least attention from academic researchers and rating agencies, despite the fact that service is one of the three main functions of higher education institutions along with teaching and research. This negligence is partly due part to the difficulty of defining and measuring service quality. Higher education institutions offer different types of service activities, such as working with local schools to improve the quality of education, helping government agencies make better decisions and policies, and so on. These contributions are also affected by the research and teaching that takes place within academia, which means that the quality of service is partially reflected by teaching and research indicators [122].

There is a great variety of rankings that have been endorsed by numerous scholars, and the outcome impacts decision-making. Some of the most popular rankings include:

- World's Best Universities Ranking: US News and World Report.
- Leiden Ranking: Leiden University, Netherlands.
- Performance Rankings of Scientific Papers for World Universities: Higher Education Accreditation and Evaluation Council, Taiwan.
- Universities Ranking: Reitor, Russia.
- European Union University-Based Research Assessment: AUBR Working Group, European Commission.
- CHE University Ranking: Centre for the Development of Education U-Multirank ranking: EU-funded project.
- Assessment of Higher Education Learning Outcomes (AHELO): Organization for Economic Cooperation and Development (OECD).
- Webometrics Ranking of World Universities: Cybermetrics Lab, Science Center.

These criteria are reflected in the study by De Nicolás [123] that compares the most influential rankings worldwide, highlighting ARWU, THE, QS and Webometrics.

ARWU,[190] University Academic Ranking of World Universities of the Jiao Tong University Shanghai, dedicates 80% of its assessment to the quality of research (Figure 37). They include the highly cited researchers in Web of Science, number of articles in Nature and Science, including the number of articles published in the Science Citation Index and Social Science Citation Index databases, and Nobel Prize laureates working in the institution. However, only 20% correlates with the quality of education taking into account alumni who won a Nobel Prize or a Fields Medal, and the number of full-time professors. This ranking fails to value the quality of services.

Figure 37
ARWU 2019 Ranking

ARWU 2019 rank	Institution	Country/Region
1	Harvard University	United States
2	Stanford University	United States
3	University of Cambridge	United Kingdom
4	Massachusetts Institute of Technology	United States
5	University of California, Berkeley	United States
6	Princeton University	United States
7	University of Oxford	United Kingdom
8	Columbia University	United States
9	California Institute of Technology	United States
10	University of Chicago	United States
=11	University of California, Los Angeles	United States

Source: ARWU (ARWU, 2019)

190 Known as the Shanghai ranking, it was the first global university ranking. It is based on criteria such as: (i) the number of Nobel prizes won by both, students and teachers, (ii) the researchers with the highest number of citations, and (iii) the number of publications in high impact journals such as Nature, SCI and SCCI [123]. AWRU's ranking has been widely criticized because the weighting of the Nobel Prizes represents 30% of their qualification. Therefore, universities that do not have academics with these honors are relegated to a secondary position. Moreover, it segments scientific production by defining as important only those that have been published in journals such as Nature or Science. One could also point out that this ranking has an "elitist" character and implies a certain "disdain" for Spanish-language journals.

The criteria applied by the THE[191] ranking (Figure 38) by the British magazine The Times Higher Education attaches 60% to the quality of research – divided between 30% to actual research and 30% to citations. The quality of teaching counts for 30%, services 10%, of which 7.5% go to the international perspective and 2.5% to the results from industry.

Figure 38
Top 3 of THE Ranking

Rank	Name Country/Region	No. of FTE Students	No. of students per staff	International Students	Female:Male Ratio
1	University of Oxford United Kingdom Enquire	20,774	11.1	41%	46 : 54
2	Stanford University United States Explore Enquire	16,223	7.4	23%	44 : 56
3	Harvard University United States Enquire	21,261	9.3	25%	49 : 51

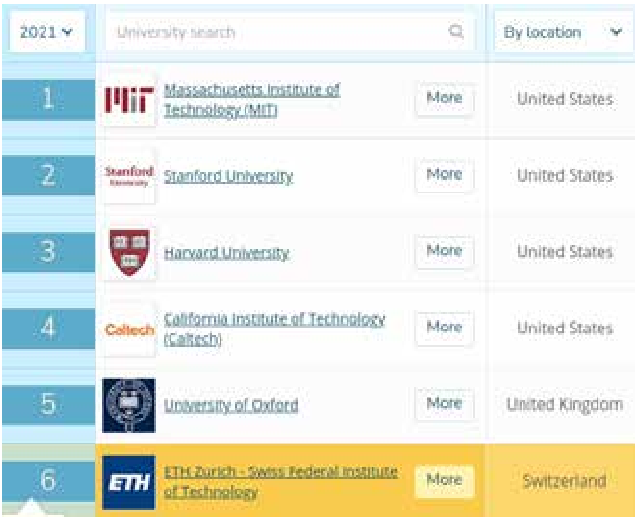
Source: Times Higher Education, 2020

191 British ranking created in 2004, associated to "Times Higher Education" magazine. regularly classifies 200 individual universities and a total of 600 at greater intervals: (i) processes, actors and forms of teaching, (ii) scientific production and lines of research, (iii) number of citations, (iv) social impact and collaborative networks at the international level and (v) exchange of knowledge with industry. This ranking incorporates indicators with an innovative aspect, but with subjectivity (Martínez Rizo, 2011) (Ordorika & Lloyd, 2015) (Stack, 2016). A debatable disadvantage is the territoriality of the analysis, since only 5% of universities correspond to Latin America while 30% or more belong to Europe. It should also be noted that the ranking only assesses 50 universities from three different Latin American countries.

The QS[192] ranking, named after Quacquarelli Symonds consulting, divides its criteria into teaching quality (50%), academic reputation (40%) and student employability (10%).

In addition, there is the quality of services (30%) valued by the ratio of students (20%) and international projection (10%). Ultimately, there is the quality of research (20%) evaluated by the number of citations per department.

Figure 39
Top 6 of the QS Ranking



Source: Quacquarelli & Symonds (Quacquarelli Symonds, 2020)

Yet, Webometrics,[193] an initiative of the Cybermetrics Laboratory research group of Spain's Consejo Superior de Investigaciones Científicas

192 QS ranking is issued by the company Quacquarelli Symonds. Its classification involves around 800 universities and is based on knowledge areas; its indicators include (i) academic reputation, (ii) employability, (iii) number of students, (iv) citations by academic area or faculty and (v) their international collaborative networks (de Nicolás, 2017). This ranking, like that of THE, contemplates subjectivities when evaluating the indicators, for example, the use of advertising or consultancy services to weight in the ranking.

193 This ranking uses data from the universities' websites. Webometrics is based on the exploitation and analysis of data on the web through the use of automatic robots or through

(CSIC) research council, weighs the quality of the services (50%) by means of the impact indicator, measuring the prestige of the university with respect to its relationship with society. This is followed by the quality of research (40%) of which excellence accounts for30%. The remaining 10% go to the quality of teaching, including indicators such as sports facilities and others.

Figure 40
Webometrics Ranking.

Ranking	Universidad	Det.	País	Presencia (Posición*)	Impacto (Posición*)	Apertura (Posición*)	Excelencia (Posición*)
1	Harvard University			1	2	1	1
2	Stanford University			5	3	2	3
3	Massachusetts Institute of Technology			2	1	4	10
4	University of California Berkeley			20	4	3	18
5	University of Washington			27	5	66	9
6	University of Michigan			13	9	10	8
7	University of Oxford			25	13	9	5
8	(2) Johns Hopkins University			397	22	33	2
9	Columbia University New York			69	8	6	14
10	Cornell University			8	6	15	26
11	University of Pennsylvania			21	12	11	15
12	University of Cambridge			37	19	7	12
13	University of California Los Angeles UCLA			102	17	8	16
14	Yale University			61	10	14	23
15	University of Wisconsin Madison			12	15	26	37
16	University of California San Diego			64	27	5	21
17	University of Minnesota System			31	16	18	39
18	UCL University College London			110	47	12	7
19	University of Toronto			97	34	21	11
20	(2) Pennsylvania State University			69	11	37	51

Source: Webometrics, 2020

search engines. The evaluation of its indicators offers universities: (i) evaluate the university to know its real situation in a global context, (ii) integrate the institution into the virtual world, and (iii) plan new strategies to improve the university (de Nicolás, 2017). In addition, Webometrics seeks to improve a university's position in the educational ranking by allowing it to increase its visibility, recognition and impact on society. The indicators it uses include (i) the impact according to its data on links with society and collaborative networks on the web, (ii) its presence, which is measured in terms of academic offer, teaching, etc., (iii) the openness and performance of its lines of research, and (iv) its excellence in research by publishing its results in high-impact journals.

For Altbach (Altbach, 2012), measuring the quality of universities through rankings also identifies a number of problems, such as:

- Zero-sum game: as countries accept the need to build and maintain research universities and invest in higher education, the number of distinguished research universities will inevitably grow. The ascent of universities is only partially reflected in the rankings by underestimating progress in other regions.
- Absence of teaching: one of the principal functions of any university is teaching, which appears as the least developed criterion in the most significant rankings as comparable measures of its quality and impact have yet to be developed.
- Research dominates the rankings: the criterion of research dominates the rankings. It is the easiest way for universities to measure the various parameters. Research funds, publications, Nobel Prizes, etc. are the only quality indicators that can be counted in a comparable way across institutions and countries.

The use of the rankings drives decision making by university authorities seeking assistance, funding and other support to reach the most prestigious positions; indicators determine whether specific programs are eliminated or promoted. In short, the university should be concerned about how the institution fits into the higher education system and how it can improve the quality of its graduates. Similarly, students and faculty should be more concerned with developing skills than meeting an indicator of an institution's prestige.

Criticizing the vision of the current society considering the concept of knowledge that links it too tightly to the market economy, where it is labeled as knowledge economy, means that it confuses information for knowledge with the epistemic, scientific principles and of proximity to the truth. This creates a panorama, where universities resort to the search for opportunity rather than the search for truth. Removing the burden of human values to adopt a value of change limits their critical capacity to self-define their meaning in society.

The work essentially proposes strengthening the relations between the different actors in the system that produce knowledge in order to manage it; not as an attempt to govern and direct it but focusing on the individual and his or her objective response with society as opposed to the self-referential and freedom-constraining system of university rankings.

This section provides some indicators (manual) for researchers, teachers and students to co-evaluate and co-project educational initiatives in the framework of social innovation by improving the teaching-research links with the support of ICTs. Therefore, we need a model of design and participative evaluation that focuses on the student to develop the capacities of all (teachers, researchers, students, community). Promoting the individual takes place in an "Environment that Enhances Capacities" the academic and extra-academic contexts (process) and strengthens the Teaching-Research nexus (product).

Self-organization in terms of self-mutual-construction of knowledge, decisions, actions, etc. implies providing actors (in different ways and at different rates) with information and best practices on a given topic (domain knowledge); developing shared decisions and implementing actions for change in the processes in which the members themselves participate.

Universities and the "Knowledge Society"

All societies, in one form or another, have always been knowledge societies, although the term was first introduced by Peter Drucker in 1969 (Drucker, 1969).

Today, we relate the knowledge society with two concepts: the information society and the knowledge economy. The first one seems to come as a qualifier by the emergence of the ICTs, and the second one is understood only in terms of economic growth based on the production of knowledge rather than as the management of knowledge produced by a society,.

This is a subject that seems obligatory for every university. In reality, the problem is not that it would not be a valid ideal, but that it is incomplete and wrong. Knowledge is not information and the knowledge that societies require is not only knowledge that is economically useful.

Economic growth alone as a paradigm of development and the prevalence of the forces of supply and demand imposed by the market on the production of knowledge have led to a situation where "*science is in danger, and therefore becomes dangerous*" (Bourdieu, 2003). This is particularly true of applied sciences with highly profitable areas such as biotechnology, military research technology, or genetics. Many universities devote most of their energy to the production of knowledge in research centers that are controlled by large industrial firms that seek to sustain their commercial performance through patents.

This would not be too compromising for the university if researchers and research teams were not threatened by becoming controlled by demands that are guided by profit imperatives. Again, the problem is not profit as such, but subordinating ethics and the holistic intelligence of human beings to it.

A well-understood Knowledge Society is one that can innovate and be built from the knowledge it produces, that can exercise self-government to guarantee its rights, focus its efforts on its needs and enhance its capabilities. This is the kind of society that the University must contribute to, perceiving cities and the environment as the classroom and the citizens as class mates.

The Ecosystem University recovers the *sense of knowledge* as a fundamental element for stimulating the development of the *person in community*. Knowledge production must be seen as the primary heritage for the academic community and society related to the university. The dynamics of the hurricane that produces that knowledge involves the community of responsible citizens by studying over and over questions such as: What happens after knowledge is produced? What knowledge is relevant? How can we connect such knowledge to the organization and build the system? How does that knowledge liberate the person? How does that knowledge make us a stronger community? What knowledge motivates action in terms of the sustainability of the common pool resource? How do we understand ownership of the production of knowledge?

I dare say that knowledge *management* in the university has generally been left or subjected to neoliberal and business-related logics of intellectual property rights. It is weakened by the fact that the university has lost its ability to develop systems of social and economic innovation.

Enhancing the dynamics between *tacit* knowledge and *explicit* knowledge is the challenge for the Ecosystem University to make sure it does not only pass on knowledge; it is also the nucleus that produces critical reason, understanding and social validation of knowledge.

Information management is not the same as knowledge management. That is why the university must not restrict itself to passing on knowledge but must engage in training citizens who produce knowledge a guarantee of active citizenship through developing moral judgment based on the critical distance to imparted and explained knowledge.

Simply passing on knowledge and accepting but never questioning it, as well as confounding liquid information with knowledge will reduce the value of society and lead to a liquid society (Bauman 2000). Faced with the common interests that we have as a society, the Ecosystem University that is immersed in the knowledge society must tackle the challenge of building responsible autonomy based on its own production of knowledge and on the articulation of a critical and reflective academic community.

From an ecosystem perspective, knowledge transforms the social structure and liberates it by questioning its "truths" and destroying its "lies".

The university is a privileged actor in this dynamic, although *liquid modernity* (Bauman, 2015), in which we are embedded, seems to prepare us for the worst. We must also accept that there have been notable changes in the paradigm of society that could be a great opportunity. We have moved from the structuralism of *critical Marxist theory* (criticized for being a system without a society) to *post-structuralism* (Tourraine, 1997), which suggests the return of the *actor* (making it clear that it is not the *actor without a Parsonian system*) in a structurally given social scenario and that the actor is capable of transforming through his presence and action.

For this reason, the Ecosystem University, being an *actor*, is also defined as *social*, as it is the product of society and its action has an the *societal impact*. By forming citizens with transformative capacity and producing pertinent and relevant knowledge for the host society, the Ecosystem University has the opportunity to be a product and producer of society,

University Between Homogenizing Merit and the Virtue of Value

Mechanisms have emerged recently that seek to evaluate universities by comparing them with each other. They exercise a significant influence on university organization since *copy and paste* allows people to adopt an identity subjected to the paradigm of *publish or perish*. Such an organizational reality denies the structural differences and asymmetries that do not separate the university from the "*ideal model*" and are consubstantial to its identity and raison d'être.

If the university's action in society and the capacity to process its demands should be of relevance, the evaluation of its action must therefore not be subject to instrumentalizing and homogenizing methods. The university's relevance must be evaluated by its social significance and not by "merits"-based rankings. Societies are not equal and neither are universities as products and producers of society; therefore, their merits cannot be homogenized.

The indicators used to evaluate scientific production of universities cannot compete with each other because they are not comparable, and their relevance will depend on the conditions of the moment and their importance for the university and the society it belongs to. Once again, it is necessary to find a balance between redundancy and efficiency of knowledge production.

The university must be able to process all these mechanisms within itself to avoid the neo-liberal individualistic myth of the *self-made man*[194] associated with merit, and the illusion of being the exclusive owner of its resources, competencies and qualities that produce this "success." The narcissistic view of "success", which puts one university above others will blur the university vision, leaving in second place the pertinence and relevance with the context, with its students and with society at large (Guglielmi & Koubi, 2000). *Merit* is opposed to *privilege* and is a quality that could benefit the University by legitimizing the criteria of equality and justice. However, *merit* can also become a utilitarian concept and a mechanism that increases inequalities. Thus, what begins with equity and legitimacy becomes *"merit versus justice"* (Duru-Bellat, 2009).

The merit represented later in the rankings has become an aberrant ideal, since merit is not necessarily a virtue. Although it is true that a university can and should improve, it is equally obvious that it cannot be perfect, and furthermore that perfection is not necessarily more meritorious. The desire for this perfection leads the university to narcissism and selfishness, which are opposed to its nature and function in society. Some universities will always be better than others in some respect; their strength for transforming society lies precisely in their complementarity and diversity.

The problem of meritocracy is that despite its contradictions and lack of theoretical and ethical foundation, it is extremely effective and therefore conditions the thinking and behavior of modern homo oeconomicus, who will eventually turn into *homo inaequalis.* [195]

194 Self-made man

195 "The calculating individual of merit is indeed a variant of the homo oeconomicus" (Girardot, 2011)

Thus, contrary to what the Ecosystem University teaches, universities are tempted to compare themselves and apply the same logic to evaluate students and teachers; immersed in competition and competitiveness, they make *merit* the objective criterion of their competencies seeking to achieve "efficiency and excellence" without the least effort to question them.

The ecosystemic perspective invites us to uniqueness, identity, experience and specific capacities that are themselves worthwhile. The universities and all its groups must not fall into the trap of "objectivity of merit-based evaluation" because this would eventually homogenize and banalize them and also make them interchangeable (Girardot, 2011). The unconditional focus on merit-based evaluation has reduced and reified all activity that is irreducibly human to a utilitarian perspective.

Today's organization of the university is transversalized by the individualistic search for merit that disregards creativity. Meritocracy has produced an excessive pursuit of order and regulation and the suspicion of legitimacy of anything that seems to come from outside that order. Organizational knowledge no longer knows how to become a tool of control and to which those who hold the merits attribute a kind of "bureaucratic reason." It is no longer that "organizational, systemic, communicational, communal knowledge but rather instituted knowledge".

We need to rediscover in organizational knowledge the power to decipher and understand life and matter and their interconnections as described by Edgar Morin in his prolific writings. The organization of the Ecosystem University that we envisage is not made up of bits and pieces, but is a complex set of systematic rules, where rich and diverse groups and the exchanged knowledge form synergies that materialize in rhizome structures.

The community of the Ecosystem University is the product of collective feeling and participation in the construction of the *common whole*. It originates in the relationships and shared values that build and define the association and organization. The relations of interchange influence the socioeconomic and political strategies, which constitute the basis for autonomy and self-organization.

The social articulation or structuring of the Ecosystem University thus becomes a model of systemic organization that transcends the interests of the market and appreciates the concept of sharing. It is a kind of collective personality that is aware of its values and interacts with the environment with relative autonomy as it is able to question, understand and respond to the demands of the context and not simply submit to them in an instrumental way.

Synergies keep an organization-system alive[196] (Hermann Haken, 1984) as they unite actors at all levels and bring out the properties of the macro-level from micro-level interactions (Hermann Haken, 1979). These synergies occur in a *non-linear way when the system is destabilized or enters in crisis and reorganizes according to new attractors* (values) seeking a new equilibrium of a superior state. Yet, at the same time it respects the shared history and values, which *optimizes self-organization*.

The relationship between the emergence of values resulting from self-organization (*bottom-up*) and the consensus of the values when shared (*top-down*) form a permanent virtuous cycle of causality. The values that emerge (*bottom-up*) as a result of synergies gradually give coherence and meaning (direction and raison d'être) to the organization, which influences the action of the groups (*top-down*) since they are permeated by the organization's systemic properties.

As for any evaluation, it is not the merits but the values that provide the university with identity and autonomy. Meritocracy may be useful under certain conditions, but evaluation based on any homogenizing methods is aberrant whenever the vitality of a living organization of people come into play.

One needs to value merit as an intrinsic indicator that dialogues with quality standards and is useful for comparative evaluation in certain ways. Yet, we also need to be clear that merit does not satisfy the needs of the university community that identifies with the values it shares.

Meritocratic mechanisms imposed from outside threaten to affect the university and condition what it understands as ethical, using people as a means to obtain certain *merits* useful to the rankings and evaluation mechanisms. The work of the Ecosystem University must make sure that it acts in favor of the person as an end and not as a means, since the very existence of

196 For Morin (1984), the concept of system has three facets that he considers indissoluble:
System (which expresses the complex unity and phenomenal character of the whole, as well as the complex relations between the whole and the parts),
Interactions (which expresses all the relationships, actions and feedback that are made and woven into a system),
Organization (which expresses the constitutive character of these interactions - what forms, maintains, protects, regulates, governs, regenerates - and which confers its backbone to the idea of system).

persons and human society in itself has value over values and as an end in itself it is the basis of all the rules and regulations of the organization.

Values are values to the extent that they are shared and therefore valued rationally and sociologically. For Weber, values represent a kind of imposition for the members of a community (Gewalt über den Menschen), although not from the outside but from the inside. That is why values have a normative power that comes from the inside, which constitutes a challenge for every individual and the community at large.

Hence the importance of not confusing merit with value. Merit is a feature that eventually conditions the university from outside to meet certain objectives included in rankings that are not necessarily fundamental for it, while values produce *social ethos*. The more intense and shared by a community these are, the stronger are the social ties within that community.

While it is true that the university cannot disengage from *forces opposed to its values* (gegenüber anderen Mächten des historischen Lebens; Weber 2000), care must be taken not to separate the values that constitute the community from the ends belonging to the field of instrumental reason, or rather that instrumental reason will eventually not destroy evaluative reason (Horkheimer, 1968).

Evaluative rationality, where values originate, does not only imply moral knowledge but also understanding their practical and social dimension. Thus, in the Ecosystem University, the individual gets recognition from the collective once his action is identified in the collective values and therefore guarantees its moral ethics not from the duty to be but from an internal requirement. In addition, its action, as Hegel (G. W. Hegel, 1986) would say, establishes the law among citizens as a political society.

That is how value constitutes the virtue from which the Ecosystem University can judge and think about its response to the instrumental demands from the outside. Each value constitutes a virtue insofar as it depends not only on the relationship between people, but also on an ethics of values that is based on the collective dimension, as the individual turns its own existence and also that of others into an absolute value, "value is my goal for the other" (Sartre, 1983).

Based on what was stated above, we could say that research in the university is not a mechanism for producing "*impact factor papers*" and other merits for the rankings, but rather it is the atmosphere that enables the university to breathe; it is a condition for its existence. Jaspers [506] recalled that research facilitates teaching and is therefore a requirement for teaching. Hence, a university that does engage in research has nothing to teach.

As was said before: Research is the fundamental function through which the university interacts closely with society and demonstrates the relevance of its work with the environment. It becomes evident through the responses the university provides to the technical-economic and socio-professional demands at the institutional, local and territorial levels; as well as nationally and internationally, through research activities and scientific-technical services, scientific production; and development and innovation, in close relationship with its research projects.

Research of the Ecosystem University goes beyond the *publish or perish*, its dynamics are recognized in the university environment and in the social environment for its scientific-methodological work and for its active participation in solving the problems linked to the profile of university research. The results of university science and technological innovation projects and programs must guarantee recognized and guaranteed social, economic, political, scientific-technological or environmental impacts. This will help create a recognized and visible image at all levels that is backed by the positive results of its research, development and innovation activities.

Although there exists the latent need to publish and disseminate research results, we must not forget that a university that engages in research in order to publish is not the same as a university that publishes because it engages in research.

Values can only be built through dialogue and negotiating personal interests based on common interests. One precondition for it is the diversity of interests and groups of people. Only through critical reflection on how different interests are, can we formulate the moral judgment that is the basis of any society.

Contrary to meritocracy, diversity produces heterogeneity and not homogeneity, which provides the Ecosystem University with a greater number of possibilities of responses[197] from within to external demands.[198]

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197 Elmqvist establishes a quality of ecosystems called “response diversity” (Elmqvist et al., 2003).

198 According to Ashby, internal diversity can satisfy external complexity, the value of heterogeneity (W Ross Ashby, 1961).

The diversity of responses to external demands and the appearance of novelty and discontinuity in the processes of knowledge production[199] are fundamental for the resilience of the Ecosystem University (Chapin et al., 1997)

This "system overload: (Ulanowicz, 2000) or redundancy of interests, lines of research and groups within the Ecosystem University, effectively serves as a mechanism for maintaining ecosystem integrity and providing future livelihoods. In other words, redundancy is the price that needs to be paid to guarantee evolutionary leaps and therefore the development of societies.

Several studies refer to the concept of redundancy, identifying it as a basis for resilience capacity (Low et al., 2003) (B. H. Walker, 1992) (Muller, 2012). Although redundancy is largely unusable, it works like the energy of a spring that is ready to bounce into action when needed, thus ensuring stability and persistence.

What remains to be discovered are new forms of evaluation that respect the diversity, identity and capacities of each individual or institution (in this case the university) and does not serve to classify but to promote development and growth.

199 This argument can be extended also from an ecological perspective (Crawford S Holling, 1992).

Chapter 3

Life Forges Its Way: Liberate Yourself To Liberate Others

Freedom makes sense when it allows the human being to make the best of his life. Much has been said about transcendent experience that allows the human being to savor that potential of making the best of our lives. It is true that we always seek transcendence in our lives, as life would lack meaning without it. Yet, one common mistake is to separate the transcendent or spiritual experiences from the real world as if these two sides were incompatible.

If the University, home of reason, must focus on the human being, it cannot disengage itself from its transcendent dimension. It must provide environments that help seek meaning beyond reason. This has nothing to do with negating reason, but it must be integrated in the experience of transcendence to free individuals from anything that gets in the way of finding their true being.

The human mind has always sought to know, express, explain things but also influence reality to discover the meaning of life. This journey has led through many stages, such as archaic reasoning or magical thinking. One stage is mythical thinking, which has lasted for a significant period of time and has had a major impact. It seeks to explain in a non-rational way what we humans cannot comprehend or explain. Any myth must simply be accepted or not because it does not admit rational explanations, although as a myth, it tempts us to understand an inexplicable reality. Then comes logical thinking, which invites people to use the potential of an enormous tool – reason, i.e. explaining reality through thinking. The following step will take us to scientific knowledge, which raises a first problem for our subject. We have given absolute value to it, we negate anything as being true that cannot be scientifically justified. Thus, the experience of transcendence is inexplicable and hence of doubtful truth. Yet, if the experience of transcendence is real, what can turn it into truth?

Excessive emphasis on the absolute nature of scientific thinking has led us into a dead-end street, which means that we should better accept it without asking questions. Descartes' famous phrase "*I think, therefore I am*" has identified us as reasoning beings, but our mind is not only capable of reasoning but also of experiencing transcendence - yet transcendence is not achieved through reasoning.

The transition from *mythos* to *logos* has been a false step since we have neither overcome myth nor overcome positivist reason. The myth seeks to complete what we need in transcendence because we feel incomplete and therefore something must come from outside to fill that gap. Moreover, it must be said that the myth does not admit of reasoning, which is why we either accept it or overcome it by knowledge because it has no foundation. That is why, on the one hand, we cannot try to build a logos from the myth because we would end up schizophrenic and, on the other hand, transcendence has no basis in the logos.

Therefore, we need to liberate the university and overcome myth and reason, albeit without excluding them from reality, so that we can create an environment conducive to the liberation of the person, teaching the person not to live the truths of the university but without the lies the university may have created.

Knowledge can free us and direct the will, because the will is not a force that helps us to control our intentions, but a blind power insofar as it is attracted by the good. You cannot reject what is good or accept what causes pain, you have to demystify the idea of the will as a power that helps us go against all odds. The will works from knowledge and to change what I want, I must change the way I see reality: when I understand something is good, nothing can make me reject it, and if I find that something is bad, nothing can force me to do it unless I receive something good in return.

That is why we must understand man from a different perspective that is not limited by myth or logo but goes beyond it. Hence, we need to open our doors to non-dual, transpersonal, ecosystemic thinking, an intuitive thought that evades mythic transcendence reduced to something that comes from outside to give us what we expect and that also evades positivist reason that submerges transcendence in the anesthesia of the known. The human being under construction is a bridge that links these two shores to give meaning to his experience of transcendence that goes beyond rational knowledge. His transcendent knowledge, if it can be called that, explains the actions of daily life that reason does not explain.

Any experience of transcendence is authentic but every method to achieve it is false, because the method is nothing more than an attempt to organize the experience, not from the depths of the person but through accommodating to reason. Here is where some truths or values come in that are instruments, but not an end. By freeing ourselves and going beyond myth and logos, experience of transcendence acquires another dimension and allows us to understand that this is possible, not by evading human limitations, but in spite of them.

Transcendence eludes every dimension of time and space, while reason makes us believe that the explanation of everything depends on these dimensions and that our 'self' responds to rationality and matter. Transcendence tells us that the true being is in another dimension beyond time and space. What it demands does not coincide with the demands of the reason of the false 'self', although this ego is positive and we must integrate it and discover the value it has in the only reality of the 'self'.

Therefore, the experience of transcendence helps us ignore the drive of seeking to become better and better, because the true self IS and does not need to improve. Hence, transcendent experience is the starting point, the road to be taken, and the destination, and therefore evades the dimension of time. The true being is already definite, it does not need to be more or less.

The here and now allows us to leave time and space, and although we need to worry about providing our bodies with what they need, our true selves are in another dimension. Therefore, such true self does not negate our material reality but integrates it into a transcendent dimension. This requires awareness and without reasoning we cannot achieve that awareness. This awareness is based on the knowledge of transcendent experience and the discovery of what I do emerges from myself, but without giving it too much importance.

Reason can affirm nothing it does not or cannot know. It is limited when it comes to qualifying transcendence as true or not, but if the transcendent experience is real, it only remains for man to accept the arbitrariness of his true being and his transcendence, and to discover little by little in that arbitrariness that he is already making the best of his life.

What matters is what we can experience. The answers are not found in what we think when we have a transcendent experience but in what we live, that is why it is real and deeply human, although not rational. Thus, let us stop being what we think we are and understand that the search for that 'self' is infinite because we cannot explain it or know it, but we can live it not by reasoning but by intuition (reading from inside).

When the true self emerges from within, it is immeasurable and indescribable. Therefore, the only way to reach the consciousness of its truth is through the effects of that discovery as:

- *The unity and identification with everything* because the true being cannot be added to or taken away from anything and is, therefore, at peace with its surroundings; it identifies not only with other human beings but with all creation because it does not need to change anything in them and enables us to understand the experience of transcendence beyond all method because it identifies with the experience of transcendence and not with the method and, thus, does not exclude anyone. Thus,
- *The fear of losing and the anxiety to win will disappear*, the true being IS and cannot lose or gain anything, the fear of losing and the anxiety for what is desired comes from the false self;
- *The true being overcomes the duality of false and true*, the black and white, order and disorder, right and wrong; reality is beyond matter and spirit, it is another thing that we are unable to explain but know how to experience.
- *It overcomes all idolatry*, because it does not need another idol created according to the interests of the false self, which comes from outside to complete the incomplete. The true self is already complete in itself, it only needs to be discovered, God is in everything, even if He is not everything, He is in the *here and now* and has not postponed his coming, because He comes, but from within and returns even if He has not left;
- The true being *surpasses the Manichaeism of the stick and carrot,* it does not put day against night, or good against bad because it simply understands them as degrees or levels.
- From the true being it is not necessary to judge anyone or oneself. Therefore, in the oneness of the rational and the transcendent dimension, there is no reward or punishment, but the consequences of acting from these two unified realities exist, because the false is also part of the self and must be integrated and overcome.
- *The possibilities for discovering the true self will not be better at any time in the future;* now is the time because we must discover and not

build it, it is complete and nothing that happens will add or take away anything. Thus,

- *There is no room for lamentation about why what happens, happens*, because what happens is the best thing that can happen to the discovery of the true self;
- The awareness of the true self goes beyond the awareness of the "self" or my individuality, because it does not connect me to the rest from a vortex but in a whole where the "self" and the "you" are indistinctive, which means it is the awareness of oneness rather than individuality. We are all part of one single life that flows through the biological creatures and transcends death.

We must accept the myth and the logos, but overcome them by opening ourselves to the transcendent dimension, as Don Bosco did two hundred years ago, when he proposed the following pillars for educating his youngsters: religion, reason and amorevolezza (loving kindness) (Sáenz, 2017).

The Ecosystem University must free itself from the positivist thinking that reason is at the same time also the seat of reason and pave the way for the possibilities of transcendence of the individual. This implies creating an environment in which the human being can develop beyond the anesthesia of the known; an environment that combines not only the possibilities of developing cognitive but also emotional knowledge.

The development of the person is not a mechanical exploration of the known, it implies abandoning one's own certainties and dogmas to embrace the lushness of uncertainty, with the only certainty that it is this very uncertainty and the feeling of loss that inspires search and action. It is time to give way to an intuitive, non-dual, transpersonal or ecosystemic thinking, a bridge between myth and logos that will make us more of a family among those who are willing to dialogue and walk together with the freedom of imagination and decision.

Education at the Ecosystem University includes the individual's rational and sensitive spheres. The personal dimension plays an important role for one's capacity of thought, emotion and action, which empowers the individual to deal with all situations in life, choose ways to go, options and find solutions. This education is based on everyday things, experience, but, paradoxically, it transcends the everyday, the immediateness of an occasion that we generally describe as truth.

In order to promote the intuitive, ecosystemic, transpersonal, non-dual thinking, the Ecosystem University must provide an environment that promotes human development that is open to the possible, the uncertain, the casual and the contradictory. The only certainty in this environment is uncertainty, complexity and diversity, simply because life is like that.

Both the student and the teacher start from the question rather than the answer. The answer is anesthetic, it is limited to the known, while the question evokes action and the power of discovery and as we have said, rather than explain we must experience transcendence. It is a question of emotional and rational education, imagination and reflection that create not only an epistemological break but also extrapolate from what we know and from our normalized past/present/future.

That way, the environment that promotes human development and its capacities focuses on the individual and the permanent search for the meaning of transcendent experience and knowledge articulated with life. This implies that the University liberates itself from the limitations of reason and myth to be free to develop logics that is more compatible with life and new, non-dual and more ecosystemic, transpersonal and intuitive thinking.

An environment that empowers the individual requires us to believe in the individual, his potentialities and the capacity to free himself from what oppresses him; it does not presuppose that the human being is bad by nature and, thus, needs to be shaped through the stick-and-carrot method. The suffering caused by nature or human injustice do not come from above and nothing is further from our true being than the belief that things go well or badly for us because we are good or bad. This not only ridicules the human being but also God and following that logic in our interpretation of education could lead us to look at it as a process of indoctrination, suggesting that as long as we are good, nothing bad will happen to us. That would eventually fray every educational process.

We need to discard the Manichean vision and assume responsibility. Education is not a professor who teaches the truth but education means developing the capacity (of both: teacher and student) to live without our lies and liberate ourselves in order to liberate. By encountering the meaning of life, the individual can face and respond to daily problems and also to joys, from the freedom - even if it is only minimal - we get from the awareness of the true being. Finding meaning in the midst of uncertainty, complexity and diversity creates hope, trust and love.

Every human being is unique and has a mission assigned that no one rewards or punishes him for. Fulfilling it is our reward and not fulfilling it, our punishment. Our mission is not to do things, but to find ourselves, i.e. to grow in the awareness of our true being and to live this project to the fullest. We must seek the freedom that allows us to do one thing or the other, which is the basis of "*da mihi animas, caetera tolle.*"[200] To transcend is not to do or achieve something, but to discover and live the reality of the true BEING.

Truth Will Set You Free: The Investigation

The very first universities were called *Universitas Studiorum,*[201] which means Universal Studies. The University was conceived as an agora for dialogue and

200 *"Give me souls, take away everything else"* Motto on the Salesian coat of arms (Sáenz, 2017).

201 The word *Universitas* is an abstract name formed from universus-a-um (all-inclusive-universal). In the Middle Ages it was used for any collective, community or corporation with common interests, and also to describe the totality of things. The term *Studiorum* comes from the desire to study something, *Studium* corresponds to a group of people dedicated to intellectual pursuits. Since the University was the cradle of knowledge, it was attributed the character of "*Alma Mater*" for engendering and transforming man through science and knowledge (Pozo Ruiz, n.d.).

the search for truth. In its early days, the scholastic method that established dialogue in the European universities looked into: *lectio-questio-disputatio-determinatio,*[202]i.e. the search for the questioning, the meaning and the synthesis of knowledge to build a more ordered society through the development of the individual.

We need to re-read the university mission in the light of its origins to make socially relevant projections. Universities today mostly imply innumerous lessons and subsequent mechanical evaluation of what has been said which, in the best of cases, obeys a pedagogical mediation for the transfer of knowledge. Not only has the *questio, disputatio and determinatio* been ignored, but even the *lectio* has been rendered meaningless.

Pedagogical mediation is no more than an instrument to strengthen the scientific relationship between teacher and student in the search for truth and the discovery of how science produces and reproduces knowledge.

If the search for truth in the *Universitas* is characteristic of its identity and directed toward advancing society and humanity, we might want to question whether the centrality of the person and the search for truth is found in the ultimate goal of the University or whether, instead, we have become accustomed to terms such as: employability, competence, adaptability, effectiveness, etc. The point is not to question the above-mentioned terms, but rather the very meaning of the university in society and the possible *re-*

202 The scholastic method *"schola"* institutionalizes the medieval pedagogy based on reading *"lectio"*, knowing that the universities in their origins maintained a close link with the Church. One could then assume that it is not a question of a simply informative reading, but as a characteristic of *"lectio divina"* it means reading that presupposes listening, understanding and responding (Ratzinger, 2010). Guido II, Abbot of the Grande Chartreuse (+ 1188), advises his monks to follow the four steps to heaven*: lectio, meditatio, oratio and contemplatio* (San Guido II, n.d.). The *"questio"* (questioning) emerges from the text; in the questioning, the rational instruments of logic and dialectics come into play; the scholastics do not tacitly accept the things they read, but rather analyze them according to the search for truth; the intellectual thought is not valued by "arguments of authority" but by the rational verifications that are available and the scientific clarity with which it is illuminated. In the *"disputatio"* lies the whole dynamic of medieval education, where at least two forms of dispute become visible: free dispute, i.e. on any quodlibetal subject that was carried out only on dates close to the celebration of Christmas or Resurrection, and the ordinary dispute that dealt with the science in question and was carried out periodically. The *determinatio* was instead a resolution taken by the community or the cloister that participated in the debates (Magnavacca, 2012).

placement of truth by what could turn out to be more *useful*, and the search for *factual success*.

Although professional training is necessary to build the university's know-how, it cannot renounce promoting human development and its capacity to think about itself from its own existence. The point is that we must accompany it to discover the path of knowledge production rather than train it to reproduce that knowledge.

Historically, the university was attributed the role of "Alma Mater" for engendering and transforming man through science and knowledge. From its very origins, when it was subject to the theological thinking of the Church until it became dependent on the State beyond the university's autonomy regarding knowledge, it was the humanistic sense that prevailed in the University. The following is a quotation from the program of the Institución Libre de Enseñanza (Spain 1876):

> ... seeks to assimilate that whole of knowledge (humanities) that every epoch demands to build on its foundations a professional education in accordance with people's aptitudes and vocation as far as possible, chosen more conscientiously than customary; it tends to prepare them to become scientists, literati, lawyers, doctors, industrial engineers.... but above all, men, persons capable of conceiving an ideal, of governing their own lives through the harmonious combination of all their faculties. (Institución Libre de Enseñanza, 2009).

It is worth mentioning that in the origins of the University *science is not taught or learned but explained and understood.*[203] Thus, beyond the paradigm of teaching-learning, we must reinvent new logics that combine know-how and knowledge in a scientific relationship between teachers and students.

The key lies in understanding science production -- not only by learning content, but above all by understanding and therefore having the ability to explain reality from the logic of a certain specific character of science. Therefore, an academic program that is limited to a summation of disciplines can hardly produce scientific understanding and training in a certain time without the logic and epistemology of a certain science. The latter can only be understood in a program of theoretical-applicative research that develops new knowledge from

203 According to José Sanchez-Parga, university teaching does not follow a pedagogical-educational logic, where the teacher transmits knowledge, but rather establishes a scientific relationship between teacher and student that corresponds more to communication between *know-how and knowledge* (Sánchez Parga, 2003).

the very science. Academic research not only illuminates university teaching, but also constitutes the final result of university training.

Based on this fundamental mission, and considering that the world is changing, constant renewal and innovation are therefore a prerequisite for a university that wishes to evade stale academicism or an approach devoid of any content; if the university lacks the capacity to constantly reconsider its mission and its fields, it will run the risk of becoming socially irrelevant.

The path to understanding science implies conceiving the University from its origins, *Universitas,* privileging the dialogue between know-how and knowledge beyond the scientific method,[204] with new subjects and defining new objects of research, identifying new and promising projects in the community and articulating knowledge with transformative practices.

Opening the university to new *creative indisciplines* from the "scientific knowledge" disciplines, preparing it to incorporate new knowledge conceived in different places, languages and logics, will guarantee the university's universality and avoid the false universal conception of a single way of thinking.[205]

Illuminated by its founding principles, the university must project itself into the future, re-found itself on a daily basis, incorporate knowledge from otherness, interact with the context to understand its economic, political and cultural reality in a diverse manner, beyond technical rationality and the invisible economicist functioning of the markets.

The contribution of the university to a humanized modernity lies in confronting its instrumental rationality and its critical rationality in a conflictive and constructive way. Illuminating it through ethical thinking that offers various options, i.e. responding to the demands of society, being able to respond to the problems of society, but above all being able to identify and confront these social issues.

204 The concept of the infallibility of science and the monopolistic approaches of positivist science as a source of definitive truths have been strongly questioned. Latour argues that scientific facts are constructed according to the influence of the political or economic context (Latour, 1987) and more and more non-positivist paradigms such as the constructivist one (Edelman, 1989) are emerging in an attempt to produce meaningful knowledge. Although knowledge is incremental but scientific concepts are not, the paradigm of cumulative science seems increasingly unsustainable, Khun states that a scientific paradigm is subject to cycles of rise and fall to which not even the sciences considered as exact can escape (Kuhn, 1970).

205 Feyerabend, from the problematization of the method, justifies the incommensurability of science (Feyerabend, 1975).

Every epoch has experienced epistemological changes, a change of rationality, which directly involves the logics in which knowledge is produced and reproduced; currently there are new rationalities such as the instrumental, the utilitarian or the market rationality, which is why there is a latent risk that critical rationality and the search for meaning will be replaced. The university faces the challenge not to stop *thinking* about reality, *explain* its causes, and *understand* its meaning.

If the university fails to meet the challenge, it will be trapped, both as an accomplice and as the culprit of a kind of *loss of thought and intelligence*. If the university produces applicable rather than theoretical knowledge, it will enter into a pernicious cycle that is destined to teach rather than think about knowledge. Our Ecosystem University model cannot be practicable if it fails to *explain* how knowledge is produced or if it fails to *understand* how it is produced.

Science does not need an explanation but explains itself through the research process, by linking up with other fields of knowledge and specializing and deepening analysis. Therefore, it is less important to learn new knowledge than to *learn to think, learn to learn, learn to understand.* This can neither be explained nor transferred, but can only be achieved through unraveling and producing science.

The freedom of decision and action lies in the capacity to think, which we all have and have to make use of: to *think and act* in order to know reality and think. Rather than teaching knowledge, the university must teach how to think, because thinking involves an implicit factor of transformation of reality that a person understands, which is why thinking is political. The effectiveness of the university's action in its territory is a consequence of the committed thinking that it produces rather than of the thinker's intentions.

Complementing the challenge of *thinking about reality*, the university should not only teach knowledge, *but teach to think about it.* It is not a question of thinking politically or thinking about politics, but the very fact of thinking is a political exercise of the university's role in society.

The university as a social institution can be justified by the contribution it makes to the production and communication of knowledge that is conceived and reproduced within the university (Molitor, 2009), as well as forming active, critical, reflective, and supportive individuals.

The fundamental challenge for the university lies in its ability to develop a model that combines the efficiency and effectiveness required by the context with its own way of choosing and defining its response.

The freedom to think derives from expanding the fields of science, comparing them with other visions, taking a critical distance, make a case for our positions, in short, defining our own thinking. Therefore, we need to understand the way in which science produces science, or produces itself. It is not only a matter of assimilating knowledge, but fundamentally of developing our capacities to produce it.

The search for truth ungags the word and unmutes intelligence, since it is no longer forbidden to disagree or justify counter arguments, and thinking goes far beyond the irrelevant practice of memorizing and replicating data and information.

The university must not ignore the dynamics of explanation and understanding; understanding knowledge allows us to develop new knowledge; pure memorizing is a waste of time, effort, and resources. The world is changing and failing to understand and explain things will prevent us from making use of them and, therefore, everything that is "learned" will not be useful in the future.

The objective is teaching how to think, how to understand knowledge, discover how it was produced, understand the moments in history to which this knowledge responds, understand how it was transformed or evolved so that we can project it to the future in accordance with the new social context, the new business realities or paradigms of science itself.

It makes no sense to think of the future as an extrapolation of the past, and neither can we pretend to predict or establish a model of a future university. The future will be shaped in the eternal present by those who assume responsibility for building it. Thus, it is the university's responsibility to live the present, since this is where the past and the future converge. [206]

The university cannot seek its identity by merely responding to outside demands, which is why our actions must contribute to the university based on *thinking* its autonomy and integrity; imagining possible futures will make

206 In the Andean cosmovision it can mean the recent past, or the present to anticipate the future (ñawpa); the present as the past of a future that will come, therefore, the immediate past, the present and the immediate future can coexist in the same moment and the same space (Herrán Gómez, 2015, p. 134; Qespi & Eusebio, 1994, p. 176).

sense only if it leads us to act in the present with liberating interest and ethical intentions.

A Liberating Environment

In the previous chapter, we discussed the Environment that Enhances People's Capacities from an ecosystem perspective and used the analogy with biocenosis of a natural ecosystem; from this standpoint, we described the characteristics and explained the potentialities of the ecosystem. In this section, we shall try to look at the liberating dimension of this environment with respect to [i] human beings and their education, and [ii] the common dimension of the community that makes up the university, communal but inappropriable[207] and therefore free.

The fundamental value of an environment that enhances the capacities or the development of the individual in community is the freedom or the capacity to choose, act, function better in that environment than in others to develop a socially responsible life project. The Ecosystem University Community focuses on developing the potential of people and their life projects in community and, in doing so, recognizes their capacity for self-promotion and self-organization.

The capacities in this case go beyond the elementary freedom and constitute the range of opportunities from which to choose and *act* on (Martha Craven Nussbaum, 2002). The choice and the action are directly linked to the dimension of being and doing, more than to the utilitarian dimension of the individual. As we said before, the University is capable of acting in society through the two genres of action defined by Aristotle: the *productive-creative action* (poiesis) focused on results and the *practical action* (praxis) focused on means (Aristóteles et al., 1970).

According to Sen, the *functions* constitute the well-being of the person, represent the acquisition of one or more capacities and describe what a person can do or be, and, therefore, improve his life conditions in the sense of well-being (Amartya Sen, 2014, pp. 63 and 76). This ability to *function better than in other environments* highlights the ability to choose opportunities in

207 In the sense of exercising ownership over an asset, that is, it is not an appropriation of use that has been discussed in this book, but this word in the context of this paragraph refers to possession.

freedom and therefore determines the person's lifestyle (Amartya Sen et al., 1991). Sen refers to it as the *capacity to function*, which forms the constitutive basis of a person's BEING.

Based on its system of values and its components, an Environment that Enhances the Capacities expresses a context that brings out the *socio-political-economic conditions* that are the synthesis of a community that acts around *knowledge*. Far from being an isolated bubble, the Ecosystem University is affected by society and in its interior creates similar conditions of diversity, complexity and uncertainty, in order to bring out the capacities of each person (J. P. Salgado et al., 2017). This environment, which we defined in the previous chapter, as a *biocenosis-context* is a *capacitating context* (Ellerani, 2017) (Evans, 2002).

The aim is to offer opportunities that can catalyze initiatives, emotions and life projects that foster learning in a real context; an environment capable of relating *cognitive knowledge* with *emotional knowledge*. *Cognitive knowledge* can be understood as the development from a thought, belief or knowledge, to a bodily sensation that triggers an emotion. Boekaerts summarizes cognitive work on motivation by establishing four principles: (i) if the person feels competent[208] 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[209] to learning, (iv) if he 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).

In other words, tacit knowledge is "*deeply rooted in an individual's action and experience, as well as in the ideals, values or emotions the person embraces*" (Nonaka & Takeuchi, 1995). The dynamics of knowledge can be explained from the cognitive and emotional nature of knowledge, while the decision-making process can be better understood in terms of rationality and emotionality.

Emotional awareness is characterized by content and intensity. For the same emotional content, we can have different levels of intensity, which really constitutes the main difference to cognitive knowledge. In an attempt to explain what he perceived as novelty (intensity), (Charles Sanders Peirce, 1998)

208 Feeling competent does not mean knowing everything about a subject, but rather understanding oneself as being capable of executing a learning process, which implies accepting ignorance about the subject, but being sufficiently motivated to face the challenge.

209 Even crises can be a favourable learning environment.

defines as *abduction* the process through which the receiver through his own logic (which is unique) constructs his own hypothesis. This process begins simply by receiving the signal (content) of data that carry a novelty that needs explanation. In search of this explanation, the individual generates, classifies, selects and connects information to give meaning to a new belief, a new creation of knowledge, always bearing in mind the surprise caused by novelty.

More and more researchers corroborate the cognitive sense of emotions. Alessandrini (2017) maintains that emotions *not* only sustain the psychological mechanism of a human being that reasons, but that they also form a constitutive part of the person's reasoning capacity. In other words, it is through emotions that the human being attaches importance to what surrounds him, creating values and valorizations, giving meaning and value to knowledge. Ellerani argues that being able to develop emotions in order to imagine, understand, be empathetic, be aware and differentiate, i.e., emotional integrity, is a sine qua non for learning (Ellerani, 2017).

Figure 41
Emotion - Cognition - Creation and Research - Participatory Action

Elaboration: Salgado-Guerrero, J. P.

As we stated in Part I of this book, by analyzing Nussbaum's capability approach, Moschini concludes that *capabilities* endow the individual with feelings, sensations, emotions, desire for happiness and eagerness to safeguard his own environment and the future of his loved ones (Moschini, 2017). Abbate agrees with this principle, adding that positive or negative emotions (pity, compassion, love, pleasure, or negative ones such as fear, anger, displeasure, or neutral ones such as shame) give meaning to existence (Abbate, 2017). He also maintains that recognizing a *cognitive content to emotions* means not only abandoning the concept of irrationality, but also understanding that mere intellectual activity may not be sensitive enough to capture or communicate these emotions.

Another important consideration is that emotions are a major factor for taking action. Costa (2017) comments that emotions sustain *agency*[210] processes, while the *telos*[211] of action establishes a directionality of values constituted by a system of principles that might go unnoticed by the cold intellect. Emotions such motivations favor or overthrow the decision to act according to principles, which is why they can be considered as a constitutive part of the system of ethical reasoning, the basis of each participatory social innovation process.

The relation between *epistemology and pragmatics* invite us to consider how science leads us to reflect on our actions and transform them, as well as to conceive that scientific production depicts the complexity of the world as we perceive it. These relations inevitably require a cycle of action-research-decision-social regulation (Morín & Le Moigne, 2006).

How can we monitor an environment that is so dynamic and changing that it combines a number of variables? The interaction with the context produces a series of subjectivities. Stake argues that monitoring or re-

210 The term *agency* can be understood in pedagogical or social development literature as the capacity to do or act, which is directly related to *autopoiesis*, which for Aristotle is *productive action* (poiesis) that focuses on *results* (Aristóteles et al., 1970). *Plato defines the term poiesis as* "the cause that converts anything we consider not to be into being" (Crespo Güemes, 2007). Sen "refers to what a person can desire - since he places value on it - to do, to be" (Amartya Sen, 2014). The value of "*activation*" *(agency)* implies the concept of freedom to act, the *agency* inherent to the action starts from the subject, but it is generated within social and learning contexts (Massimiliano Costa, 2014).

211 Telos from the Greek *τέλος* is a Latin word referring to an "end", "purpose" or "objective" used in philosophy.

search must respect the continuous dynamics of change, and therefore be empathetic, i.e. respond to contingencies[212] and develop progressively (Stake, 1995). Only this type of research will produce organizational knowledge created from action guidelines and strategies, allowing the organization to be sustainable, flexible and capable of learning.

Action-research uses multiple methods that depend directly on the information that needs to be generated (Banister, 2011). *Subjectivity* should not be seen as a problem that we want to eliminate, but as an essential element we want to understand (Stake, 1995). Learning is not limited to the development of specific skills to *know how to do,* but takes into account the system as a whole that interacts with the context (Senge, 1990), where the biggest problem is not the way the university produces but the gap that may exist with the context. Only the interaction with the environment favors the transformation of knowledge into a tacit-explicit continuum and then one also *learns to learn* and, more importantly, one *learns to be*.

Free and Formative

The environment of which we speak transcends the dimension of the *educational institution* because it is not an extrapolation of paternal authority; it is not even a question of analyzing the exercise of authority to teach. Authority, on the way to unraveling science in order to learn to think about it originates in science itself. Hence, it is not the teacher who explains the knowledge, but science itself.

We are, therefore, not talking of an environment marked by *pedagogy that transmits* knowledge, but rather of the *communication of thought*, which breaks the dichotomy of superior and inferior between the teacher and the student because both participate in the same knowledge and become similar actors in the learning process (L'Heuillet, 2002).

As similar actors in the learning process, what is imparted is not knowledge but the *experience of learning to think scientifically*, that is, how knowledge is produced and explained. This - and not the simple possession of knowledge - is what qualifies (A Sen, 2001) an individual. It is all a question of imparting training for freedom, controlling one's own life and good living.

212 The term emergence refers to situations that emerge from within the organization.

Sen designed his *Capability Approach* as an expression of the active development *based* on the capacity to be and do, beyond economicist *functionalism.*

The freedom to reason, the capacity to think and question what has been established, to look for and propose new alternatives is in the center of the liberating environment, of this environment that enhances the capacities of the individual in community. This environment raises as many questions and concerns as observations and experiences, which also produces multiple possibilities of understanding and explanation of knowledge. This, in turn, leads to the combination of different rationalities and levels of rationalization.

In this environment, the coded search in research is marked by the *ways of knowledge production* but not by the means, instruments and methods of research. It is the communication of the experience of production of knowledge and the search for its meaning that makes the university indispensable for *exercising, practicing and acquiring scientific thought*.

The creation of knowledge in the learning process is the research model of the Ecosystem University; teaching and research are one whole that do not get mixed up but go together; they form a base fabric for this liberating environment. There are multiple variables that make this approach a permanent and personalized search. *"I teach because I search, because I investigated, because I investigated and investigate and investigate myself. I investigate to check, checking I intervene, intervening I educate and educate myself. I investigate to know what I do not yet know and to communicate or announce the novelty"* (Freire, 1997).

Although it is necessary to specialize in science in order to study it, understanding it would be impossible without complexity. Therefore, in order to create an Environment that Enhances Capacities, the university cannot succumb to the *phantom* of specialization. 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. From the vantage point of nature, we, therefore, must understand another form of competition based on BEING and cooperation.

Free of the Phantom of Specialization

Although nature seems to have evolved to achieve highly specialized processes and organisms to fulfill certain roles or functions, it is no less true that these depend on a cyclical whole and that their functions are not independent; everything has a reason for being and a consequence in the great organism called planet.

Far from linearity, an Ecosystem University cannot evade life, it seeks compatibility with its methods and accepts insecurity in order to remain vital and not terminate its existence by clinging to what is safe. Non-linearity pushes the Ecosystem University to avoid encouraging specialization driven by competition and meritocratic careerism. It is necessary to measure to what extent the specialized diplomas and exams contribute to forming reflective citizens, who, by marking a critical distance with the imparted knowledge, develop moral judgment.

An Ecosystem University understands the actors as diverse beings with multiple capacities, open to dialogue, creative and willing to face complexity. However, both specialized teachers and students today also act in a specialized way. That is to say, by closely sticking to the program and the curriculum, this can become a serious problem when dealing with a life that is full of – sometimes even antagonistic - diversity, uncertainty and complexity (full of multiple forms of knowledge).

The paradigm of complexity and the conception of the greater whole, pushes the University to constantly manage "the permanent tension between the aspiration of knowledge that is not partitioned, divided, or reductionist, and the recognition of the unfinished and incomplete nature of all knowledge" (Edgar Morin et al., 1994). It is not a matter of contrasting disciplines, nor of making them interdisciplinary, but rather of understanding the disciplines from the points of view of other disciplines to understand the unfinished whole. The organization of these diverse points of view is what Morin calls the organized complex unit (Edgar Morin & Piattelli-Palmarini, 1983), and which he sees as following an inseparable Trinitarian-man system: individual, species and society.

The act of knowing or producing knowledge is a physical, biological and social process (Böhm, 2008) that allows the human being to connect diverse and apparently unconnected phenomena. This multi-relational capacity of intuition (C. Peirce, 1998; C. S. Peirce & Buchler, 2012) appears to be widely ignored by the current concept of science that has led the University to seek refuge in an educational system of fragmentation and specialization.

The Ecosystem University must find mechanisms that enable it to validate the emerging new forms of knowledge and learning, which - generally unrelated to careers or disciplines - assume the complex situations of projects and fields of study, creating a new organization of knowledge beyond the disciplines. We could then say that it is the indisciplines (with respect to the concept of traditional science) that assume the capacity to transform. It is not the specialized sciences but the processes and research that try to understand them. Specialization and complexity constitute the not only antagonistic but also complementary pair of the Ecosystem University, just as in nature the species specialize to survive, but are also part of complex cycles of a whole that organizes them in an order of superior dynamics.

It is through research that the University achieves this process. One of the processes of research is to specialize science, and another process is to interconnect and unite what is expected. This is the preferred perspective for explaining and understanding how science becomes complex by associating, aggregating or combining fields of knowledge.

Science not only develops by specializing but also by becoming more complex, and a sustained process of research makes science more complex. This means that knowledge is not in itself transdisciplinary or interdisciplinary, but only becomes "inter" or "trans" through research.

If we try to mold science to help us understand it, we will also condition it by the research model of science itself. It means that only by discovering how science produces its own knowledge that we can explain that knowledge. That is why the explanation of the logics and dynamics of specialization and complexity of scientific development are not simply learned but understood and conceived on the basis of research. Thus, we could say that science is almost self-explanatory.

Research implies thinking and treating scientific knowledge and concepts not as contents or data, and their elements as constitutive, but as results and products of the interrelations of the fields of knowledge, of the modes of production of knowledge that constitute science. These modes of knowledge production will lead to new fields of specialization and also to new complex inter- or trans-disciplinary fields, results of theoretical accumulations or epistemological ruptures.

This eco-systemic implication of specialization-complexity is of equal significance when it comes to understanding university organization, as it would imply that there is no teaching of a science that is not the teaching of its research efforts and the production of its knowledge.

Freedom Between Competition and Cooperation

For Lynn Margulis (1991) life is a symbiotic and cooperative union in a way that allows those who associate to succeed. The physical association between organisms of different species, called symbiosis, has had a crucial importance in the history of life, while most biologists emphasized competition in the evolutionary process, Margullis focuses on cooperation, questioning the belief of that only the strongest survives, for her the agreement is symbiotic in such a way that no one wins or loses but there is a recombination, that is, something new is built.

Competition, not to be mistaken for rivalry, is defined as the capacity based on knowledge or experience. The complex cycles of an ecosystem shed light on the reasons for competition; species develop competitiveness by fulfilling a specific function in a biotope, i.e. not because they try to be better than others, but because they try to be better themselves to survive.

In the social context, the ambition for profit related to competition appears to be behind all the current crises: economic bubbles, unemployment, inequality, climate crisis, democratic crises, etc. The structure and social cohesion paradoxically obey to opposite values such as solidarity, equity, cooperation, complementarity, etc.

Paradoxically, life expectancy is today higher than ever before and offers unprecedented possibilities for prosperity. And yet, our societies are increasingly excluding the majority of the world's population from the benefits of development, and the global impoverishment and social disintegration have gained momentum as a result of shortsighted competitiveness of economic performance.

Taylor raises three reasons why our societies produce "forms of malaise" (C. Taylor, 1994):

- Individualism caused by the loss of meaning in our lives, destruction of social ties, and impoverishment due to lacking moral limits.
- General disenchantment because of a utilitarian predominance in all spheres, the so-called instrumental reason or what Schön called technical rationalism, the predominance of efficiency and the achievement of objectives at the lowest cost using technology. Rather than enriching, we are suffocating and limiting our lives (Schön, 1992).

- Lack of a sense of community caused by prevalence of the political sphere, which causes apathy in public life and the social spectrum. This limits and reduces options, as well as ever growing individualism, marked by concern for the personal - all this alienates anything that is beyond the self, be it of a philosophical, ethical, or historical value, leading to a state of neutrality that is proper of a liberal society.

We must take into account that societies have always had an economy and a market, social institutions that were conditioned by a model of society. Yet, today we are witnessing a global development of capital that conditions society as a market society and not as a society with a market that seems to have become a hegemonic institution; the "market logic" has formed and penetrated societies, creating new values where social relations are determined by the terms goods and capital.

For Sánchez Parga identity is created through re-cognition, since values can only be defined if they are valued as such, where the members of a community recognize and identify with each other, which in the author's opinion implies (Sánchez Parga, 2012):

- Assuming sense (i.e. it makes sense to me).
- Identifying with that recognized value.
- Assuming sense and identifying with values are impossible unless they are (more or less) collectively shared.

Not separating reason from morality is a capacity for authenticity and provides identity; identifying with something for its part implies a chain of values and their respective valorizations that are recognized in community.

Individualism undermines the essentially social identity of human beings. Values are not part of cognition or knowledge but of social re-cognition. These values serve to mediate relations between individuals; social identity is a consequence of the development of people's own identity through identifying with the group. "The identity of each individual is thus linked to the appreciation the individual has for the group he belongs to." (Godbout & Caillé, 1992).

The homo *oeconomicus* seems to forget that our species has subsisted because of its social instincts and because of the consequent expressions of social cohesion that constitute the basis of and also condition the development of homo sapiens due to his capacity to communicate. Our society is characterized not only by the natural and biological rules of coexistence, but also by the elaboration of values that result from the social organization that goes beyond the other species that populate the planet.

What we see is a modern individual without ties but full of rights and duties, the reification of people and the extreme commodification of their relationships. Simultaneously, all possible recognition between them deteriorates, making the conception of values and their valuation difficult. This individualistic competition sends people in a controlled race that is guided by having rather than being, which is absolutely inconsistent with the ecosystemic logics, where competence is based on strengthening people's identity as a species.

With regard to knowledge production, identity-based competence has important implications in the Ecosystem University. Nonaka-Takeuchi define knowledge as a "truly justified belief" (Nonaka & Takeuchi, 1995), created from information by giving it meaning through significance and 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, such knowledge is the result of studying and researching its reasons and causes.

Therefore, university teaching explains knowledge rather than teaching it (Sánchez Parga, 2003); not that it can be learned by the students (who might forget it as the content moves to their passive memory), but so that it can be understood and then even passed on by the students themselves.

Learning as such is not shared but passed on. Conversely, knowledge is understood to the extent that 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 is the reciprocity in the dialogue of knowledge by its members. It builds the free flow of ideas and of the space-time dimension, where it is possible to emulate and re-appropriate the knowledge of others. Thus, we will have to relativize the copyright and make a qualitative jump to the right to copy. Emulating corresponds to the spontaneity of energy exchange; again, for nature it is more important to optimize cycles than maximize competition.

The value of emulation for building knowledge lies in the fact that we need others for our own improvement. This produces the cyclical dynamics of reciprocal improvements, which generates social bonds in addition to sharing the qualities, objects and contents of knowledge, both in science and in professional performances; it also produces participation in the common and shared goods of knowledge (Hess & Ostrom, 2007).

In contrast, meritocratic competitiveness not only fails to establish social relations but produces inequality and finally leads to the exclusion or elimination of the other. Such mistaken competitiveness throws people into a battlefield with nothing but winners or losers, and will only produce “warlike vocations...the expropriation of the future by the dominant to the detriment of the young” (Petrella, 2007).

Action-communication-knowledge is therefore a more important cycle for the Ecosystem University than the predominance in predatory and self-referenced rankings; action, which does not ignore the level of implicit theoretical understanding, starts a cyclical process where the old understandings are absorbed and once assimilated have a great potential to inspire practical changes. We are talking about an abductive fusion (C. Peirce, 1998) between what is already understood and the new ideas. This cycle, which has no beginning or end, let alone comparative scales between individuals, will urge the Ecosystem University community to value its identity more strongly (which forms identities between the actors), and at the same time promotes dialogue of knowledge that generates new practices and knowledge.

Freedom of Choice

Comprehensive education that develops the person requires combining rational and sensitive aspects, i.e. the course of scientific development must include aspects such as perceptions, arguments and language, which are influenced by particular interests and desires.

It is a matter of proactive research-teaching whose strength lies paradoxically in its lack of direction. That is why through the Environment that Enhances Capacities, the Ecosystem University will seek to recreate the conditions of search, i.e. starting from the question and not from the answer; an environment that provides opportunities to rediscover the deep meaning of experience, of knowledge that goes hand in hand with life; to leave aside all the established presuppositions and totalitarian truths that get caught up in the realm of the linear and make people perceive imagination as a break with education itself.

Research has a place in all academic spaces and processes, when teaching embraces the form of research of each science, then teaching itself becomes a search and reconstruction of knowledge in itself. Therefore, teaching must incorporate the principles, assumptions and motivations to oppose prescriptive teaching, leaving space to the production of knowledge unique to each individual through analysis, assessment and understanding.

As was discussed earlier, the crucial thing is to make that leap from what is learned to what is understood, in a process that involves thinking about the acquired knowledge and sharing with the teacher the understanding of how to produce it; it is a matter of sharing the same research exercise. We cannot learn scientific knowledge and scientific thinking but must understand it in a progressive manner, whose axis is research as a process of scientific production (Sánchez Parga, 2003).

Without research-teaching there is no scientific production of knowledge, let alone awareness of scientific thinking. Hence, Teaching and Research relations are indivisible.

The challenge for the Ecosystem University lies in the capacity to create bridges and mediation between the emerging instances present at the different levels of academic action in the fields of teaching and research. This implies using the *Teaching-Research Fabric* (Salgado, 2014), for which freedom constitutes a fundamental value, and which offers the individual the possibility to choose his own path to produce and give meaning to knowledge.

The *fabric* formed by teaching and research for an ecosystemic organization in the university must show the following characteristics: [213]

- 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,
- The understanding of "responsibility" as something that is not only limited to rights, obligations and methods (problems are not seen as being the responsibility of others),
- A commitment to the organization beyond any technical relationship,
- A network structure of authority and communication. The sanctions applied to the conduct of individuals in their work function derive

213 Burns &Stalker establish differences between mechanistic and organic organization, the characteristics listed were developed based on their book *The Management of Innovation* (1961).

more from the interests of the community and the survival and growth of the organization than from a contractual relationship represented by an immediate superior,

- Knowledge can be located anywhere in the network; this location becomes the *ad-hoc* center of controlling authority and communication, and does not rest solely with the head of the organization,
- Lateral and not merely vertical communication. Furthermore, communication resembles a request rather than a command,
- Content of communication that consists of information and advice rather than of instructions and decisions,
- Commitment to the organization and to the *"technological ethos"* of progress and growth is more valuable than loyalty and obedience.

Participation, as a process of increasing learning in social life, must be designed and evaluated with respect to the achievement of common goals and services by the community. That is to say, it is necessary to define the criteria and procedures for the co-production of knowledge/decisions/actions in the design/implementation/evaluation of policies, actions, projects, services in educational and social areas.

The promotion of an Environment that Enhances Capacities integrates the academic-extra-academic contexts (process) and improves the Teaching-Research nexus (product), particularly by sharing an innovation model through teaching-research, that is, a model oriented towards the development of capacities through authentic tasks and research linked to real social problems.

In this sense, it is a matter of promoting a virtuous circle between research and teaching for social innovation, facilitating organizational learning processes in terms of self-mutual/knowledge construction/decisions/actions. This means making information and experiences on a given topic (domain knowledge) available to different members (with different modes and time of access) and then developing shared decisions and implementing actions for change in processes with the participation of the same members.

This organizational connection between teaching and research constitutes the basic structure for developing an Environment that Enhances the Capacities for the development of the person in the community and whose characteristics are (i) define the opportunities of encounter (meeting places) to strengthen dialogue between teaching and research and the corresponding production of transformative and pertinent knowledge; (ii) support the development of youth enterprises (life projects) linked to the priorities of the local context; (iii) deepen the emancipatory knowledge, as a source of innovation and development of alternative forms of production, (iv) strengthen competence planning through active socio-constructive didactics in order to obtain an effective and successful evaluation for *"learning to learn"* in the UPS, (v) guide research as a driving force to promote social innovation and as a tool to improve self-realization in sustainable development in relation to the needs of the context.

Being able to be an *agent* of one's own life project, to *function* better when implementing it, and to develop the necessary *capacities* will give the individual the freedom of choice. Option implies choosing - by invention or selection - the paths among a number of possible combinations of form and function offered by the Ecosystem University - as long as the environment offers opportunities of organizational structure, financing mechanisms and access to knowledge, based on an environment that favors the production, transmission and appropriation of knowledge. Both form and function are implicit in the teaching-research network.

Traditionally, the definition of a strategy sets an objective and defines the means. However, when we speak of a life project, it is a mistake to track an objective that is in motion and therefore implies that the means also change. It requires flexibility in choosing the path to follow, because this is both a means and an end in the process of the education of the individual.

It is, therefore, fundamental for an environment to offer the possibility of being recursive when choosing, because the world is an open space, in constant movement and offers no room for pre-established stories or scripts. There are multiple possibilities of building paths and developing capacities. This environment has an attitudinal dimension, where determinism and freedom, thought and action, understanding and uncertainty, knowledge and ignorance, order and disorder, are contradictory and complementary.

In the midst of the constant hunt for the future of our lives, the liberating environment of which we speak offers the person the possibility to live and find a sense of commitment and action to the eternal present, which, unlike the future and the past, is in our hands.

Free and Common

The first part of this book has discussed the issue of the Common Good as a necessary biotope to produce biocenosis. Leaving the perspective of private or public law on the side, the approach to this topic evades the interference of the State or the market and generates a kind of environment in which the relations of exchange (economic or not) develop with relative autonomy. That is to say, the *commons* institutionalized by the community,[214] which acts and develops on the basis of a specific good on which it depends, is state- or privately owned; its value is one of use and not of property.

The use that the community makes of that good is a matter of social practices that can generate rights, independently of the State or the owner of the resource. In other words, it is an ontological issue because these social practices empower the *common being or communal being*.

It is the very *value of use and not the value of property* that enables *managing a commons* (Ostrom, 2008), since, if the use of a common good by a community produces a *subject,* this is not the *subject of the commons* in question because it does not pre-exist to such practice (Laval & Dardot, 2015). Hence, there is no opposition between the collective use of a common good and the domain or property of that good exercised by another actor.

The environment of which we speak has a material base in a resource of common use, which is free because it is not appropriable by the commoners from the perspective of the exercise of property but only from the perspective of its use. It is necessary to resort to the concept of management to link it with the concept of use to understand that it is not a matter of denying but of overcoming the subjectivity of the ownership of things.

When speaking of public economy, some people associate the term management directly with the government (Rousseau, 1985), which has executive power and must obey the will of the people. For others, management and government are opposed because government action is necessarily arbitrary and management must therefore be delegated to wise organs that regulate society (Enfantin & others, 1831).Thus, *management* will eventually be reduced to the relationship with two spheres - the execution of the general will, on the one hand, which implies command, and the rational management of production, on the other.

To solve this difficult situation, we must reflect on the purposes of management beyond the general will and the rationalization of production to lo-

214 Communality involves decision making often in search of balance and often in situations of crisis. Community implies a set of values already defined.

cate the value of the use of a particular good. That way the purposes are no longer only categorized by *poiesis* but turn *praxis*[215] also into an end in itself. In other words, we must accept the political scope of the community, which is the intrinsic deliberation of the ends and not only assume them *from above* (*to work under the orders of someone who represents the general will)* or *from outside, (to become a servant of productive rationalization).*

The *use* of what is inappropriable puts us in another environment, not only government and management but the active use that produces such participation that mobilizes a community that can create legal but not state norms. In terms of ownership, the inappropriable assumes a category of *praxis, managing the use of the commons*, since it is a matter of managing the good of common use and not of appropriating it[216].

If we then exclude the claims of ownership, the *management* and *use* of a commons will eventually be consubstantial.

We also need to clarify that the appropriation that we exclude derives from ownership and links a thing to one or several persons, but has nothing to do with the purpose or convenience between a thing and one or several persons. This differentiation opens the door to the possible existence of an appropriation of a common good that is derived from the *communal activity destined to appropriate it and provide the common good that is* inappropriable, i.e. an appropriation of social and non-natural nature.[217]

Once we understand that a thing can be collectively used without being private or state property, we must think about how that good can be sustainable and still be of collective use; and about how we can avoid predatory appropriation that undermines the social nature of which we speak? Elionor Ostrom (Ostrom, 2011) conducted an extensive study on the management of common goods and established the necessary characteristics to respond to the questions that we have raised.[218] As far as this part is concerned, we will

215 Aristotle defines: *productive action* (poiesis) focused on results and *practical action* (praxis) focused on means (Aristóteles et al., 1970).

216 Keeping the right proportions, this issue is something that the Catholic Church has been developing over the years, it is about safeguarding the collectivity of the common set of moral and material goods that no one should have dominion over.

217 The purpose of a thing depends on its natural properties, the appropriation by the natural purpose may include the property, but a social appropriation has more to do with the purpose of use (Laval & Dardot, 2015).

218 The biotope analogy was discussed in Part I of this book.

emphasize that we cannot ignore the *institutional dimension of the whole*, i.e. the relationship of *use* with the institution itself.

It is precisely at this point that we find what is instituted and what is institutional in the Ecosystem University, what is instituted as a result of the practices of community action, which *uses* a common good with the purpose of *instituting life*, and what is institutional as a logical function whose symbolism is constructed by the adherence of the subjects that identify with a place in it and therefore give it identity and legitimacy. [219]

The essence of the Liberating Environment of which we speak is the principle of the commons, which is not the result of an *abstract principle of solidarity*, which would work as much for a child's game as for an army engaged in a war, but a product of social interaction where communication plays an absolutely essential role. In the environment that enhances the development of individuals in community, the meaning of the commons is rooted in the *political aspect of the economy* and not in the *economic aspect of politics* and translates to the political sphere as the action on a resource of common use, no longer understood as *property* but as a *process of political institution of the commons*.

The common is a noun and not a qualifying adjective, it is a principle and not the characteristic of a thing, it is therefore beginning and end in itself. The action of the community is transversalized by this principle, it gives orders and governs it as far as political, economic and social decisions and action are concerned. Given that the *use* and *management* of the common good merge and together form the common action in relation to the good, the commons is a *political principle* not reserved for a few but open to the deliberation and the exercise of the judgment of the community.

If the commons is a political principle because it is *common action*, communication implies a *political economy of speech* and guarantees that the commons determines the institutional and not vice versa. In other words, the legal-political structure descends (top-down) to the bases because what first emerged is *the institution of the commons* (bottom-up) that conditions that structure; it is some sort of adjustments and correspondences in a continuous dynamic cycle.

219 Institutional creation is a manufacture or production insofar as the institution is an effect of the essence of the instituted, that is, the instituted does not invent the institution, but produces it from its essence. (Legendre, 1999).

The common action that constitutes the *commons* as a political principle is, at the same time, *action* and *obligation* - obligation because its strength lies in the practical commitment that links an individual to his community with which he agreed on the rules about his activity (obligation in a certain external way), and at the same time because the capacity to act makes him an agent of his own development (external obligation). The political implications of this principle are co-activity, co-obligation, co-operation and reciprocity.

Action in community enhances the development of the human being and at the same time makes things truly common, which is why we must abandon the concept of the commons as a thing or a legal commons that inevitably separates the thing from the activity. Interpreting the commons as an unbeatable principle that facilitates the use of common goods by an activity of sharing is the action that turns a common pool resource into commons.

The commons as a principle does not have to be instituted but recognized in a practical way. A culture that defines the rules of operation in a certain environment-space works better in a certain environment than another, it is also part of the development of capacities. It is the praxis that institutes through the *use-management* that appropriate conflicts and the way to overcome them.

The environment is liberating above all because it is a place where you experience, learn and produce values from living in community. The often federalist associativity generates both social and economic structures, but always understood in a liberating environment as a way of being, of relating, of responding to life. The human groups within the Ecosystem University are motivated by personal interests that are transformed into common interests of academic, pedagogical, and economic reciprocity.

The university redimensions and becomes an ecosystem on the basis of tangible coexistence of reciprocity, co-responsibility, redistribution and exchange, which make a common pool resource sustainable and promote the fundamental principle of the commons. The objective is to promote personal, professional, socioeconomic, local and regional development, carried out within a framework where collective action creates the environment that enhances both personal and collective capabilities. Based on the common good, this environment develops people's *capacities,* allowing them opportunities that contribute to the freedom of choice to function better when it comes to acting (functioning), [220] and to be an agent (agency) of action and change in their own decisions (Nussbaum & Sen, 2009, p. 31).

Managed as a resource of common use, (*cf*. Salgado Guerrero *et al*., 2019), the Ecosystem University ratifies the centrality of the person and promotes the enhancement of their capacities to develop their socially responsible life project. Education centered on the person, in an environment in which the person learns and is formed because of the experience of life in community, paves the way for forming honest citizens, who are free to reflect, and act and be architects of their continuous presence.

The *common action* of strong cognitive intensity, which identifies the university, is a universal and spontaneous operator of the commons (Hardt & Negri, 1979). This network knowledge affects the way in which the community understands the context and acts on it; this way knowledge becomes an inappropriable and uncontrollable resource.

To regulate use without becoming an owner is the clay pot that contains the treasure of the *commons* that as a principle is superior to the common pool resource that it regulates. It is the institution of the *commons* that guarantees the sustainability of the resource; again, beyond appropriation as ownership of an object, but in appropriation as a destiny that adapts something to a certain end: sustainability and shared self-sufficiency.

220 According to Sen, functionings are states of "being and doing", such as being well fed, having shelter, etc. and should be distinguished from the means used to achieve them (Amartya Sen, 2009).

Chapter 4

The Key to Heaven Lies in the Economy

Transforming the Person by Transforming Community Action

For Boff there are two basic ways of “being in the world”: work and care, if both are action in themselves, it could be understood as that it is the interdependent action with others that constitutes the subject, since according to him acting through work and care is the basis of “the process of construction of human reality” (Boff & Valverde, 2002). Care implies living with what surrounds man and establishes subject-subject links, and therefore avoids the subject-object reification of what surrounds him. No type of action – and, thus, transformation and creation (Francisco, 2015) - can be disengaged from the subject-matter bonds. Its meaning goes beyond the right because it is a social duty and goes even beyond the utilitarian concept because its place is in the dignity of the person, where the dimensions of life conjoin: *“creativity, projection of the future, development of capacities, exercise of values, communication with others, an attitude of adoration”* (Francisco, 2015) (John Paul II, 1986).

The actor is social, he IS in so far as he is a product of society and because his action has a social effect, that is, it produces society. Because of the dimension of social actor, sociology ceases to consider the *subject* (Touraine, 1965) as *subjected* to a structure and society to think of them as actors of social transformation. The objective of the balance between the individual and the communitarian is to eliminate extreme communitarianism that would eventually eliminate the subject but also to eliminate extreme individualism that renders all form of society impossible and, paradoxically, would also end interpersonal relations that are constitutive of individuality. For Foucault (M. Foucault, 2009, pp. 131-138) in the *Technologies of the Self,* the other is indispensable, that is, for the *technology* itself to become *me*, the other is indispensable. Foucault adds that the restlessness of oneself is only achieved through the presence and intervention of the other person.

This definition of *being-subject* becomes more evident in the pedagogical field, since the teacher does not impart knowledge to build the student but to ensure he can build himself and the student when passing on his experience of not knowing what he knows; together with the student he then walks the path of knowing that they do not know.

For knowing the true being it is necessary to *know oneself* and *care for oneself*, because knowledge modifies the subject (M. Foucault, 2009, p. 33). Since knowledge passes from being spontaneous to being reflexive, the discovery of reality is also the discovery of the subject's freedom; the essence of truth is freedom (Heidegger, 1949). For Foucault, knowledge is the object of a practice (Michel Foucault, 1997, p. 238), defined not from objectivity but from the subject and his action of *caring for himself*. Foucault marks a distance from the hedonistic vision of the cult of the self without reference to the other. For him, when the concern for oneself ceases to be the concern for the other, the subject ceases to be a subject and becomes the object of his own concern (Michel Foucault, 1997, p. 177), the self becomes an object, it reifies itself and reifies others.

We act in community and we are the product and producers of society, which is why the Common Good is not a given reality, but the result of the action of exchange and of a political action. That is to say, it is not a quality of an existing reality but a socio-political construction, the result of a correlation of forces that define it. What defines the subject is *being an actor*, as Foucault would say: "it is the effort of transformation of a lived reality into free action" (Michel Foucault, 1997, p. 23).

"The subject is the desire of the individual to be an actor, subjectivation is the desire of individuation" (Touraine & Pons, 1997, p. 78), which has always supposed a social process (Touraine & Gregorio, 1997). To be an actor of one's existence implies associating the political subject with the personal subject, because the subject is constructed on three levels according to Touraine: "(i) the reflection on existence and individuality as a reason for being, (ii) the recognition of the other, (iii) the construction of society based on the guarantee of the right to be subjects" (Touraine et al., 2002, p. 189).

The individual is as much as the community to which he belongs. Touraine describes as subject the individual's effort to be an actor, to act in his environment and create his own individuation (Touraine & Pons, 1997). For him, subject and actor are inseparable notions, although he foresees a risk in today's society: on identifying the action with the results of his works, the actor would dis-identify himself as a subject,[221] since it is not the works that make him a subject but the fact of acting.

The subject transforms the environment with his action, but it is the community action which transforms the subject; human beings are the product and producers of society; we act to transform reality and this transforms us anthropologically. Involved in a creative and self-productive activity, we produce ourselves by the praxis and our sociality produces us as social individuals (Marx, 2004). The question is: To what extent are individuals producing the social changes that later condition them? Or is it that today people are becoming less free to act and intervene in the production of society, and are increasingly dependent on economic forces that fail to govern politically?

It is important to emphasize that it is not about advocating historical materialism, since *one cannot deny the reality that cannot be explained from the material point of view*, but rather to get out of the schizophrenia of living in one way and thinking in another. It is about assuming that we are a product of what surrounds us and that, at the same time, we can act and therefore transform what surrounds us, besides the fact that today that action can be enlightened by a new ecosystemic, transpersonal and intuitive thought.

It is impossible to exclude political, social and economic action when speaking of the subject and its subjectivity. Rather, we must ask ourselves: To what extent is that action linked to the Common Good and respectful of individuality? To what extent are economic or socio-political forces ultimately defining the "good"? To what extent is the separation of the economic and social from the institution of the commons acceptable? If the praxis of rational politics[222] could

221 It is worth noting that this action is an end in itself since by identifying the action with the results, that is with the plays, the actor would be de-identified as a subject (Touraine, 1993).

222 Habermas's position on the separation of the economic and the commons 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 cause consensus, the communicative action of the collective resources is based on modes of communication-exchange that implies a political economy of the word, a communicational model that privileges the exchange, which recognizes that the word is not an inno-

not be confused with production and exchange, to what extent is the condition of the commons, [223] shared and participated, a political guarantee for the good? Is it possible to transform people by transforming social practices?

The principle of the Common Good, or rather of the *commons*, is a school in itself. It is not enough that political, social and economic action promote the *commons,* but that the *commons* becomes political, social and economic action. Political and economic action is social action in itself, and therefore, psychic facts, facts that imply transformation in the way of seeing, thinking and acting reality will create a new attitude and thought and therefore practical and life forms. The human being is transformed through practice, through which it can acquire a more human condition of social, aesthetic, intellectual, moral and material life.

Therefore it is necessary to reconcile the economy with the most deeply human, something like calling the economy[224] sister as a metaphor for Saint Francis and the wolf.

The Key to Heaven Lies in the Common Good and in Communal Action

Social action is as social as it is economic and political, because it depends on the political sense of the economic objectives that are subjectively understood by the social actors. Weber (Weber, 2014) states that the relationship between economy and society depends on the nature of the objectives that can be:

- Group with primary economic interests (Wirtschaftsgemeinschaft), which involves covering needs or profit.

cuous act but an exercise of the synergies produced by an exchange of knowledge and the construction of values that transcend the “control ethics” and the “programmed organization”, even is beyond the intermediated negotiation between individual and corporative interests (Habermas, 1981).

223 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 public common of the Athenian democracy and res publica romana, but from the use of a determined good on which we all depend indistinctly on whoever exercises their property.

224 Aselle, M & Piccaluga, A. (2020). Sorella economia. Edizione Porziuncola. Italia.

- Groups with secondary economic interests (wirtschaftende Gemeinschaft), using economic practice as a means to obtain other types of results that are related to the objectives of the community.
- The actions of the community produce a combination of economic and non-economic effects within the community.
- None of the above.

The diversity in the chaos permits the emergence of the political dimension of the socio-economic reality since in today's society the boundaries between the first two cases raised by Weber are hardly noticeable. In this sense, all communities seeking to meet needs employ economic praxis when it is indispensable and depends on the correlation of needs and goods. At first sight, there seems to be a difference in: whether a community action arises to cover a need by responding to the economic aspect, or whether they are pursued for other purposes simply because they clash with the specific economic fact and restrict economic practice. However, in practice there is a clear distinction insofar as the community action has characteristics that remain the same when abstracting the specific economic fact.

In the Ecosystem University, *institutionality* is the *purpose-outcome* and *autonomy* is the *purpose-objective*, and action is endowed with *critical reason* (understood as sense, justification, questioning) and *instrumental reason*. The Ecosystem University can be determined by economic causes regarding its structure and development, just as it can be constituted from the angle of relevancy and by means of economic practice. Under this logic, action is poiesis and praxis[225] because the subject exists once it acts, and actions are driven by a specific end.

On the one hand, the purist perspective of the group that has primary economic interests is guided by satisfying the needs through productive results. This perspective starts from the assumption of unlimited needs. On the other hand, the purist vision of the economic group can presuppose that the good of common use is unlimited. However, neither of the two presupposi-

225 According to Aristotle (Aristotle et al., 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 a sense of institution (from not being to being) (Crespo Güemes, 2007), and praxis is defined by the objective of this purpose, i.e. autonomy. The community is both things because institutionality is its finality-delivery and autonomy its finality-objective.

tions is right. Therefore, we need to find a dialogical and non-dualistic balance to guarantee good individual performance and development that eventually leads to good communal performance and development.[226]

Historically, economic considerations have played an important role for obstructing of facilitating community-building. Ideology is not persuasive enough to build communities, whereas economic interests may foster community action in multiple ways. This raises the question to what extent the *logics of capital* have modified human behavior and to what extent *acting economically* has transformed the logics of capital.

Acting economically is the result of an experience and therefore of the knowledge produced by this very experience.[227] In other words, it is the result of the rationalization of a previous action –discerning opportunities, options and possibilities - that produces a new action.[228] *Practical action* articulates *scientific know-how of the economic activity* and *economic acting* (applying this know-how) creates the basis for developing *economic science*.

It is important to note that economy, society, and politics are science and action at the same time. This means that the *knowledge on acting economically* (economic science) feeds on the results and rationalization derived from acting economically. Provided that all human action is free, the science of which we speak is therefore not necessarily exact.

There is a mutual relationship[229] between *economic know-how* and *knowing how to act economically*. Although the first alludes to science and the second to politics, all economic activity needs a *political* balance between scientific knowledge and economic action. Favoring one over the other can produce *dogmatic science* or *ideological economic practices*. The danger is that we turn economics into an applied technique and not see it as an interdepen-

226 Schumpeter shows that economic thinking can become confused when it ignores the abyss by conceiving that maximum yield is incompatible with maximum profit and proves that the latter implies the former (Joseph Alois Schumpeter et al., 1971).

227 Experience has to do with the thoughtful experience with which knowledge and rationality are generated (Erfahren), rather than with lived experience (Erleben) (Weber, 2014).

228 Aristotle calls it practical rationality, because it is not based on proposals but on programs and decisions of a logistic order, this "logistikon" assesses and rationalizes the action (Aristotle et al., 1970).

229 The know-how of economic activity draws upon the rationalized results of the economic acting and the latter is based on developments of the economic resulting from science as skills of economic activity.

dent social and political science. By way of paraphrasing Latouche, we could say that to believe that everything is economics might in practice abolish economics (Latouche, 2001).

The common good is the result of action and as we said before, we must understand the difference between practical action (*praxis*) and productive action (*poiesis).* As for praxis, the subject's intention is fundamental, while for poiesis, the intentionality of the result or product is independent of the subject, although in reality, the subject is one and indivisible. If we submit the capacity of action to a merely instrumental logic of economic science, it would also affect the political and social dimension. In other words, the *political government of the economy would be changed to the economic government of politics*, by which political action would no longer be a *praxis-ethics*[230] but become a productive technique subject to its ends. This also has social consequences that are evidenced by its own weight: submit the economic action of the community[231] to the logics of the result or product.

On the other hand, making all ends absolute and subject to economic action, subordinates the economy to the market, which would then wrongly acquire an ethical condition. In a society *of* the market and not *with* the market, the needs, their satisfaction and the appropriation[232] become infinite; failure to understand that the goods are limited then leads to the tragedy of the commons;[233] eventually the anthropological transformation of the human being to a *homo oeconomicus* (Sanchez Parga, 2013b) reduces his action to buying from others as cheaply as possible and selling as dearly as possible.

230 For Aristotle, politics consisted of a praxis-ethics made up of the political perfection of the citizen and the happiness of the polis, but since the Renaissance and the respective emergence of the cycle of politics and the State of the development of political forces and institutional powers, politics has become a technical-productive action defined by its results and works rather than by the intentions of the subjects (Aristotle et al., 1970).

231 Communality involves decision making often in search of balance and often in crisis. Community implies a set of previously defined values.

232 For Ostrom, the problems of the management of the commons are characterized by collective action and, therefore, by the problems related to appropriation and provision of the Common Good (E Ostrom, 2008).

233 La *Tragedy of the Commons* is an essay by Garrett Hardin, which describes how in the absence of regulation, each individual will have a tendency to exploit the commons to his/her own advantage and independently but rationally destroy a limited shared resource, and eventually themselves (Hardin, 1968).

This complementary relationship between *economic know-how* and *knowing how to act economically* is possible when we distinguish and combine the *rationality of ends (Zweckrationalität)* and the *rationality of values (Wertrationalität)* (Weber, 2002); a society that is governed not by a *rationalistic* but *reasonable* logic for the life of the commoners.

Regarding the balance between economy, society and politics, Karl Polanyi (K. Polanyi & others, 1957) states that *"the economic system is a mere function of social organization; under market capitalism, the economy is not embedded in social relations, but social relations are embedded in the economic system"* (K. Polanyi & others, 1957). One should probably look out not for an articulation of the modes of production (Wolpe, 1980), but for a complex combination of relations and diversity of production in the capitalist periphery. This coincides with the approach of Ostrom (Elinor Ostrom, 2011) regarding the *commons,*[234] according to which the socio-political ability to develop the rules and institutional diversity will translate into the adaptation of the members of the community to the different conditions of production. For Ostrom the commons translates into institutions such as the university that permit a management according to the rules of several levels that are established by the same *appropriators-providers* of the system. It involves neither the need to privatize the commons in a framework of property rights nor to resort to nationalization to force individuals to obey public interests.

Ostrom shows that there are forms of socio-economic activity and production that depend on communities whose political economy has been unable to account for them. In a way, the paradigm of the commons exists in parallel with 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.

While it is not may intention to make Ostrom's approach a general principle for reorganizing society, it certainly breaks with some precepts of neoclassical *mainstream* economy[235] by showing that the commons requires voluntary participation, synergies built on close social ties, a system intercon-

234 It is worth emphasizing the variant of the term commons instead of common good, the literal translation into Spanish makes one lose the essence of the term which is rather close to: a tangible good of common use.

235 *mainstream* meaning established or dominant

nected by exchange-based communication and clear rules based on strong relationships of reciprocity. [236] In the words of Polanyi (K. Polanyi, 2001), this is a counter-movement. The construction of the commons evolves without discrediting or underestimating the quality or the rationality of the market; on the contrary, it absorbs and dialogues with them within its community.

There can be no doubt that we must overcome the naturalistic limits of Ostrom's analysis to conceive goods of different characteristics, the *new commons*[237] - such as the university - to give new meaning to the concepts of the *commons, cognitive activities, means of knowledge production*, that are somewhat different from the management of natural resources called CPR.[238] We therefore need to abandon the limiting sociological or economic postulates that presuppose that the commons is born of social life (Proudhon, 1865) or the argument raised in *Capital* (Marx, 2007, pp. 1857-1858). We must find the types of practices that organize the institutions, a definition of the commons that takes into account people's creativity but also works when putting it into practice; a model that does not exclude the social from the collective practices and the economic from the political struggles, that articulates the social, economic and political as sources of institution and law, i.e. find a path for instituting the commons.

It is also important to rethink the *use value*[239] of a resource subordinated to that of property. There will not be an *eternal predominance* (K. Polanyi

236 Meaning ecosystemic. Cf. Part I.

237 This expression refers to common goods beyond natural goods and knowledge communities (Hess & Ostrom, 2007).

238 Common Pool Resource (Ostrom)

239 St. John Paul II in his encyclical Laboris excernis explains the principle of property, subordinating it to the right of common use, as follows: "The above-mentioned principle, as recalled then and as it is still taught by the Church, is radically different from the program of collectivism, proclaimed by Marxism and realized in various countries of the world in the decades following the epoch of Leo XIII's encyclical. Such a principle differs at the same time from the program of capitalism, practiced by liberalism and by the political systems, which refer to it. In this second case, the difference consists in the way of understanding the right to property itself. The Christian tradition has never sustained this right as absolute and untouchable. On the contrary, it has always understood it in the broader context of the common right of all to use the goods of all creation: the right to private property as subordinate to the right to common use, to the universal destination of goods (John Paul II, 1986).
To consider them in isolation as a set of separate properties in order to counterbalance them in the form of "capital" with "labor", and even more to carry out the exploitation of labor, is contrary to the very nature of these means and their possession. They cannot be

et al., 1977) of the market, which will facilitate forms of social organization beyond market logics. Polanyi argues that we need to mark distance with the obsessive notions centered on all things economic and understand that these reflect *"conditions tied to an epoch"*, as, otherwise, we would not be able to find *"the solution to comprehensive problems, and not even be able to adjust the economy to new social environments"* (K. Polanyi et al., 1977).

To value the capacity of human action to act economically means to build an economy that is centered on the human being. We must not produce more but aim to produce to be able to live well and give priority to sufficiency rather than capital accumulation or economic growth, [240] i.e. to what is necessary rather than to commercial efficiency that leads to uncontrolled competition. It is necessary to find strategies to empower communities vis-a-vis their economies (Schuldt, 1997).

Relationships of co-responsibility, reciprocity and redistribution are non-monetary production strategies that encourage two dimensions: (i) free democratic participation based on the common action and not the simple representation, which delegates what cannot be delegated: the rights of the citizen, and (ii) the production of *the common* as the purpose to which all action is directed. For Bourdieu and Wacquant these strategies correspond to *social capital,* i.e. *"the aggregate of the actual or potential resources of an indi-*

possessed against labor, they cannot even be possessed to possess, because the only legitimate title to their possession - whether in the form of private property, or in that of public or collective property - is that they serve labor; consequently, by serving labor, they make possible the realization of the first principle of that order, which is the universal destination of goods and the right to their common use.

One can speak of socialization only when the subjectivity of society is assured, that is, when every person, based on his own work, has full title to consider himself at the same time "co-owner" of that kind of great workshop in which he commits himself to everyone. One way to achieve this goal could be to associate, as far as possible, labor with the ownership of capital and to give life to a rich range of intermediate bodies with economic, social, cultural purposes: bodies that enjoy effective autonomy with respect to public authorities, that pursue their specific objectives by maintaining relationships of loyal and mutual collaboration, with subordination to the demands of the common good, and that offer the form and nature of living communities; that is, that the respective members be considered and treated as persons and be encouraged to take an active part in the life of these communities" (John Paul II & Caffarra, 1981).

240 Sen is adamant that economic growth is not only a means to an end, but also that for certain important purposes it is not an efficient means (Stiglitz et al., 2010). In other words, it is possible to grow and not achieve development (Max-Neef, 2011).

vidual or group which are linked to possession of a durable network of more or less institutionalized relationships of mutual acquaintance and recognition—or in other words, the aggregate of capital and power that such network can mobilize (Bourdieu et al., 1995, p. 82).

According to Acosta (Acosta, 2012), reciprocity and redistribution produce a kind of *self-centering of endogenous productive forces,* which includes human capacities and productive resources, and the corresponding control of accumulation and centering of consumption patterns. In other words, in non-monetary production strategies, reciprocity occurs at the level of production and redistribution at the level of consumption, and these are always complementary.

Redistribution means social control by the community to avoid the social differentiation in its interior and to strengthen the equity that social justice entails. The reciprocity could be *"the new name of the social capital, en route to a dimension of human value that answers to the reification that implies the concept of social capital"* (F. Salgado, 2019).

It is clear that the heaven of which we speak is not in itself the Common Good, because a person's transcendence cannot be reduced to a concept. However, it is the very action in community and for the common good that liberates and enables the person to savor that heaven of transcendence. It is no longer a matter of a *duty to be good* fighting against everything that perverts, but of changing the perverse logics so that the will is guided by kindness. It is about freeing oneself from the schizophrenia of *wanting to be* something that the system prevents, in order to change the system, even if it sounds like a utopia, and to be able to *practice the being*.

This perspective avoids that capital will *wantonly* appropriate social development or the general intellect (Marx, 2007). We must bear in mind that capital is an *inherent contradiction* (Marx, 2007). While work is a means of emancipation, the mere accumulation of wealth produces total domination of work. It is necessary to escape the dialectic of these two characteristics to understand their dialogical complementariness for the objectives of the common good. In this case, the principle of the *commons* regulates and avoids the polarization that produces contradictions.

Based on the principle of the commons, work acquires a social dimension. The point is to transcend the *commons* of capital to transcend the *commons* of work. If sustainability, self-sufficiency and the common good are the principle that determines the community, the meaning of work lies above all in the dignity of the person (Francisco, 2015) (John Paul II & Caffarra, 1981). Work is a space of freedom, of personal development and of support that may not aim at accumulating unlimited wealth, but at a dignified life; the development of the other community members offers the chance to develop the individual commoner.[241]

The Ecosystem University that we envisage - composed of a Liberating Environment that promotes human development and based on the principle of the commons - preserves the capacity to give critical sense (direction and raison d'être) to what surrounds it and, therefore, to respond to the demands of society without being subordinated to mere instrumental reason. The inherent dilemma is not how to adapt work to the market, but rather how the development of people committed to a socially responsible life project can be compatible with the production of knowledge that transforms society, which also responds to social demands and illuminates how the university acts.

Community members are not forced to work but, on the contrary, they feel a self-obligation towards others. This obligation is not moralistic because it does not come from the *duty to be* but from the interest and the common need to sustain the common pool resource of which we are all a part. Creativity, fraternal bonds, tacit rules of mutual help and, above all, non-commercial strategies of access to work, will emerge when there is no absolute obligation – all of this obviously within the bureaucratic framework and general imperatives that the organization has to battle with. As its name explains, the social organization of work relates the concept of organization to that of work. It attaches much greater value to the *living organization*[242] than the concept of administration.

241 A popular folk tale provides the following parable as an explanation for cross-pollination: *"There was a farmer who had the best crop of corn that would win him the first prize in the village fair year after year. And yet, each time he would bring one quintal of the most select of his crop to share with all other participants; someone eventually asked: "How can you pass on your best seeds to your competitors? Don't you fear that they might outperform you?" Replied the farmer: "Don't you understand that the bees that pollinate their plants will also pollinate mine?"* According to FAO, cross-pollination is the transport of pollen from one plant to another, generally carried out by insects and directly affecting the quantity and quality of the crop (FAO, 2005).

242 To approach the Theory of Organization from a non-positivist paradigm of science we turn to Morín, since the paradigm of complexity offers a broader view. Morín resorts to the concept of organization to explain the systemic conception; for him, system is a "global unit constituted from interrelated elements whose interpretation constitutes an organization...

Similarly to what happens in the economic field, where economic science has been instrumentalized, making it exact and leaving aside political and social *economic action*, the Theory of Organization has moved from responding to a social system, to being a rationalization of how to act organizationally. Concentrating their efforts on building a discipline on the model of positive science, Organizational theorists have created a science that, instead of coming from *organizational know-how*, has become the result of the efficient *maximization of the machine system.*

The challenge is to recover the sense (understood as meaning and direction) of work and not to submit it to the commercial logics and recover its social, moral and cultural values; to recuperate the supremacy of the person over capital, and that of society over the market, not by negating them but by starting from cultural sustainability and the communal qualities of *being* rather than *having.*

The *personal dimension in the social aspect* of work will have a bearing on the sense of appropriation by using common good,[243] regardless of who rules the private or public domain, reinforces the sense of appropriation-provision and therefore, the sense of the common that *"in form of a concrete cooperation in freely formed groups, is certainly one of the ways to follow to counteract the effects of hierarchical domination in work and social life, and permit that everyone develops in the framework of a true collective work... they must participate in the elaboration of rules and in the decisions that affect them"* (Laval & Dardot, 2015).

The ethics of care implies a community characterized by a subject-subject relationship, which models the mechanisms of appropriation while promoting provision expressed in work by dignifying the forms of production and its social organization. In this sense, the communal-university complex emerges from the action of the commoners characterized by this logic that focuses on the sustainability of the common pool resource.

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it is a combination of different elements that are in interdependence... it is not identified with the phenomenal object, it is projected on it" (Edgar Morin, 1974).

243 "But it must be emphasized here that, in general, the working man wants not only due remuneration for his work, but also to be taken into consideration, that as part of the production process he wants to fell that even while working on common property, is working 'on something of his own.'" (John Paul II & Caffarra, 1981).

The Heavenly Dimension of the Common Enterprise

As we said before, the principle of the *commons* regulates the logics of how the community and the institutions develop, and also applies beyond the exercise of ownership and the use of a specific good.

We must understand how the *commons,* which also results from the management of a common pool resource, influences the fact that the *common enterprise* is a communal institution and not necessarily a refuge of shareholder autarchy. Regarding the common enterprise, we must reconcile some aspects since in our globally phenomenologically and also epistemologically structured world, any democratic action immediately clashes with the domination of capital over what is considered to be exclusive property.[244]

The key lies in the social dimension, which offers the principle of the *communality* to work, since the company does not only legally exist but is *instituted* by a collective that has an impact on a common pool resource whose purpose is not only to share and take advantage of the economic results, but the use in itself as a development potential for the members of the institution-community.

The company as *action of the community* belongs to no-one, cooperation and knowledge produced by the community cannot be translated into capital for the benefit of anyone. The communal action flows freely, it is an end in itself and its objective is the development of the individual interests that benefit the common ones. What counts are the means that are put to common use and are the result of communal action.

This is why we must not be afraid to call the university a common enterprise. After all, it is capable of combining the two purposes in support of the Common Good: It produces and reproduces society, and - through reciprocity – it produces much more than financial value, and any surplus will be reinvested in the very purposes of the university.

The common enterprise of the Ecosystem University that we envisage is understood as a reality that defies particular interests or the sole principle of profit-making. Therefore, we must understand the common interest that comes from the concrete management of a common good and is the basis of

244 Auroux: "the citizens in the city, the workers must also be the same in their company" (Auroux, 1981).

an environment that promotes development based on the principle of the common. If the superior value is the Common Good, we are talking about de-commercializing the enterprise, in other words, institutionalizing what is instituted by the non-commercial logics of the social dimension of dignified work.

We must also make it clear that it can certainly not be our aim to develop a kind of *capitalist democracy* by extrapolating representative democracy, not because that would be a contradiction, but because the principle of the common transcends representative democracy and builds on democratic action, i.e. permanent participation in co-responsibility of the good, reciprocity in exchanges and redistribution as an exercise of social control. Nor is it a question of workers' control over production, since Community action not only has economic effects within the institution but also on the society that receives it.

The search for a practical response for the common enterprise involves:

- Perceiving the common enterprise as a result of what is instituted by the common, that is to say, not only collecting the best from the capitalists and the workers but also going beyond that in establishing the mechanisms for managing the common good.
- Not suppressing the market and trying to replace it with a planning and distribution body, because without a market there will be nothing to distribute or plan. It is a matter of recovering the freedom to choose individually in a collective framework, i.e. recovering the social aspect of the market.
- Placing the social value of work before financial gains, without denying the two realities but demarcating the common enterprise of the systems of domination of money over action.
- Incorporating the dissipative dimension[245] of production, that is, the fact that the common enterprise is the producer of society and the product of society at all levels, including the economic level. This will help incorporating society to some extent into the decisions of the common enterprise and not to set consumers against workers but build relations of a new shared civic dimension both within and outside the common enterprise, that is, a bridge between self-government of producers and the freedom of consumers. The production of the common enterprise integrates consumers into social action, the construction of results and the feedback of the context. We need to reintegrate the

245 Part I of this book addresses the concept of dissipative systems.

economy into social life and into society, the plurality of points of view and their impact on the rules that have been established.

- It must be clear that the point is not to change global paradigms that influence companies top-down, but that we must create the awareness of the *common* that comes from the *management of a common pool resource* and that as free option facilitates an endless number of common goods that as any innovation process will gradually start swarming (Joseph A Schumpeter, 1963) from the bottom up.
- That work recovers its dignifying role.
- That above all there is the socially responsible life project of each person, an objective that is valued and promoted in community, whose intangible value transcends all material reality and amalgamates the *communal complex* even though it rests on the paradigm of the tangible management of the commons, and amalgamate the *communal complex*.

Chapter 5

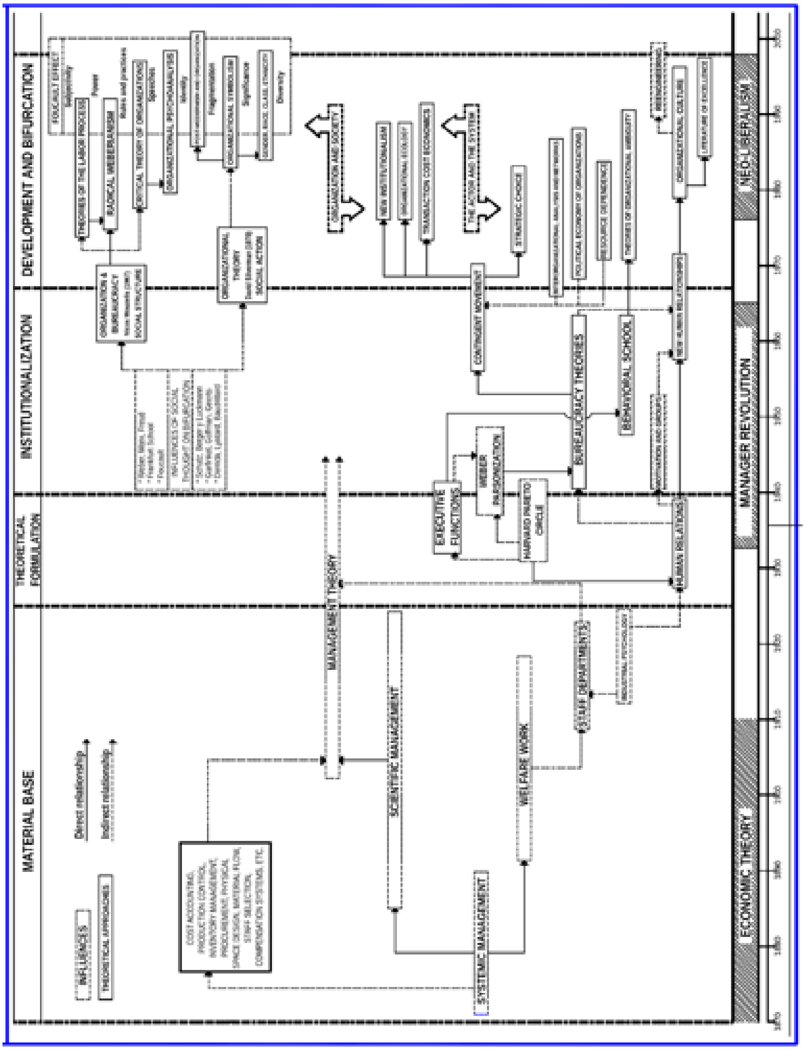
From the Instrumentalization of the Organization to Organizational Know-How

Throughout history a wide range of problematizations have stimulated the research on the Theory of Organization; all of these have been strongly influenced by the socio-economic and cultural changes of each era (Hirschman, 1983), as well as the relationship between the theory of organization and economic theory. Ibarra (E. I. Ibarra Colado, 1999) makes a historical *conceptual map* (Figure 42), which shows the notion of the theory of organization in the field of knowledge. The different approaches of the discipline give an account of the constant dilemmas between *rationalization and power* to which the theory of organization has been subjected throughout time.

For Ibarra, the first stage can be dated between the years 1870 and 1925, when the problems of the organizations were related to the emergence of the modern enterprise and the professionalization of administration, which is why he linked the theories to the socio-economic needs of the organization. Ibarra explains the influence of Fordism and Taylorism on these theories as modes of production and consumption. Company problems evolved around internal efficiency and productivity, the *invisible hand,*[246] which self-regulated the economy would benefit the best cost-benefit balance (F. W. Taylor, 1981); accelerated growth of markets, competition and technology generated a certain commotion that industry management had to deal with.

246 In her book "Governing the Commons," Ostrom criticizes Smith for failing to take into account that in a changing and complex context, the decision between exploiting or sustaining the pasture (this would be the worst case scenario in the game of the Prisoner's Dilemma (Luce & Raiffa, 1957)), which depends considerably on the discount rate 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 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. (Elinor Ostrom, 2011).

Figure 42
Organizational knowledge, stages, approaches and dilemmas



Source: (E. I. Ibarra Colado, 1999)

The industries established regulations and organizational principles and then organized themselves internally through functional departments and divisions of labor (Owen, 1993). In fact, that epoch saw the first appearance of accounting and costs systems, [247] production control, inventories, personnel and other administrative principles (Litterer, 1986).

At the end of this first period as defined Ibarra, intensive technical and organizational improvements closed a first cycle of rationalization of administration (Thompson, 1914) that eventually established the notion of work and production control. This period also saw the emergence of the first planning and standardization units (F. W. Taylor, 1911). On the other hand, increasing workers' resistance to production conditions resulted in *labor welfare*[248] schemes as an attempt to regulate labor relations through benefits such as: industrial safety plans, personnel departments, welfare policies and profit sharing (E. I. Ibarra Colado, 1999).

The second stage, which Ibarra referred to as *pre-institutional organization*, encompasses the 1927-1939 period, and is characterized by the continuity and deepening of solutions for social problems associated with production and human behavior at work. It led to the *human relations* movement (L. W. Porter, 1995) that applied changes in industrial communities and studied work-related specific effects (Warner, 1963).

This is when *informal social organization* assumes importance in opposition to the explanations developed before regarding the causes of performance. [249] The organization begins to be considered as a social system that seeks to be in balance (Roethlisberger & Dickson, 2003), and two organizational objectives emerge, which in turn produce two subsystems:

247 The cost-benefit rationalization vocation of the time has its maximum expression in accounting as a set of techniques that would allow to record, calculate and project the aspects of the operation of the organizations. Such information, in turn, would allow the planning and evaluation processes.

248 Theories about labor welfare emerge together with labor psychology. Techniques and programs begin to be designed in order to manage and constitute the identities of people with respect to discipline and work practices, which facilitates achieving consensus for the organization.

249 This period addresses the problems of economic and political instability derived from the 1929 crisis caused by the collapse of the New York stock exchange, which led to a prolonged period of deflation and the collapse of the international payments system. Critics see the causes in factors such as overproduction, monetary disorder and unequal and relative economic recovery (Silva, 2017).

- The *formal organization,* which manufactures a product with the help of technology and efficiency, understands the rules, norms and policies that define the expected behavior in the company.
- The *informal organization,* which seeks to keep people satisfied at an emotional level by introducing human elements and managing of interpersonal relations.

With respect to the social organization, Henderson (Henderson, 1937) a physician and biochemist, while studying blood chemistry, added the concepts of *balance*, *regulation* and *homeostasis* based on the sociological writings of Pareto,[250] which analyzes society as a system of interacting particles. That comparison was later used by Henderson, who drew analogies of the human body in his work on society, thus introducing the *organic* analogy little by little to analyze the concept of *organization.*

The concept of *system* is one of the most relevant contributions of this era, as it allows to conjugate different realities assuming that there are universal principles for the organization. However, the concept of *balance* (as it was understood until then) marks an exclusionary point of view; it seeks to solve the problems of the organization understanding them as imbalances or internal misalignments of a *social enterprise machine* (Burns & Stalker, 1961); therefore, the sense of control is reinforced from the logics of articulation between material components considering its operation.

Going back to Ibarra's conception, the third stage he describes, consolidates the academic vision of the Theory of Organization and unites the academic community with similar theoretical concerns and a common or compatible paradigmatic vision; this stage is associated with Weber (Weber, 2014). Parsons later only collects the aspects of Weber's work that are of interest to him and introduces them in the United States, strongly influencing the Theory of Organization[251] in this stage.

250 Pareto proposes 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, 1974).

251 Parsons makes an interpretation of Weber in his work The Structure of Social Action (Parsons, 1968), then makes a translation of The Protestant Ethic and the Spirit of Capitalism (Weber, 2002), as well as the translation of the first part of Economy and Society with the title The Theory of Social and Economic Organization (Weber, 2009), none of which is exempt from criticism.

For Ibarra, Parsons' mediation deforms Weber's approaches because based on Parsons' interpretation of the *ideal type,* the organization theorists did not understand that for Weber the *ideal type*[252] was a methodological resource to recognize tendencies and establish hypotheses to explain certain historical realities, but not the reality itself or a model that could be achieved. Parsons, however, also introduces the idea of a difference between *power* (Parsons, 1968, pp. 58-60) and *authority* (Parsons, 1968, p. 152). Ibarra establishes that for Parsons the Weberian concept of *domination (Herrschaft)* was equivalent to the concept of *authority,* and that *power* could be regarded as a degenerated or immature form of authority (E. I. Ibarra Colado, 1999).

Since then, authority would be considered to be a right to influence the behavior of individuals in order to meet cooperative purposes, as power and authority were synthesized *"in a new formulation that reaffirms the centrality of the concepts of authority, cooperation and force"* (E. I. Ibarra Colado, 1999).

In the same Parsonian line of *structural-functionalism* (Parsons, 1968), arises the *contingent movement* (Donaldson, 2001); it aims for relations that permit us to understand the impact that *the context* can cause on the *structure* and the *operation* of the organization to make it more effective, but staying within a framework of positivist scientific rationalization. This movement gained space as the center of the institutional development of Organizational Theory because of the promise of giving it "disciplinary identity and legitimacy." Yet, two different approaches have gained momentum that also contribute to the institutionalization of Organizational Theory.

The first input has been made by the school of *Administrative Behavior* (Herbert A Simon, 1978) (Hickson, 1995) which proposes that organizations are decision-making structures based on a model that combines the *subjective rationality of the decision-maker and the objective rationality of the organization* (Herbert Alexander Simon & Ros, 1964). Although this vision is broader, its purpose is that the two rationalities coincide, once again superimposing the ends to the organizational community. This has produced a series of

252 The Ideal Type is a methodological resource created by Max Weber, used in sociology to study the essential features of certain social phenomena. Examples of the ideal type are: authority, power, feudalism, Protestant ethics. "An ideal type is formed by the one-dimensional accentuation of one or more points of view and by the amount of synthesis of diffuse concrete phenomena (...) which are placed according to these unilaterally emphasized points of view in a unified analytical construction (...) such a mental construction (...) purely conceptual, cannot be found empirically in reality" (Weber, 2014).

proposals regarding systems, procedures and policies (Crozier et al., 1990) to influence the behavior of the decision maker and ensure operational ability of authority (and power).

As we can see, there is continuous duality between the *satisfaction of the needs of individuals and the structure of the organization* (Argyris et al., 1964). Structures are considered rigid and therefore do not allow for the development of individuals (Bennis, 1967). This has led to new approaches to the *new human relations* (L. W. Porter, 1996) (L. W. Porter, 1995) that seek to resume the study of the problems of human behavior at the work place and include types of input that are not purely economic, such as participation in the decision-making processes, proper communication, redesign of work and adaptation of the production lines, etc.

In addition to this duality, both the second and the third stages have been marked by the *managerial revolution* (Burnham & Sánchez, 1967) (Berle & Means, 1991), based on the consideration that enterprise decisions passed from owners to managers. This premise conditions the Theory of Organization and justify:

- The entrepreneurial vocation of company leaders who reject state intervention or the participation of lower hierarchies in the same enterprise.
- The tension between business corporatism and economic liberalism (Ibarra, 1994).
- Top management strategic planning to curb market distortions (Chandler, 1988).
- Promoting neo-liberalism or neo-individualism as a predominant government reason for making changes in the institutions of our society and forms of organization, as opposed to "government excesses" that inhibit individual initiative and limit social intervention (Michel Foucault, 1991) (Michel Foucault, 1982).

Despite the theoretical ambiguity, two clear lines have appeared: one, the consequences of instrumental rationality and bureaucratization as alienation and dehumanization of work and, two, the relationship between personality and organization that seeks to analyze how bureaucratic rules enable the introjection of thought and action, and favors depersonalized and dehumanized behavior (Pauchant, 1995).

In the last part of the 20 th century the so-called *Foucault effect*[253] seems to have converged the relations of meaning and the production relations in a kind of space that simultaneously produces material and symbolic relations between diverse social agents dependent on a defined structure.

Because of the conception of relations between *ethics* and *know-how*, and between *discipline* and *power, s*ome have established a proximity between Weber and Foucault (Dreyfus et al., 1968); others, however, maintain that Foucault liberated Weber from interpretation of Parson (E. Ibarra Colado, 1993). What seems to be clear is that, for Weber human life takes place in an iron cage of bureaucracy, while Foucault places the cage inside the institutional network of imprisonment (Burrell, 1988).

It is essential that we rebuild the organization in another way, possibly *returning to the future,* rediscovering the nature of the human condition (Francisco, 2015), renewing our practices of freedom, rethinking our lifestyles so as not to submissively fall into *"the kind of individuality that has been imposed on us"* (Michel Foucault, 1988).

Finally, providing scientific rigor to the Theory of Organization implies introducing logical or empirical procedures in its study that promote the improvement of its internal functioning and its contextual adaptation. Scientific discipline will seek to understand organizations by studying the *context*, *decisions* and *behavior* (E. I. Ibarra Colado, 1999), but its pretensions to control everything that happens in organizations will always leave little room for understanding it as a *living whole.*

Organization theory has gone from responding to a social system to rationalizing of how to act organizationally. Concentrating their efforts on building a discipline on the model of positive science, organizational theorists have created a science that is not based on *organizational know-how*, but is the result of *efficient maximization of the machine system*.

One could argue that the science of Organizational Theory is inconsistent because it ceased to reflect on the facts, processes and cycles of a human organization dependent on society, and has become the ideology of an organizational

253 *"Foucault effect"* is a term referring to the impact that the French philosopher used as a starting point for rethinking government practices (Burawoy & Serratacó, 1989) (Barry & Osborne, 2013). Foucault shows that the problem of governance is a problem of organization that goes beyond state action (Michel Foucault, 1991).

practice. Thus, if we believe to apply the science of Organizational Theory, we are in reality applying an instrumental policy of Organizational Theory.

The organization does not have an economicist utilitarian reason, but obeys the triad of economy, society, and politics. The critical objective of the organization is to objectively combine people's individuality and interests with the interest of the collective entity on which they depend, and their interactions within and outside the social group, including the relationship with the common goods on which they also depend.

To approach the Theory of Organization from a non-positivist paradigm of science we shall resort to Morin. As the paradigm of complexity offers a broader view, Morin resorts to the concept of organization to explain the systemic conception; he perceives system as a *"global unit constituted from interrelated elements whose interpretation constitutes an organization... it is a combination of different elements that are in interdependence... it is not identified with the phenomenal object, it is projected on it"* (Edgar Morin, 1974).

The singleness of system-organization develops in the relations, interactions, the attractors, in cooperation, but also through repulsion and antagonisms because *"if there were not any force of exclusion, repulsion or dissociation, everything would be gathered together in confusion, and no system would be conceivable"* (Edgar Morin, 1976). All this permits one to define each of the parts of this complex system.

These notions produce a dual contradiction, although in a complex system they are not only antagonistic but also complementary. Thus, for example, ordering disorder through systemic organization not only orders the necessary interactions but also creates disorders in the new order. It is a movement that associates them. Organization is the paradox between order and disorder and negotiates the relationship for the maintenance of the systemic balance.

Karl Polanyi identified the contradiction of the logics of the market and the logics of society. In "The Great Transformation" (K. Polanyi & Sánchez, 1992) he argued that "a self-regulated market is utopian, and that an institution of this type could not exist for long without annihilating the human and natural substance of society".

Polanyi suggests a ray of hope with the theory 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.

Polanyi's study of the economic models of pre-capitalist societies retrieved a concept of reciprocity and redistribution with respect to the sharing of labor, and demonstrated that it was not only possible to find solutions in harmony with social values, but that these have existed throughout human history.

One example is the development proposal of movement of indigenous people in Ecuador: Sumak Kawsay [good living] defines the relevant values: integral humanism, communitarianism, communitarian, plurinational democracy, plurinationalism, unity in diversity, self-determination, sovereignty, independence and international solidarity (Confederation of Indigenous Nationalities of Ecuador, 2007). Based on community knowledge and practices, the movement proposes the harmonious relationship of man with nature, establishing the concept of harmony as mediating individual and group interests. The Sumak Kawsay development proposal does not seek to respond to the neoliberal model, but prioritizes cultural sustainability by educating new generations on the basis of values that help create new forms of reciprocity and democracy and respond to the new contexts in which the indigenous peoples live (Herrán Gómez, 2015).

Various and diverse proposals and alternatives have bee raised ranging from economic schemes to environmental protection, social justice, national sovereignty, etc. Most of them do not seek to be exclusive; on the contrary, they seek to be combined with other models or structures that leads to mutual enrichment. Economy of the common good, solidarity-based economy, economy of minus-growth, social economy, collaborative economy are approaches that have the same root; a counter movement that seeks to de-commercialize society and reaffirm social, moral and cultural values.

If the counter-movement aims to reaffirm these very values, if its objective is the political governance of the economy to recover the supremacy of the person over capital and of society over the market the answer cannot lie in applying economicist solutions to fight or take revenge on the market economy. The solution must lie in preventing political governance of the economy but not through an economicist counterattack that would produce only more of the same.

The objective must be to recover the sense (understood as meaning and direction), change economic logics and recuperate social, moral and cultural values; recover the supremacy of the person over capital and the supremacy of society over the market, working from cultural sustainability, from the determinant qualities of the commons that point to *being* rather than *having*.

PART III

Getting Down to Business, the UPS Ecosystem

Chapter 1

Knowledge Flows and Action Cycles

In the first part of this book, we developed the argument of the reason for an ecosystem and the analogy between *energy flows and knowledge*, as well as between *resources and biomass*, between *the hurricane of knowledge and a dissipative system*, biocenosis and the environment that enhances capacities, the *biotope and the paradigm of the common good.* In this section we will try to explain how these elements have been articulated to create *knowledge flows* (energy flows) and *action cycles* (biogeochemical cycles) as well as how they have been activated in the case of the UPS.

The knowledge flows (energy) and cycles of action/resources (matter) exist in an interactive context between the biotic or biocenosis part that we have identified as an Environment that Enhances Capacities and the abiotic or biotope part that in our case is the *common pool resource.* These two components conform the *communal complex*[254] of the UPS Ecosystem University.

I would like to point out that throughout Part III, there will be recurring terms that were addressed before. That is why readers will find a glossary of terms at the end of the book for their convenience. In addition, a platform-ecosystem of intelligent tools called CREA MINKA has been developed that we shall discuss later, and that makes use of *knowledge discovery and semantic web techniques, Big Data and Learning Machine, etc.* to monitor the behavior of the ecosystem and identify the flows and cycles included in its organizational complexity. The graphs presented in this section have resulted from this platform.

Dynamic Flows of Knowledge-Energy

The logic of dissipative systems, as mentioned above, demands that they be open to the context and exchange knowledge-energy and resources-matter.

254 Communality involves decision making often in search of balance and often in crisis. Community implies a set of previously defined values.

These flows modify both biotic and abiotic conditions, which means that the university community is responsive to changes in both material and environmental conditions and because of the dynamics of the relationships of exchange of interests, knowledge and dialogue between people and groups inside and outside the university. Likewise, it is necessary to emphasize that the community and its processes and exchanges are also responsible for the transformation of common resources (this constitutes a cycle).

Although it is difficult to codify, let alone quantify, the knowledge that enters the ecosystem, certain results or evidence point to exchange[255] in one form or another; agreements or reciprocal interests that imply that the ecosystem is open and there is interdependence between it and the environment from a cognitive-energetic point of view. Once the ecosystem receives input, the messages circulate and motivate actions that degrade and eventually dissipate.

It is, therefore, necessary to understand the relationship between knowledge-communication-action[256] (this constitutes a cycle), since the exchanges made in agreements that are monitored hint to the existence of knowledge-energy flows from outside to the inside of the ecosystem and also within the system. The social reality of the university community is the result of a social construction, which implies that theory and practice form a whole, and therefore, cognition and social interaction are also indivisible and complementary. Communication is the cause of this indivisible relationship. Far from behaviorism, communication manages to unite constructively the nature of relationships and exchanges and the phenomenological level through a kind of system of ideas and concepts that interact with actions. Communication in the university is directly related to knowledge.

In this way, more than communicating meanings, the exchange of meanings, knowledge, and recognition produces a communication-relationship that is fundamentally intercultural, i.e. the grammatical level of communication permanently shows the normative dispositions of the group more than the individual experiences of the members (Bernstein, 1975, p. 65), which lends cohesion to the ecosystem and makes it dynamic.

255 Exchange: there is a political economy of the word, a communicational model that privileges 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.

256 Part I of this book addresses the concept of knowledge-communication-action.

The knowledge-energy involved in one way or another in communication is codified in ways that reinforce recognition and identities, solidarity relationships and socio-cultural integration. Communication is not a simple medium, but represents the synergy produced by the exchange of value.

Every organization is communication (Broekstra, 1998) and every culture is communication (Laplantine, 2001), every cultural relationship can be understood as an act of communication and synergistic exchange of knowledge.

Although there may be multiple forms of knowledge exchange that go unnoticed or are difficult to perceive, there is evidence of communicational exchange codified in agreements that can be monitored within an ecosystem.

There are basically two ways in which knowledge-energy can be inscribed in the Ecosystem University:

1. *Through internal knowledge production*, i.e. the synthesis in the relationship of knowledge production and organizational construction. The Ecosystem University creates knowledge (Ikujiro Nonaka & Takeuchi, 1995) from an autopoietic process,[257] in which the whole is more than the aggregate of its parts and more than the analysis of their subordination, i.e. a process permeated by self-organization and autonomy. The basis of the organization of the Ecosystem University is the knowledge produced and used within it (Leonard, 2011) (Nelson, 1991) (Sveiby, 1997). Hence, the University's ability to adapt to new circumstances and recreate itself through innovation and knowledge creation.

Opening the university to its context develops the capacity to be a product and producer of society, and makes it possible through the flows of knowledge-energy that permeate it, to develop innovation and organizational knowledge, whereby the latter is an amplification of knowledge that is generated individually and that materializes within the organization's knowledge system (lkujiro Nonaka et al., 1996).

257 *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).

As previously stated, the continuous transformation from tacit to explicit knowledge is motivated by the flows of knowledge-energy from the context. Tacit knowledge is "deeply rooted in an individual's action and experience, as well as in the ideals, values or emotions that he or she embraces" (Ikujiro Nonaka & Takeuchi, 1995, p. 9).

The SECI organizational knowledge creation spiral (Ikujiro Nonaka et al., 2000) is considered to be a self-transcending and continuous process that results in new knowledge and thus a new world view (Ilya Prigogine & Hiebert, 1982). In this sense, the Ecosystem University creates knowledge in a dynamic way, and depends on the internal flows and exchanges of knowledge-energy. It is supported by the human groups that make up the wider university community and were previously labeled as producers, consumers and digesters, and shall be addressed later on with greater detail in the case of the UPS.

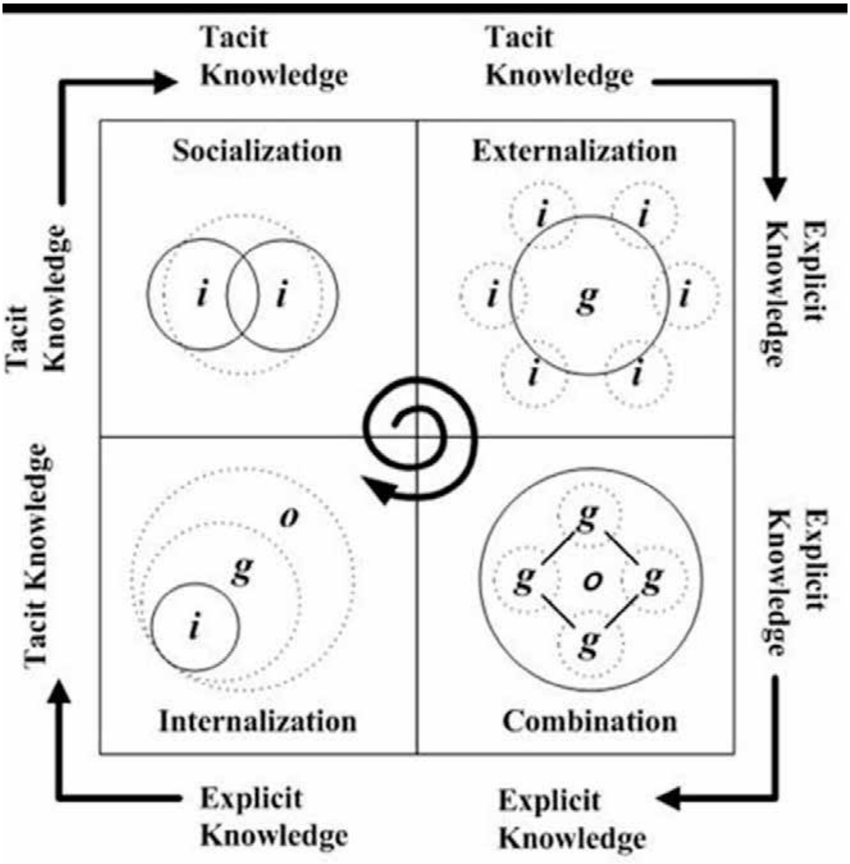
The creation of organizational knowledge is produced by the SECI spiral (in Figure 43), which demonstrates the conversion of tacit and explicit knowledge and the organizational construction (Ikujiro Nonaka et al., 2000) of the community. As of July 2020, the UPS Ecosystem counts 73[258] Research Groups, 15 Educational Innovation Groups, and 180 Innovation and Entrepreneurship Groups. Figure 35 shows the traceability of the knowledge-energy flows identified among producers, consumers and digesters of the UPS Ecosystem by the Crea Minka system as of June 2019.

2. *By importing knowledge from the context*, i.e. the construction of community and its capacity to validate the knowledge produced in all stages of the knowledge spiral. More relevant than the communal as a way of life, is the community management as a cultural factor that is present in the decision making, where communication plays a leading role for moving from theoretical-individual knowledge to an experienced-communal one. Organizational knowledge is not a simple agreement but the result of a process in which through the SECI cycle, the knowledge resulting from the action is communicated to involve the internal aspects to the community and those that affect it from the outside. This learning by doing and reflecting develops skills among the members of the university community. It is not a methodology of teamwork but is community action that participates in the definition of actions and decision making, which is why it is essential to validate knowledge with the context. Although action is essential for the production of experience-based knowledge,

258 Number of Research Groups updated in 2020.

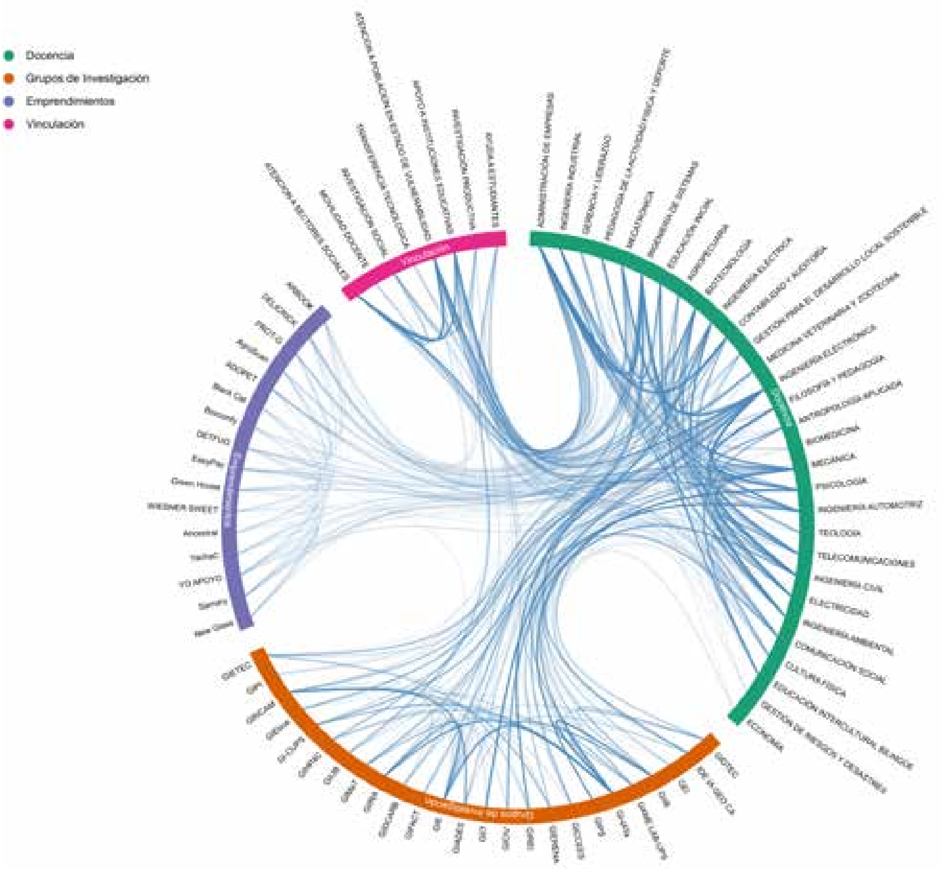
it is not action for action but rather an action that is capable of communicating, questioning what is known, validating it and, therefore, producing organizational knowledge. While this has nothing to do with activism, it is suggested that the university open up to the context and actively participate in validating experienced knowledge and promoting mutual learning.

Figure 43
SECI Nonaka Takeuchi spiral and the relationship of organizational knowledge creation and community building through the emergence of groups



Source: (Ikujiro Nonaka et al., 2000)

Figure 44
Traceability of knowledge-energy flows between producers, consumers and decomposers of the UPS



Source: CREAMINKA, data updated to 2020

The knowledge-energy from the context enters the Ecosystem University and permeates the rhizome structure of the groups and the SECI spiral, undergoing a triple transformation[259] until constituting validated knowledge:

259 The three levels: grammatical, phenomenological-interactive and cognitive-systemic as suggested by (Broekstra, 1998).

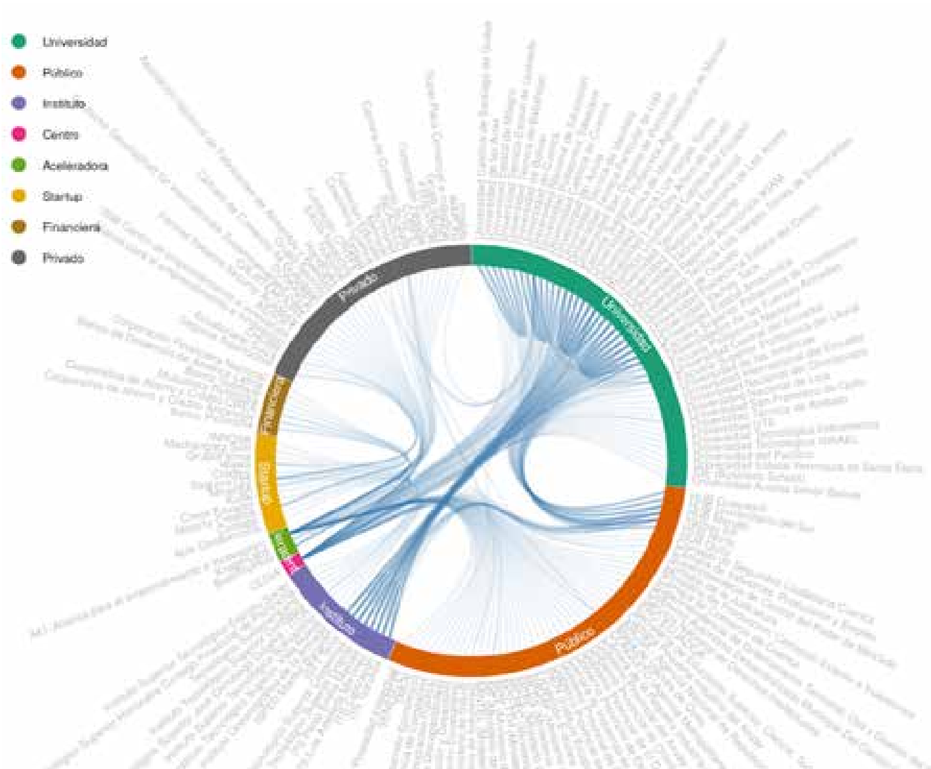
- Grammatical level: the most basic level of rules, preliminary agreements, guidelines and specific procedures of the interaction between the University and the context, up to more general policies, strategies and systems based on common interests.
- Interactive phenomenological level: the dynamics of the recurrent interactions between the university and its social partners in the midst of complex adaptation and according to their experiences. This level has a tangible, observable or explicit aspect of the social system of interaction, and a tacit and intangible, non-observable aspect, both by virtue of the value-enhancing projects of the exchanged knowledge-energy.
- Level of cognition: although generally understood as the domain of explicit knowledge, cognition encompasses both explicit and tacit knowledge, the aggregate of which produces a systemic relationship, i.e. a mutual dependence and continuous exchange between the university and the social context based on common interests. The third level gives way to the re-emergence of level one in a second level of complexity (this constitutes a cycle).

The relationships develop between the different actors of the Ecosystem University and their social counterparts. The emerging and self-organizing characteristic permit these relationships to develop bottom up and will not be imposed by superior government bodies. Therefore, it is necessary to monitor the agreements and results that show the connections between university and social actors; this does not involve simple agreements but a wider range of possibilities. In the case of the UPS, the Crea Minka system has started to monitor the knowledge-energy flows produced by *imports* since 2017. Figure 45 shows the traceability of the knowledge-energy flows between the UPS actors and the social actors with a cut-off date of 2017-2020.

Action Cycles

The *action cycles* of the Ecosystem University are what would correspond to the biogeochemical cycles of a natural ecosystem. Ecosystems are not only determined by energy flows but also by fundamental resources for the life of the community; the maintenance of many of these resources is the result of cyclical processes that cut across the university community (biotic component) and the common pool resource (abiotic component) in the Ecosystem University.

Figure 45
Traceability of knowledge-energy flows between UPS and context actors



Source: CREAMINKA, period 2017-2020

Earlier we addressed the importance of complexity for the Ecosystem University, which helps understand the phenomena of organization from a much broader perspective than mere instrumentalization[260]. According to Morin (Edgar Morin, 2017), learning *knowledge organizationally* is possible by putting *know-how into a cycle*. That way transdisciplinarity can unravel

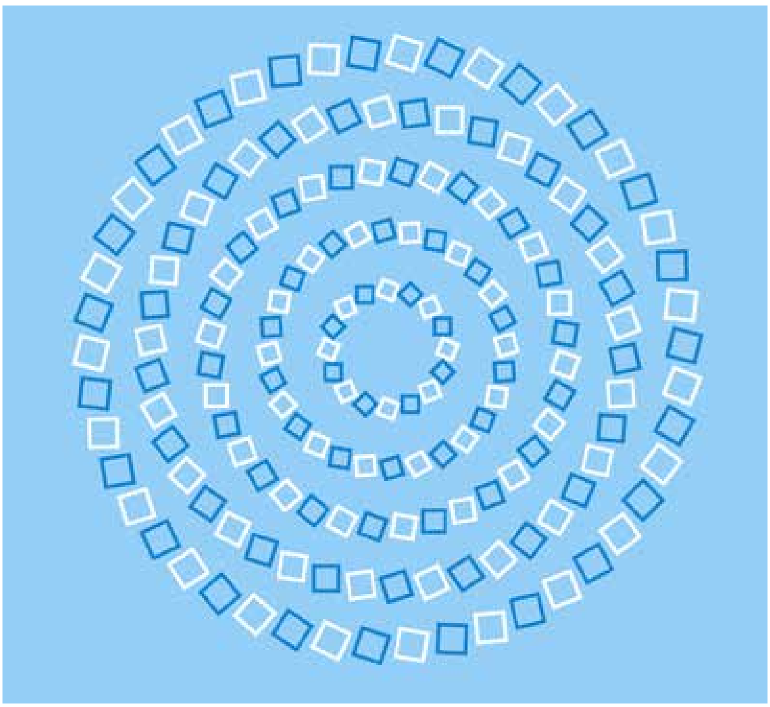
260 Organizational knowledge was instrumentalized throughout the last century, ceasing to be organizational *knowledge* to become a tool for the domestication of organizational aspects and the respective orientation to *the end that justifies the means*. The issue will be addressed at great length at the end of Part II.

the complexity of reality to understand it as organized reality (Edgar Morin & Piattelli-Palmarini, 1983, pp. 205-212) (this constitutes a cycle),

Ecosystem complexity focuses on the person, hence the need for action cycles to connect and form integrative links related to the facets of life, reciprocal relationships in *complex cycles* that recognize the multidimensional unity of the human being in its diversity and also indissolubility. This requires open-mindedness and thinking from the linear to the complex to be able to gauge learning and understanding of knowledge that lies more in experiences and relationships than in disciplinary elements and components.

Through an optical illusion, Figure 46 attempts to show the dynamics of the cycles of which we speak. People, be they students or teachers, can navigate and define themselves through various cycles and connections

Figure 46
Cycles of action and their dynamic vitality



Elaboration: Salgado-Guerrero, J. P.

without restrictions, supported by their groups connected in networks of rhizomes. The options are multiple and the curricular organization is no longer disciplinary but post-disciplinary since this new conception supposes a positive degree of disorder and deregulation. It relates to the projects and action only obeys the motivation and the desire to participate and intervene, develop knowledge and getting recognition for being useful to the community.

These cycles are created and interwoven in a way that leaves no room for exclusivity simply because it is no longer useful, and the sense of personal development in community becomes strong enough to create cohesion in the ecosystem. The social accumulation of knowledge, the result of all this movement, becomes so strong that it makes the common good sustainable and gives social support to the production of knowledge.

The cycles of action and its communicative vitality articulate the university community and provide the aesthetic[261] and moral dimension, as well as the organized albeit not ordered, order.[262]

In the case of the UPS, some cycles have been identified that depend mainly on the action of the university community (Juncosa Blasco et al., 2019), which is why we refer to them as *action cycles*. These and their fundamental characteristics will be described below*:*

- Their movement involves both actors and resources, which can circulate inside in a flexible, self-governing way, in permanent flow and transformation.
- They are dynamic and the results provide feed back to the next level.

261 In his novel "The Idiot," Dostoyevsky wrote that *"beauty will save the world,"* trying to express the diversity of the human condition through its characters, and to represent all aspects of the human soul. He makes some very interesting approaches that relate to the complex thoughts dealt with in this book, since for him: "beauty is mysterious as well as terrible. God and the devil are fighting there and the battlefield is the heart of man". For Dostoyevsky, more than a thesis of "beauty will save the world", without the aesthetics of beauty the transcendent loses its existential sense and even more so in a profane and decadent world where only the deepest truth of the soul can reaffirm existence. "Man can live without science, he can live without bread, but he cannot live without beauty, for then there would be nothing at all to do in the world. The whole secret is here, the whole of history is here," said Dostoyevsky. The aesthetics of beauty establishes a dynamism in existence and prevents *evolution* from being petrified, it instills a subtle tendency in matter that leads it to transcendence (Dostoyevsky, 1999).

262 Cf. the glossary for more detail.

- They are emergent and consequently top-down, autopoetic and self-organized.
- Their development with respect to time seems to be spiral rather than non-linear.
- There are multiple and unpredictable connections between them, they are linked by leaps or vanishing lines, leaving traceability of knowledge as social memory or externalized knowledge to be taken by those who consider it useful for their needs or projects. It is here where knowledge is systematized in some way.
- The recursiveness of cycles is the basis of the principle of non-linearity[263] for the organization, since products and effects are at the same time causes and producers of what produces them.
- Every moment something is produced and is also a producer, as a cyclical uniqueness and communication is maintained with other dynamic cycles. This is the basis of the self-constructive and self-organizing processes.
- Knowledge develops in different moments, circumstances, spaces, meeting places,[264] associations, groups, laboratories, etc.
- The knowledge of a cycle depends entirely on the cycles, and vice versa. It is a kind of double movement that produces knowledge in which diversity organizes unity that in turn organizes diversity.
- The more autonomous the living organization conformed by the cycles is, the more it depends on the context, which implies an unstable logic that conforms the communal complex and another logic that assures the reproduction of the cycles.
- The communal complex conformed by the action cycles is not an object because it is organized and organizing, i.e. living and social. It goes beyond being a simple element, it faces, by way of dialogue, the uncertainties and contradictions hidden in the simplifying knowledge.

It would be a mistake to see these characteristics as abstract formulations that express absolute truths, since they do not prove anything. Rather, they illuminate thinking to recognize problems in their context.

263 Cf. the glossary for more detail.
264 Cf. the glossary for more detail.

The Indivisible Relationship Between Teaching and Research

Teaching-Research rests on three pillars: the plurality of values, the search for human development and the common good, and the recognition of the centrality of the person, the person's life project and community reciprocity.

This kind of approach leaves room for rethinking processes, curricula and knowledge limited to individual disciplines and notions to pave the way for a concept of human development and the common good; in other words to look at teaching-research as the path to development and advancing good coexistence.

The indivisible concept of teaching-research is in line with the UPS mission to place the person at the center of its attention, developing the individual's potential toward a life endowed with meaning in the light of human dignity.

The new place of university education lies in subjectivation, subjectivity understood as knowledge that expresses perceptions, arguments and languages of communication with respect to the person. These are influenced by the individual's particular interests and desires brought into play in a community to which the individual belongs. This implies combining the rational and sensitive aspects of the person that permits to speak of a comprehensive education that guarantees the person's fullest development.

The subjectivity of which we speak invites us to understand that reality is not a simple extrapolation of a normalized present; we must break with the purely instrumental and rationalist meaning of scientific knowledge to move on to questioning paradigms and abandon routines that impede understanding reality in a different way.

The motivation that makes us active learners is not only based on intelligence but above all on the meaning we find in our lives, and hence on sensitivity. Giving meaning or significance involves inventing, creating, assuming, knowing how to explain, being able to name, understand, knowing why we do what we do, integrating content and action; in short, the education of which we speak depends directly on our ability to give meaning to things.

Research-teaching breaks the anesthesia of the known. Paradoxically, its strength lies in the lack of a pre-established purpose. The university must therefore provide an environment[265] that is conducive to opportunities for research

265 An Environment that Enhances Capacities. Cf. glossary.

to ensure that learning starts with the question and not the answer. Leaving aside established budgets and totalitarian truths, the teaching-research we are talking about allows us to rediscover the deep meaning of the experience of creating and recreating knowledge, an experience that goes hand in hand with life and abandons false truths that chain people to a linear approach.

Research is what differentiates university education from any other; it catalyzes the development of knowledge, intelligence and logical thought. It allows students and teachers to question paradigms, recreate conditions of search, and start from the questions and not from the answers. Thus, research gives meaning to teaching and makes sure it is not limited to transmitting information, but develops the ability to understand and fill it with meaning to guide it on the course of knowledge production. Research-teaching is not afraid of un-learning, and seeks to understand the particular logics that facilitate the production of knowledge.

Without research training, university professionals will not be able to ask questions and resolve them in their work, let alone exercise critical thinking with respect to ideas and give meaning to the world around them and their personal proposal for life.

Teaching is inseparable from research because science is learned by doing science. Research can accompany the process of scientific training, deepening and specializing the fields of science, but at the same time, teaching makes research more complex, producing inter- and trans-disciplinarity.

Although teaching is inseparably linked to research, the two are managed differently. The approach to teaching is usually marked by the objectivity of its processes, including pedagogical ones, while for research the potential to produce novelty lies in subjectivity that is charged with. Being able to ignore certain things opens the mind to new fields of knowledge.

We must change the disciplined strategy of acquiring competencies through concrete skills, that is: *know-how* or *how-to*, to move to: *how-to-know?, know-why?, for-what?, know-in-what-conditions?* Failure to do so will destroy our ability to define the world around us.

Teaching-research enhances a person's judgment and makes it the main condition for successful learning. It, therefore, goes beyond the curriculum and ventures into projects and situations that allow both the teacher and the student to see the world from different angles, and chose an approach that is based on the doubt of science.

The greater the freedom of thought, the greater the risks that learners will take and the maturity in the approach, which creates a virtuous circle for developing the human *being*.

Sharing research practices permits students to make the leap from what they learned to what they understand, in a process that involves thinking about knowledge and participating with the teacher in understanding how to produce it. Scientific knowledge and scientific thinking are not learned but understood in a progressive manner whose axis is research as a process of scientific production; without a teaching of research there is no scientific production of knowledge, let alone an awareness of scientific thinking. Therefore, the relationship between Teaching and Research is indivisible.

Finally, subjectivity added to the need to understand and explain produces multiple points of view, critical reasoning and knowledge development. This permits the university to generate new lines of knowledge and not only replicate and reproduce what is already known.

The Scientific Community and the Ecosystem of Research

As said before, we need to resort to the concept of system to understand the concept of organization and vice versa (Edgar Morin, 1999a). It is impossible to understand the organization as an imposition from privileged spaces, but rather from the collective construction and, thus, self-organization. Once emerging common values are shared, they will permeate the community and create social relations and, therefore, culture. This is the strategy built from the multiple meeting places and university projects filled with uniqueness between the scientific research path and the development of the persons who propose and execute them.

This lends uniqueness to the Academic or Scientific Community of the research organization-ecosystem; one leads to the other in a physical unity of body and soul of the University.

From this vantage point it becomes difficult to attempt to govern university organization based on the rationalization and efficacy of policies, disciplinary norms, and regulations, or to tame it in accordance with pure data. We must understand the communal complex[266] of the university from subjectivity and make the necessary efforts to read it from the inside. This approach

266 Communality involves decision making often in search of balance and often in crisis. Community implies a set of previously definde values.

obviously does not relieve anyone from the responsibility and the methodological and assessment challenges (more than evaluation); the latter will be tools to understand the university rather than mechanisms of subjection.

The Academic Community that pursues active research allows the University to rethink and even recreate itself and, therefore, respond to the dynamics of administrative objectivity and subjective vitality. The common agenda is what gives the university its identity and expresses its values.

Education cannot be understood in parts or by disciplines but only in a holistic way, including its own movement, meaning, emotions, and self-regulation. The way of producing, thinking and investigating one's own knowledge, the definition of the theoretical objective, the rupture of internal epistemology, awakens the questioning of situations and challenges that arise in the University, as well as the importance of participatory work, the redimensioning of the University, shared values, knowledge-based leadership, etc. The common task that is perceived and executed as a whole, which is greater than each of the parts (Edgar Morin, 1984), is the Scientific, Academic and Educational Community, the University Community (Juncosa Blasco et al., 2019).

The communal complex[267] emerges from the system-organization-knowledge relationship (Edgar Morin, 1999), the logics of the eco-systemic principles[268] enhance self-organization and the development of the hurricane of knowledge-organization.[269]

We can build community synergies only through dialogue and exchange,[270] which is why perhaps the time has come to discard *copyright* and make a qualitative leap to the *right to copy*. If the primary value is to build a free flow of ideas, the dialogue of knowledge, understanding and being able to explain it is fundamental to make use of the knowledge of others. The challenge for the university community is to move from official policies to shared practices.

We also need to overcome institutional and personal behaviors that block the capacity for change to allow shared activity to flow with the logic of

267 Cf. the glossary for more detail.

268 Cf. the glossary for more detail.

269 Cf. the glossary for more detail.

270 A communicational model that privileges exchange, recognizes that the word is not an innocuous act but an exercise of synergies produced by knowledge exchange, and the construction of values that transcend the "ethics of control" and the "programmed organization", is even beyond the intermediated negotiation between individual and corporate interests

reciprocity, and to be a community of communities that ensures the academic-research process and not a mere functional organic one. The social-creative capacity and its intimate relationship with teaching has an impact on the institution, providing the university with the capacity for reflection and choice.

The proposed ecosystem is always complex, but as we overcome difficulties and accept differences, the values of reciprocity, cooperation and freedom will form an environment that strengthens the community and the capacities of its members.

The ecosystem perspective allows the community to transcend study programs and research projects, which is why the UPS academic community seeks to (Herrán Gómez et al., 2014):

- Establish the links in knowledge that has been divided into disciplines.[271]
- Educate for life, for free citizenship based on the elaboration of moral judgment.[272]
- Form a socially responsible life project, starting from individual autonomy and social relations from the vantage point of ethics.
- Find complexity, evading superficiality.
- Awaken the logic of transformation of science through research and motivate a passion for reading and writing as a means of constructing knowledge.

Therefore, the scientific community first needs to be a community and secondly scientific. As we saw earlier in the hurricane of knowledge-organization,[273] synergistic relationships between people are fundamental to the production of knowledge to ensure that knowledge and community organization will go hand in hand.

The management of the *commons* calls on collective action and articulates projects through a shared vision. Ostrom (E. Ostrom, 2008) won the Nobel Prize for proving that the management of shared goods returns control to the community of its own resources, refuting the economy of privatization or nationalization.

271 Further down we will see how the UPS produces and identifies its lines of research. Cf. glossary: research lines.

272 Will be addressed further down in greater detail in an environment that enhances capacities at UPS.

273 Cf. glossary.

The community concept has served society for centuries, but today it has spread to different organizational models, from urban spaces to knowledge, the economy of the *common good* provides answers to current problems. The truth is that the community is not so much a social organization than a model of sociality (Sánchez Parga, 2013a, p. 16).

Communal action redefines the person's work, since it involves not only working with but also working for others (Durkheim & Posada, 2012). Moreover, communal action sets off the processes of knowledge creation and communication, and links everything to the individual's life project. Hence, investigation, the common good, communal action, knowledge and organization will create an ecosystem.

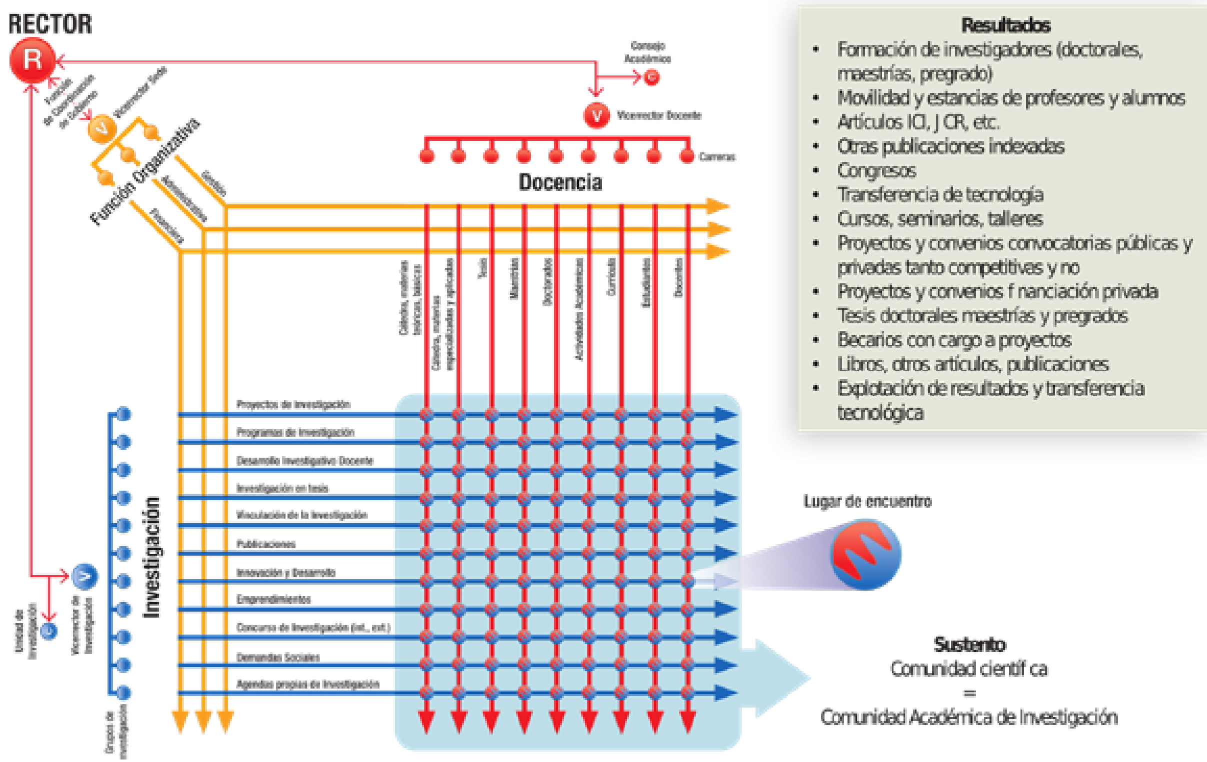
Therefore, the nucleus that generates the oneness of teaching-research that enhances the development of people lies in unique meeting places, a series of nodes that articulate communal action and the production of knowledge in a rhizome fashion. We must, therefore, find new forms of university, without dissolving the actual form, but going beyond it, to sustain and foster the meeting places, whose dimensionality no longer lies in the traditional and cold structures but becomes the result of multiple flows that intervene in the creative and research dynamics.

The personal interest and each aspect of a person's identity relate to a certain dimension, which in turn *encounters* the dimension of the other; the aggregate of interests and the search for meaning convenes these individuals in a meeting place within the academic research community and creates motor cells: the Research Groups. University research is nourished by the experience of spaces and images that determine the process of personal socialization.

If the productive action must be taken at the community level by a person who is both a teacher and researcher, certain situations will have to be dealt with by those who are familiar with them, and problems of synthesis must be addressed by those who see the whole picture. As established by the UPS in 2014, university governance should, therefore, be based on a non-pyramidal or at least a matrix structure, as shown in Figure 47, where each university function is articulated in a matrix. It means that while there is co-ordination, nobody oversees the other. It is more like co-government and interdependence. Similarly, this structure makes sure that the community can tackle the specific problems of the development of science in each node or meeting place.[274]

274 Cf. the glossary.

Figure 47
UPS Teaching-Research fabric



Source: (Herrán Gómez et al., 2014)

It is impossible to find a homogenizing plan for everything; only the process adapted to each case gives meaning to planning as a method, even though there are common axes of articulation. Therefore, planning from below that starts from each Research Group and provides feedback to the planning of each university function, will not be in the way of other university spaces that exercise planning that responds to a shared general conception.

The planning from each *node* (Research Groups and careers), and its interactions Teaching-Research in the many meeting places create the network base, where *central integral* planning takes place that deals with the generic long-term problems that are dealt with by a *socially disseminated university network*. *Nodal* and *integral* planning not only coexist but also recognize the specificity and complexity through a framework of constant dialogue and accompaniment that guarantees life, unity and identity. *Integral* planning that seeks to integrate *nodal* planning in its action, requires communication that does not shun self-criticism and makes a permanent effort of recognition within a *socially disseminated university network* (Herrán Gómez et al., 2014).

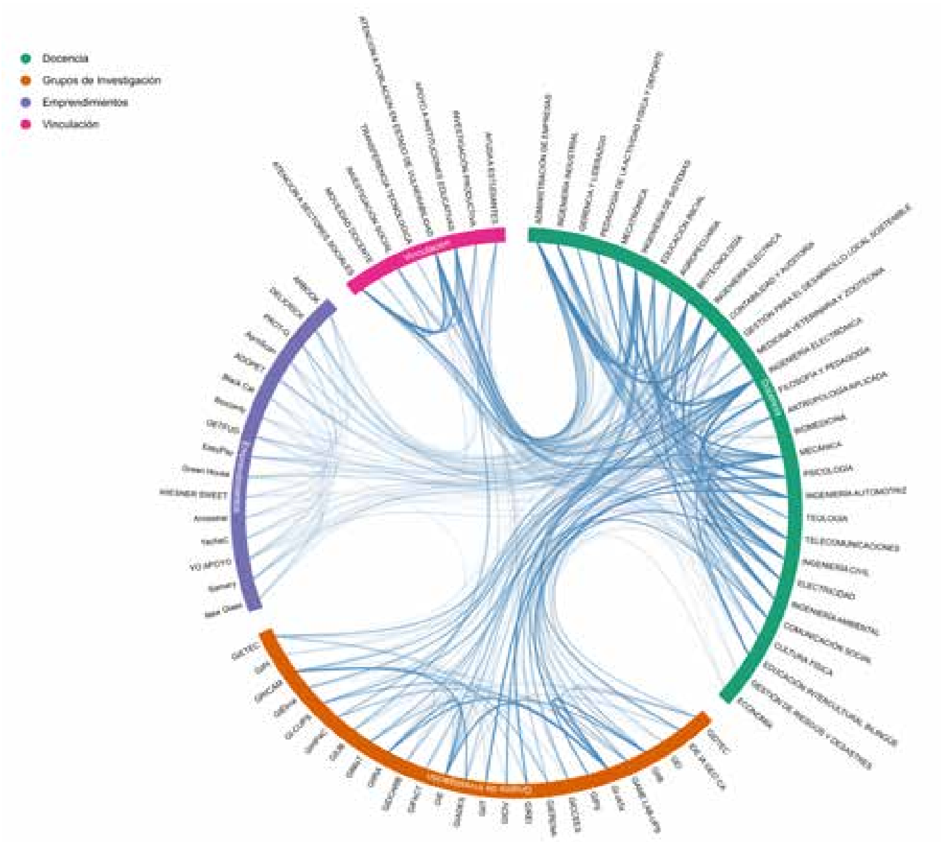
Figure 48 shows the interactions between the university functions produced in the meeting places that have been collected by the CREAMINKA platform, and solve the specific problems and governance of the university community.

Interests are negotiated according to the common good and the interactions necessary for the effect produce balances and shared values. The management of common goods[275] is always perfectible and open to possibilities for new forms of self-organization. The UPS has identified the following values:

- Sustainable management.
- Consensus-based management.
- Management that shares benefits.
- Management of collective action.
- Management of self-governance.
- Management of reciprocity.
- Management of a non-commercial economic and exchange model.
- Organized society management.
- Management of voluntary participation.

275 Cf. the glossary.

Figure 48
Interactions between university functions produced in the UPS meeting places



Source: CREAMINKA

The aim is to organize the scientific community in accordance with management principles that will provide real power to act, the logic of fair remuneration and recognition for all those who participate in communal work. This is fully in line with what we previously discussed regarding the ecosystem pillars: an environment that enhances capacities and a management of the common good as analogy to biocenosis and the biotope.[276] The ecosystemic conditions that are produced in the living and organic structure of the community enhance the development of people and their life projects.

Consumers in the Ecosystem University

We earlier made an analogy between consumers, decomposers and producers[277] of an ecosystem to show the flows of energy (knowledge) and matter (resources) within the university. The consumers of an ecosystem use all the opportunities of energy and matter to carry out their daily activities; in nature this place corresponds to living beings that feed on the primary matter of the trophic pyramid to produce the necessary energy.

Based on operational logics, the UPS defines consumers as:

- Research groups and educational innovation groups.
- Innovation and entrepreneurship groups (including spin-offs)

Research, Innovation and Entrepreneurship Groups

The association of groups goes beyond the regulation and hierarchical structure, they are related to the heterarchies[278] that were discussed earlier, and will depend on the shared values and motivations that bring people together. Thus, they move away from the traditional concept of the classroom and recover the academic space to think together and produce synergies for creative dialogue.

The university for the production of knowledge is not so much concerned with the project but rather with the group that carries out the project. The diversity of groups and their projects multiply the possibilities of ways of learning, and each action and initiative it inspires the academic community. In reality, the group is the driving force behind the entire ecosystem of research.

Trans- and interdisciplinarity as well as the uniqueness of teaching and research are possible within the groups. Each group manages its autonomy from the central university instances, thus harmonizing the ecosystemic relationship in the academic community.

276 Cf. the glossary.
277 Cf. the glossary.
278 Cf. the glossary.

The Research Groups fulfill a double function: first, they are the place par excellence that concentrates and accumulates the experience and the learning-research process; and second,, they generate academic innovation that provides feedback to the careers and research programs.

From the internal point of view of the university, each degree course ideally includes research in a transversal way to ensure that each subject considers in its descriptors the research components and the possibilities or research projects. Thanks to multiple meeting points between courses and groups, the research programs and agendas of both must be shared, complemented and provide feedback. We must bear in mind that each career can be linked to several Groups and each Group to several careers, which offers an enormous potential.

The guidelines for the research agendas should be framed by at least three basic criteria:

- Scientific development and innovation.
- Social demands that also establish the working future of students.
- New academic developments in the university itself.

Without being instrumentalized by political decision makers, state logic or market forces, the demands of society mostly from governments and the business sector, generate a challenge for the University and hence the Groups. The latter must be given sufficient autonomy to generate knowledge relevant to social needs, evading possible instrumentalization.

From the university's internal vantage point, each career and other dynamics of teaching have multiple meeting places with the Groups. Hence, the research agendas and programs of both must be shared, complemented and provide feedback to make sure any career can be linked to several groups and viceversa.

It is essential to ensure a sustained process of study and analysis of the activities of the Research Groups; the CREAMINKA platform performs this function of research observatory and manages data that support the UPS policies and strategies. These data are quantifiable in order to estimate variables or even obtain qualitative information about the reality of the groups' research. CREAMINKA guarantees the evaluation of the evolution of a given phenomenon, thus providing effective intervention tools for bottom-up planning.

Further down, we shall take a closer look at the CREAMINKA platform from the ecosystemic perspective.

This dynamics helps create a driving force for the development for students and teachers alike, and hence also for the production of knowledge at the University.

The ecosystemic dynamics that favor the creation of groups have produced many variants of groups and association (Volunteer groups, cultural groups, etc.) at the UPS. This book will focus on three types of groups:

- Research groups.
- Entrepreneurship groups.
- Groups of educational innovation.

Research Groups

The research groups are characterized by:[279]

- Independence in the management of resources, even though they belong to the UPS.
- Independence in the management of human talent that contributes to their projects; people can come from any level or area of the UPS - teachers, authorities and academics, administrative staff, and students of any level.
- They form the Research Council (Collective Action Council), where they resolve the logic for providing the Common Pool Resource, in this case the University. In other words, the Council takes care of funding research projects, authorizes and regulates mechanisms for national and international representation for the presentation of research results.
- They can dispose of the remaining resources that come from incentives for research results, project surpluses, etc. for the purposes related to their research.
- They depend directly on the University President through the Vice-President for Research.
- They have a coordinator who participates in the respective Councils and represents the interests of the group.

279 The following points are the result of the dynamic and constant work of the UPS Research Councils. The information was collected from the source and is attached to this paper.

- They constantly record the information derived from their explicit knowledge production, as well as activities related to the indicators of scientific production.
- They carry out technology and knowledge transfer in a dialogical way with the social actors related to their research.
- They participate in the processes of Ecosystem Acceleration, as well as in those related to Research Valorization.

Table 8
UPS Research Groups 2020

Grupo	Siglas	Sede
Grupo de Investigación y Desarrollo en Tecnologías Industriales (GIDTEC)	GIDTEC	Cuenca
Grupo de Investigación de Mejora Genética y Producción Global en Especies Ganaderas (GLOBALGEN)	GLOBALGEN	Cuenca
Grupo de Investigación en Biotecnología y Ambiente (INBIAM)	INBIAM	Cuenca
Grupo de Investigación en Gestión Empresarial, Económica y Social (GIEES)	GIEES	Cuenca
Grupo de Investigación en Cloud Computing Smart Cities & High Perfomance Computing (GIHP4C)	GIHP4C	Cuenca
Grupo de Investigación de Inteligencia Artificial y Tecnologías de Asistencia (GI-IATa)	GI-IATa	Cuenca
Grupo de Investigación en Comunicación de la Universidad Politécnica Salesiana (GI-CUPS)	GI-CUPS	Cuenca
Grupo de Investigación en Telecomunicaciones y Telemática (GITEL)	GITEL	Cuenca
Grupo de Investigación de Ciencias de la Educación (GICCEES)	GICCEES	Cuenca
Grupo de Investigación de Gestión de Las MIPYMES (GIGMP)	GIGMP	Cuenca
Grupo de Investigación en Nuevos Materiales y Procesos de Transformación (GIMaT)	GIMaT	Cuenca
Grupo de Investigación en Ingeniería Del Transporte (GIIT)	GIIT	Cuenca
Grupo de investigación en Ingeniería Biomédica (GIIB)	GIIB	Cuenca
Grupo de Investigación en Energías (GIE)	GIE	Cuenca
Grupo de Investigación en Simulación, Optimización y Toma de Decisiones (GID-STD)	GID-STD	Cuenca
Grupo de investigación y Valoración de la Biodiversidad (GIVABI)	GIVABI	Cuenca
Grupo de Investigación en Interacción, Robótica y Automática (GIIRA)	GIIRA	Cuenca

Grupo de Investigación Interdisciplinar en Matemática Aplicada (GIIMA)	GIIMA	Guayaquil
Grupo de Investigación en Redes Eléctricas Inteligentes (GIREI)	GIREI	Quito
Grupo de Investigación en Inteligencia Artificial y Reconocimiento Facial (GIIAR)	GIIAR	Guayaquil
Grupo de Investigación en Sistemas de Telecomunicaciones (GISTEL)	GISTEL	Guayaquil
Grupo de Investigación Socio-Económica y Empresarial (GISEE)	GISEE	Guayaquil
Grupo de Investigación en Sistemas de Control y Robótica (GISCOR)	GISCOR	Guayaquil
Grupo de Investigación de Ingeniería de Software e Ingeniería Del Conocimiento (GIISIC)	GIISIC	Guayaquil
Tecnologías de Información y Comunicación Asociadas A la Discapacidad (TICAD)	TICAD	Guayaquil
Grupo de Investigaciones Financieras y Contables Aplicadas (GIFCA)	GIFCA	Guayaquil
Grupo de Investigación de Procesos Industriales (GIPI)	GIPI	Guayaquil
Grupo de Investigación en Enseñanza - Aprendizaje de Las Ciencias Para la Ingeniería (GIEACI)	GIEACI	Guayaquil
Grupo de Investigación de Educación e Información Científica (GIEDIC)	GIEDIC	Guayaquil
Grupo de Investigación en Comunicación e Interculturalidad (GICOI)	GICOI	Guayaquil
Grupo de Investigaciones Psicosociales (GIPS)	GIPS	Quito
Grupo de Investigación en Políticas Curriculares y Prácticas Educativas (GIPCYPE)	GIPCYPE	Quito
Grupo de Investigación en Ciencias Ambientales (GRICAM)	GRICAM	Quito
Grupo de Investigación en Ecología y Gestión de los Recursos Naturales (GIERENA)	GIERENA	Quito
Grupo de Investigación Sobre Niñez, Adolescencia y Juventud (CINAJ)	CINAJ	Quito
Grupo de Investigación y Desarrollo en Ciencias Aplicadas A los Recursos Biológicos (GIDCARB)	GIDCARB	Quito
Grupo de Investigación de Educación Inclusiva (GEI)	GEI	Quito
Grupo de Investigación de Filosofía de la Educación (GIFE)	GIFE	Quito
Grupo de investigación de la Leche (GILEC)	GILEC	Quito
Grupo de Investigación de Estado y Desarrollo (GIEDE)	GIEDE	Quito
Grupo de Investigación de Ecología Política (GIEP)	GIEP	Quito
Grupo de Investigación Educación e Interculturalidad (GIEI)	GIEI	Quito
Grupo de Investigación Infraestructura de Datos Espaciales Inteligencia Artificial Geo-portales y Computación Aplicada (IDE IA GEO CA)	IDE IA GEO CA	Quito

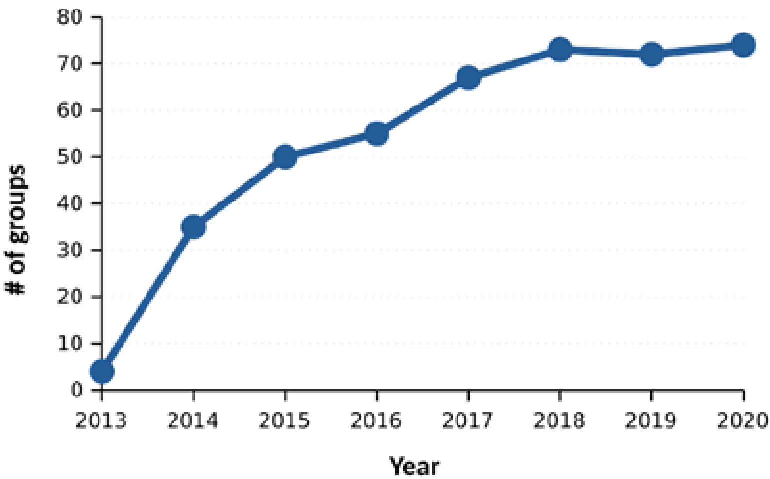
Grupo de Investigación en Electrónica y Telemática (GIETEC)	GIETEC	Quito
Grupo de Investigación en Energías Renovables e Implementación Mecánica de Pymes (GIERIMP)	GIERIMP	Quito
Grupo de Investigación en Biotecnología Aplicada A los Recursos Naturales (BIOARN)	BIOARN	Quito
Grupo de Investigación Nunkui Wakan Espíritu de la Tierra (NUNKUI WAKAN)	NUNKUI WAKAN	Quito
Grupo de Investigación Ciencias Cognitivas: Mente y Cerebro (GICCG)	GICCG	Quito
Grupo de Gestores Del Modelo Cooperativo (GMOCOOP)	GMOCOOP	Quito
Grupo de Investigación Economía, Consumo y Gestión (GIECGE)	GIECGE	Quito
Grupo de Investigación de la Comunicación (GIC 1)	GIC 1	Quito
Grupo de Investigación Comunicación Desarrollo y política (GICODEPO)	GICODEPO	Quito
Grupo de Investigación de la Carrera de ingeniería Civil (GICIV)	GICIV	Quito
Grupo de Investigación Estudios de la Cultura (GIEC)	GIEC	Quito
Grupo de Investigación Cultura, Alimentación y Agricultura (GICAA)	GICAA	Quito
Grupo de Investigación en Planificación y Desarrollo Territorial (PLADEST)	PLADEST	Quito
Grupo de Investigación Comunicación, Educación y Ambiente (GICOEAM)	GICOEAM	Cuenca
Grupo de Investigación en Finanzas, Auditoría, Contabilidad y Tributación (GIFACT)	GIFACT	Cuenca
Sustainability, Management And Regulation Of Telecommunications And Energy (SMART-TECH)	SMART-TECH	Guayaquil
Computing, Security And Information Technology For A Globalized World (CSITGW)	CSITGW	Guayaquil
Grupo de Investigación en Desarrollo Local (GDLO)	GDLO	Cuenca
Grupo de Investigación de Ciencias de la Actividad Física y Del Deporte (GICAFD)	GICAFD	Cuenca
Grupo de Investigación Ambiental Para El Desarrollo Sustentable (GIADES)	GIADES	Quito
Grupo de Investigación en Biomecatrónica y Bioingeniería (GYBYB)	GYBYB	Quito
Grupo de Investigación en Electrónica Control y Automatización (GIECA)	GIECA	Quito
Grupo de Investigación en Arte y Humanidades (ATARAXIA)	ATARAXIA	Guayaquil
Grupo de Investigación Sobre Misiones y Pueblos Indígenas (GIMPI)	GIMPI	Quito
Grupo de Investigación de Teología (GITK)	GITK	Quito
Grupo de Investigación Game Lab-Ups (GAME LAB-UPS)	GAME LAB-UPS	Cuenca

Grupo de Investigación Universidad y Bien Común (GIUB)	GIUB	Cuenca
Grupo de Investigación Mentoría y Gestión Del Cambio (GIMGESCA)	GIMGESCA	Cuenca
Estudio Multidisciplinario de la Influencia de la Creatividad y la Felicidad Corporativa en el Desarrollo Sostenible, Económico, Social y Medioambiental de los Territorios (IGOMSOH)	IGOMSOH	Cuenca
Grupo de Investigación de Enseñanza-Aprendizaje de Idiomas (GIEAI)	GIEAI	Quito

Source: CREAMINKA

The growth of the groups has been significant and seems to have reached the point of maturity as can be seen in Figure 38.

Figure 49
Group growth and research at the UPS Updated 2020



Source: CREAMINKA

StartUPS Innovation-Entrepreneurship Groups

Although innovation generates new and useful goods and services, the creation of companies to produce them has become very important for the planning of national economies since it is considered one of the bastions of sustainable economic development (Ramírez, 2016). One thing is that in a university, innovation and entrepreneurship projects have a dual importance: entrepreneurial projects are linked to the life project of the people who develop them, permitting the university to intervene in education in an integral way; the other consists in the impulse that the innovation project gives to research and vice versa.

One of the singularities of the socio-economic context that we are currently experiencing is the growing difficulty of developing as a professional within the traditional company scheme of employers and employees. This situation has led to promoting entrepreneurship as a way of professional performance (Niño et al., 2014).

The creation of new enterprises plays a crucial role in fostering competition, innovation and the emergence of new sectors (Wennekers & Thurik, 1999). Entrepreneurs who run small new firms could compensate for the restructuring of mature sectors and workforce reductions of larger, established firms (Lederman et al., 2014).

In Latin America, the level of innovation of entrepreneurs is considerably lower than in comparable regions of Asia and Eastern Europe. This has resulted in a much smaller growth of the Latin American business sector and lower capacity to generate employment, and consequently a weaker drive for economic development. This is mainly due to poor training of human capital, low competitiveness of basic services - such as communication, transport and logistics - and an unfavorable economic and institutional environment (Suarez Daza & others, 2014).

The UPS entrepreneurial strategy arises from the need to become an innovative and research university that accompanies the student's life project. As part of the learning component, innovation and entrepreneurship are considered the "catalysts" (J. P. Salgado et al., 2017) for effective short- and medium term transformation of the UPS into an "Academic Research Community " (Herrán Gómez et al., 2014).

The companies we are talking about are generally characterized as spin-offs, spin-outs and startups, etc. according to how they are created and developed (Koster, 2004). The groups of innovation and entrepreneurship are based on the concept of a startup and are managed with resources that are generally provided by entrepreneurs. These incorporate people who open their businesses without a specific experience regarding the market, finance, technology resources and factors that require further study (Ramirez Salazar

& Garcia Valderrama, 2010). As for innovation spaces at the UPS, up to the date of publication of this book, we have incubated 84 entrepreneurship projects (Table 9.), and established 28 startups by 2019 (Table 10) with the participation of thousands of students and teachers (Herrán Gómez et al., 2019). The UPS has also been awarded the seal of Incubator of Innovation Projects accredited by the Ministry of Higher Education, Science, Technology and Innovation (SENESCYT) (Table 11).

Table 9

Incubated entrepreneurship and innovation projects

Proyecto	Responsable	Sede
ARDSYS	Saltos, Jorge	Guayaquil
BALERO	Vizcaíno, Anai	Guayaquil
ELLA SED	Izquieta, Victoria	Guayaquil
GAR 3D	García, María Fernanda	Guayaquil
FRUIT REPUBLIC	Cedillo, Rómulo	Guayaquil
CBQF-BIO	León Duran, Mateo David	Cuenca
EÓN	Trelles Cabrera, Flavio Daniel	Cuenca
MUHU	Ordoñez, María Alejandra	Cuenca
VDEAF-TRAINER	Cárdenas, Christian	Cuenca
EMULATE VR FLIGHT SIMULATOR SYSTEM	Pineda, Pedro	Cuenca
KNOWORKER	Cevallos Ortiz, Xavier	Cuenca
EXOESQUELETO M.I.	Chalco Montalván, Joffre Fernando	Cuenca
RAYWANA	López Pucar, Edwin	Cuenca
CONSERVACIÓN DE ALIMENTOS	Mero, Juan	Quito
ARTÍCULOS CUERO RECICLADO	Hidalgo, David	Quito
ENSURES YOUR DRONE	Pillo, Roberto	Quito
COUCHIN EMPRESARIAL	Padilla, Cristian	Quito
PERSONAJES EN PELUCHES	Pantoja, Santiago	Quito
SILLA BIPEDESTADORA	García, Andrés	Quito
APP BACK UP	Villarroel, Kevin	Quito
ELABORACIÓN DE PRODUCTOS FITOCÓSMETICOS	Espadero, Gabriela	Cuenca
SHADED CANE	Castillo, Mathews	Cuenca
GOLDENTECH 3D	Castillo, Mathews	Cuenca
HEALTH INSOLE	Cisneros, Valeria	Cuenca

DISEÑO Y CONSTRUCCIÓN DE UN BIORREACTOR PARA OBTENCIÓN DE ANTIBIÓTICOS	León Dura, Mateo	Cuenca
MVIBE	Chacha, Sandra	Cuenca
SMART LUNCH	Espinoza, Jason	Cuenca
LA CHUMBERA	Ochoa, Miguel Ángel	Cuenca
BIOAMBIENTADOR	Torres, Andrea	Cuenca
IEEE UPS CUENCA	Rama Estudiantil Ieee	Cuenca
SIMEDEPRO	Cevallos, Álvaro	Cuenca
DEAVGC'S	Andrade Crespo, Julissa	Cuenca
FILTRO BIFÁSICO PARA LA ELIMINACIÓN DE ARMÓNICAS DE REDES RESIDENCIALES	Fajardo, Marco	Cuenca
SMART GLOVE ONE	Solórzano, Andrés	Cuenca
CAMISETAS INTELIGENTES	Pineda, Pedro	Cuenca
MJM MAISON PRODUCCIÓN Y DISTRIBUCIÓN DE VINOS	Quispe, Daniela	Cuenca
WATERPROOF	Calderón, Ana Gabriela	Cuenca
PRODUCCIÓN DE BIODIESEL	Arévalo, Paul	Cuenca
SISTEMA SEMI AUTOMATIZADO DE ASIENTO AUTOAJUSTABLE PARA PERSONAS CON MOVILIDAD REDUCIDA	Molina, Andrés	Cuenca
BIOPOLÍMERO CON ALMIDÓN	Flores, Lorena	Cuenca
MÉTODOS DE INHIBICIÓN DE GIBBERELLA ZEAE EN CULTIVOS DE ARROZ	Ulloa, Carolina	Cuenca
RCA	Cevallos Ortiz, Xavier	Cuenca
SMARTGLOVE-ONE	Montenegro, Johnny	Cuenca
SMART STOP	Trelles Cabrera, Flavio Daniel	Cuenca
BIOAMBIENTADOR	Torres Vásquez, Andrea	Cuenca
INDEPENDIZAR	Páez, Bernardo	Cuenca
CULTIVOS HIDROPÓNICOS	Robles, Santiago	Cuenca
BRANDUPS	Proaño Guevara, Daniel David	Cuenca
GREEN GARDEN	Miraba, Gabriela	Guayaquil
PLANTILLA PIEZOELÉCTRICA	Vizcaíno, Anaí	Guayaquil
ECOPEN	Vizcaíno, Anaí	Guayaquil
AUTO SEGURO	Tigua, Jimmy José	Guayaquil
BLOQUE ECOLÓGICO	Tigua, Jimmy José	Guayaquil
PHONE CARS	Ambuludí, Frank	Guayaquil

ENERGÍA ELÉCTRICA	Jiménez, Edgar	Guayaquil
COMUNÍCATE	Coca, Álvaro Andrés	Guayaquil
TURISMO CULTURAL PARA JÓVENES	Lecaro Cabrera, Carla	Guayaquil
ROBOT HEXCIPODO CON DIRECTOR ELECTRO ÓPTICO	Ulloa, Luis	Guayaquil
TRUE SOLUTIONS S.A.	Lozado Monsalvo, German	Guayaquil
STICKARGE	Suriaga, Josep	Guayaquil
CADENA DE DISTRIBUCIÓN DE ALIMENTOS DE ANIMALES Y SERVICIO VETERINARIO	Borja, Génesis	Guayaquil
PLAY UPS	Goya, Bryan	Guayaquil
MARDIZ S.A.	Torres, María	Guayaquil
HUECAS DE GUAYAQUIL	Contreras Pacheco, Génesis	Guayaquil
BICI DELIVERY	Henao, José Sebastián	Guayaquil
LOS LIDERES	Lozano, Alexis	Guayaquil
NUTRINAYCEN (coaching nutricional)	Anzules Collazo, Cesar Raúl	Guayaquil
ESAY SOFTWARE BUSINNES SOLUTION	Rosero, Sobeyda	Guayaquil
ENERGÍA BIODEGRADABLE	Carriel, Jean Carlos	Guayaquil
CITY TOUR NOMADAS	Chiluiza, Juan	Guayaquil
EQM	Quevedo, Eduardo	Guayaquil
EVRION	Caicedo, Laura	Guayaquil
ECOSEGURIDAD	Rosado Aguirre, Emilio	Guayaquil
WIESNER COOK	Wiesner, Gabriela	Guayaquil
READY CAR	Agurto, Lissette	Guayaquil
INDUSTRIALIZACIÓN DE LA FIBRA DE COCO	García González, Silvia	Guayaquil
GENERAR ELECTRICIDAD POR MEDIO DE LA BASURA	Garcés, David	Guayaquil
ENERGYMAX2	Loor, Cristian Alexander	Guayaquil
ENERGÍA BIODEGRADABLE	Carriel, Jean Carlos	Guayaquil
BN-RECARGAS	Racines, Byron	Quito
VIRTUAL	Celda, Milton	Quito
BEBIDAS FERMENTADAS	Suarez, Sandra	Quito
GUMBES	De La Torre, Israel	Quito
GRUPO DHARMA	Pozo, Alejandro	Quito
FERTI MILK	Guamán, Jessica	Quito
BIO DUO	Herrera, Madison	Quito
JORGE VALDEZ	Valdez, Jorge	Quito

AROMA A CACAO	Toinga, Lily	Quito
NUTRI APP	Topón, Andrés	Quito
IRIS	Vega, Anthony	Quito
TRIPOIDE	Bolagay, Patricio	Quito
PAMBACHUPA	Toapanta, Viviana; Patiño, Isis	Quito
DESECHABLES BIODEGRADABLES	Mosquera, Héctor	Quito
MI PAÍS TAMBIÉN LEE	Castro, Andrea	Quito
XZUMARRAGA	Zumárraga, Xavier	Quito
TOUCH SAFE	Oramas, Dayana	Quito
PROYECTO LUCY	Paguay, David	Quito
RESCATA ALIMENTOS	Carrillo, Natalia; Loja, Romeo	Quito
CONTABILIDAD APP	Nobayo, Angélica; Curay, Kevin	Quito
INTELIGENCIA ARTIFICIAL EN TRANSPORTE	Israel, Kevin	Quito
EDUMILES	Chucuri, Juan José	Quito
CHASKY GEL PROTEICO	Sánchez, Sánchez; Salazar, Telmo; Silva, Evelin	Quito
LIFE DRINK	Beltrán, Adriel	Quito
BACK TO SCHOOL	Romero, Aracely	Quito
FOODNEST	Simba, Edison	Quito
CROQUETAS	Emily	Quito
NANOTRON	Haro, Ronny; Escudero, David	Quito
NACAR	Arcos, Kevin	Quito
ARMONIMIEL	González, André	Quito
ROTEC (club de desarrollo tecnológico)	Valarezo, Arturo	Guayaquil
INNOV (prototipo de recreación y reciclaje)	Jaramillo, Erik; Vélez, Gabriel	Guayaquil
UNITRIBU	Feijoo, Steven	Guayaquil
FORTUNA'S CAFÉ	Coronel, Jalmar	Guayaquil
DOLCE VITA STOREB	Carbo, Kenya	Guayaquil

Source: CREAMINKA. Updated 2020

Table 10
Companies involved in StartUPS

StartUPS/empresa	Representante	Sede
River Rock	Luis Camargo	Quito Sur
uSHOPS	Javier Chicaiza	Quito Sur
AgroScan	Jhony Villacís	Quito Sur
GreenHouse	Luis Rojas / Joselyn Veintimilla	Quito Sur
Taller El Colibrí	Carolina Ramírez	Quito Girón
Fotosentidos	Cinthya Villacís / Alfredo Astudillo	Quito Girón
Fun And Fast English	Isis Patiño	Quito Girón
Yo Apoyo	Sandra Chamba / Tamara Méndez	Quito Girón
Ancestral	Telmo Salazar	Quito Girón
Biocomfy	Paula Salazar	Quito Girón
Tuleins.Com	Byron Villacís / Patricio Larco	Quito Girón
Quinto Pilar	Roberto Vallejo	Quito Girón
Basker Books	Nicolás Aldana	Quito Girón
Fly attraction tour	David Reyes	Quito Girón
Al Micro Tostado	Juan Esteban Ruiz Vásconez	Quito Girón
ID Makers	Andrés Castrillón / Daniel Medina	Quito Girón
Arketing	Jessica Ochoa	Quito Girón
Omniavi	Andrés Villareal / Saruk Maila / Andrea Castro/ Carlos Tamayo /Jaime Proaño	Quito Girón
Kichwa Muskuy	Juan Chucuri	Quito Girón
Su Despensa	Michael Mera / Richard Martínez	Quito Girón
Friendly tires	Cristian Chávez	Quito Girón
ENVIRONWISH	Hoover Silvana	Quito Girón
New Glass	Rómulo Cedillo	Guayaquil
WIESNER SWEET	Gabriela Wiesner	Guayaquil
Black Cat	Sergio Serna	Guayaquil
Little Gifts	Brigitte García	Guayaquil
Ale Green Rice	Alexandra Sánchez	Guayaquil
ECOODRIM	Saily Arana Peñafiel	Guayaquil

Source CREAMINKA. Updated 2020

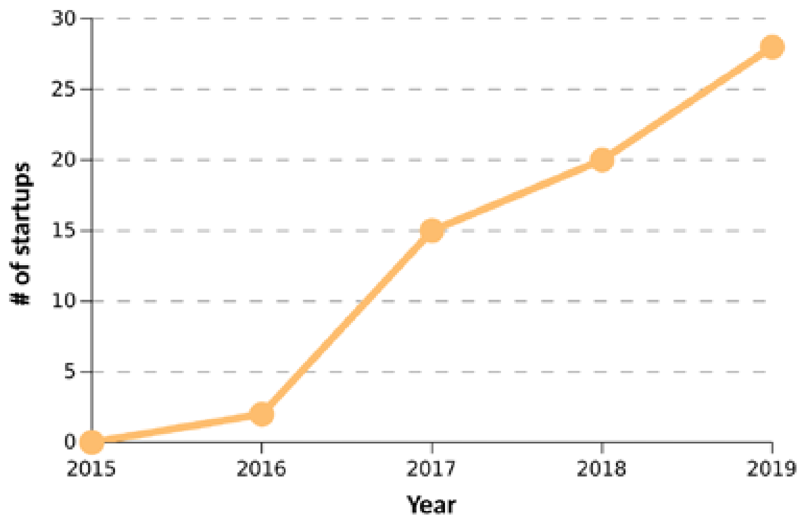
Table 11
UPS Incubator - SENESCYT Accredited Innovation Space

Proyecto	Representante	Descripción del proyecto
ESFERA FAYAK	Hétor Fabián Ayala Córdova	En la actualidad se tiene un prototipo de la Esfera Fayac, con la misma que se ha realizado la presentación del invento a varias empresas tanto nacionales como internacionales, se ha realizado la tramitación de la patente internacional con el sistema PCT por medio del IEPI, finalmente se ha realizado el respectivo acercamiento a tres jugueteras internacionales, las mismas que han manifestado el deseo de distribuir la esfera Fayac en sus tiendas a nivel mundial. Con el fin de fabricar la esfera, este proyecto persigue la búsqueda de una empresa o socio estratégico que financie la fabricación del producto, para luego entregar a las empresas jugueteras y se distribuya y comercialice.
JAVA2GINGA	Juan Sebastián Ochoa Ramos	Diseñar e implementar aplicaciones de TV Digital, que potencien el contenido audiovisual y puedan brindar espacios publicitarios adicionales para que los canales de TV puedan ofrecer como producto a sus auspiciantes.
BUS MOVIL	Erick Medina	BusMóvil es una aplicación para la gestión de la información para transportistas, y para la compra fácil de tickets de viajes interprovinciales e inter cantonales por parte de usuarios utilizando dinero electrónico.
SEEMSA	Milton Jimmy Morillo Muela	Es una maquinaria es para sellar plástico PVC –accionado por aire sistema neumático– o por fluidos sistema hidráulico estos equipos tienen la tecnología desarrollada para equipos de sellado por alta frecuencia.
CENTRIFUGAS CENTURY	Ray Jhon Valle Cortez	Contribuir con el sector público y privado de la salud, al producir de manera nacional equipos tecnológicos, los cuales se ajusten a los más altos estándares de calidad, a menor costo y con un servicio pre y post venta de nivel superior.
MYOPAY	Cesar Aurelio Honores Villavicencio	MyoPay es un proyecto que busca facilitar el uso de dinero electrónico a personas con discapacidades; utiliza tecnologías como RFID, Bluetooth, GSM, GRPS, además hardware libre como Arduino
KULL POSTER	Juan Marcelo Parra Ullauri	Kullk Poster, está basado en un concepto nuevo en Ecuador, los Smart Posters, es una herramienta publicitaria que aparte de contener información sobre un tema específico, permite la interacción con la misma. Hace uso de un Tag NFC (Near field communication) y de un código QR, que contienen información grabada. Smart Poster le permitirá al usuario el pago de los servicios básicos propios de la zona en que se encuentre el poster, enfocándonos en las zonas rurales.

Educational Innovation Groups

Since 2016, StartUPS has significantly grown and currently counts a total of 28 Startups formed by students in various productive sectors, such as agro-industrial, food and beverage, education, or social enterprises (Figure 50).

Figure 50
Annual growth of startups at the UPS



Source CREAMINKA

Table 12
Groups of educational innovation at the Salesian UPS (Initiative of the Teaching Vice-Presidency)

Grupo	Leyenda	Sede
Grupo de Innovación Educativa en Orientación Vocacional y Profesional	GIE-ORVOPRO	Quito
Grupo de Innovación Educativa en Ciencias Básicas y Ambientales	GIE-CIBA	Quito
Grupo de Innovación Educativa en Ciencias Administrativas y Económicas	GIE-INNOVADMIFIN	Quito
Grupo de Innovación Educativa en Lectoescritura	GIE-LECTO ESCRITURA	Quito

Grupo de Innovación Educativa Multimedia para la Enseñanza de Materias Técnicas	GIE-MM4TECH	Quito
Grupo de Innovación Educativa en Seguridad, Soberanía Alimentaria y Sustentabilidad	GIE-SYSAS-UIO	Quito
Grupo de Innovación Educativa en Innovación, Desarrollo e Investigación	GIE-IDI	Guayaquil
Grupo de Innovación Educativa Mejorando las Prácticas Áulicas	GIEMPA	Guayaquil
Grupo de Innovación Educativa en Tecnologías de la Información y Comunicaciones en el Proceso de Enseñanza - Aprendizaje	GIETICEA	Guayaquil
Grupo de Innovación Educativa en Matemáticas para la Web 2.0	GIE-MATH 2.0	Cuenca
Grupo de Innovación Educativa en Ciencias Básicas y Ambientales	GIE-DIÁLOGO DE SABERES	Cuenca
Grupo de Innovación Educativa en Didáctica y Metodología de Aprendizaje Administración, Contabilidad e Ingeniería Industrial	GIE-ADCOIN	Cuenca
Grupo de Innovación Educativa en Ingeniería de Automoción	GIE-IA	Cuenca
Grupo de Innovación Educativa Repensando la Educación	GIE-RED	Cuenca
Grupo de Innovación Educativa en Tutorías Académicas al Estilo Salesiano	GIE-TAES	Cuenca
Grupo de Innovación Educativa en Telecomunicaciones y Telemática	GIE-T	Cuenca
Grupo de Innovación Educativa en Seguridad y Soberanía Alimentaria	GIE-SYSA	Cuenca
Grupo de Innovación Educativa en Seguridad, Soberanía Alimentaria y Sustentabilidad	GIE-SYSAS	Cuenca
Grupo de Innovación Educativa en Tecnología Ambiental, Salud y Riesgos	GIE-TASRI	Cuenca
Grupo de Innovación Educativa en Formación Empresarial	GIE-EFE	Cuenca
Grupo de Innovación Educativa de Aprendizaje Significativo	GIE-APSIG	Cuenca
Grupo de Innovación Educativa en Neuroeducación	GIE-NED	Cuenca

Source: CREAMINKA

As we have seen, the centrality of the person goes beyond any terminology with respect to entrepreneurship or innovation. All efforts focus on the entrepreneur, who invariably learns, even if startups, spinoffs, etc. fail. The university environment is conducive to brave and learn from mistakes, while outside, conditions are more hostile and more difficult to cope with.

The UPS aims to constitute a Community of all, producers and a product of social innovation, where *trust* guarantees a new culture, where the person can build meaning and establish relationships with a new ethic, an environment in the pure style of Don Bosco, but in keeping with our times and the poverty the world is facing; a space that promotes values and offers young people the opportunity to develop their life projects by implementing the acquired knowledge in a participatory and collaborative manner.

University Spin-Off

Currently there is no definition of universal spin-off that would be generally shared, although in theory and practice we can find two or maybe three depending on the context (Poma & Ramaciotti, 2008). Shane (Shane, 2004) defines university spin-off as a new company based on the commercial exploitation of intellectual property in an academic institution. In the same line, Pirnay and Surlemont (Pirnay et al., 2003) define it as a new company created to commercially exploit knowledge, technology or research results developed within a university. For Koster (Koster, 2004), spin-offs are companies that are managed in the business sector or the university or government sector with a group of expert researchers who seek product innovation and, once they have the appropriate results to offer to the market, will consolidate with the support of resources from the parent companies where they have generated their full potential. For Steffensen (Steffensen et al., 2000), spin-offs are a new company formed by employees who left an organization, taking innovative technology with them.

In the university context, there are strong reasons that drive the creation of spin-offs, which they define as (Pazos et al., 2010) (Vendrell-Herrero & Ortín-Ángel, 2010) (Zahra et al., 2007) (Perez & Sánchez, 2003): (i) a source of technology transfer of university knowledge, (ii) facilitating companies for the growth of the local economy, (iii) the way to commercialize technologies developed in university environments, and (iv) "high technology" companies that act as catalysts for the creation and transfer of knowledge in innovation networks. It should be noted that the difference between an academic spin-off and a simple one is almost always defined by the participation or not of the university (Poma & Ramaciotti, 2008). Such university spin-offs also describe typologies that meet three criteria (Aceytuno Pérez & Cáceres Carrasco, 2009): the status of the individuals involved, the nature of the knowledge transferred from the university, and the involvement of the university in the process.

According to data from the 2015 World Economic Forum report "Leveraging Entrepreneurial Ambition and Innovation" (World Economic Forum, 2015), Latin America and the Caribbean have the highest concentration of entrepreneurial activity in the early stages, where Europe generally remains rather inactive. In Latin America, the countries with the greatest activity in innovation and entrepreneurship are Ecuador, Peru, Colombia, Chile, Argentina, Mexico and Uruguay. In recent years, Ecuador has ranked within the top ten in terms of entrepreneurial activity, according to data presented by the GEM, which measures entrepreneurship in around 70 countries (Maya-Carrillo et al., 2016). As part of the Change in the Productive Matrix and through Planifica Ecuador,[280] Ecuador pursues social and economic development based on a knowledge-based economy and the use of infinite resources such as knowledge, creativity and innovation (Senescyt, 2013). These organizations describe universities as the main providers of knowledge and technology, which, in addition to teaching and research, must be the architects of knowledge transfer, innovation and entrepreneurship to consolidate themselves as a productive facility for generating wealth and sustaining the knowledge economy.

The UPS has set itself some objectives for strengthening its innovation/entrepreneurship capacity:

- Create research networks through university/business collaboration agreements.
- Support the identification of potential inventions such as patents, prototypes, etc.
- Support the formulation and development of business plans for the creation of spin-offs.
- Hold thematic seminars and training sessions on patents and business culture.
- Effectively disseminate research results. (vi) Seek opportunities for co-financing and external or internal funding.
- Explore research of business and industrial interest.
- Generate spaces to promote innovation and entrepreneurship.

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To initiate and promote the formation of spin-offs, the UPS has developed important activities. In a joint effort between the UPS Vice-President's Office for Research and the Italian network for the Valorization of Public Research (Netval), initial training sessions were held in March 2017 on the importance of intellectual property, the creation of technology transfer units and the need for cooperation between universities, industry and society.

A search for university spin-off at the UPS leads to *PGwood Poly Green Wood*, a maker of new materials such as its outstanding new biological plastic material reinforced with natural fibers from Ecuador. It adds value to renewable natural resources that are in ample supply in our country (J. P. Salgado et al., 2017). This spin-off was born as part of a doctoral research project with Colombia, France and the Materials Research Group. Its achievements were recognized by winning the competition of the Bank of Ideas of the National Secretariat of Higher Education, Science and Technology (SENESCYT) and obtained a significant amount of seed capital, in addition to initiating the process of patenting its product.

Ecosystem Producers

The producers of the Research Ecosystem at the UPS are: Research Councils (Collective Action Councils), Ecosystem Acceleration, Research Valorization and School of Mentoring, and Change Management. They are in charge of a process of *photosynthesis*, so to speak, that starts from sunlight, from soil nutrients and coal gas, which, by analogy, in the Ecosystem University represent the recycling and transformation of the information produced by the decomposers into policies and opportunities for consumers. They are in charge of providing the financial, physical and management *biomass resources* to the *consumers*, while the biomass produced also serves the decomposers, i.e. the information produced by the financial and resource management, as well as the acceleration and valorization of the research is *metabolized* by CREAM-INKA to monitor the Ecosystem.

RESEARCH COUNCILS

The research ecosystem is viable only through polycentric management, where decisions are taken by different instances and once they are agreed upon, become regulations that govern the management of research. The Research Council at each UPS site (Cuenca, Quito, Guayaquil) is a Collective Action Council that unites the representations of the various rhizomes-research groups and actors that are part of the ecosystem (V. Ostrom et al., 1961).

Each Research Council as a collective action council is responsible for establishing rules for the use of resources that affect the structure of the action situation over which the actors have property rights, ensuring consistency between *appropriation-provision*. This dynamic depends on the consensus of the interests of the actors in the university. The actors define these consensual rules, which are flexible since they can be easily modified, but not because of lax compliance; the agreements established by the Councils include (Elinor Ostrom, 2010a) (Robles-Bykbaev et al., 2017):

- Limitation rules specify the regulations for choosing and discarding the actors of the research ecosystem for the different positions that will represent the research groups.
- Rule of positions and election to specify each of the positions and the number of actors holding those positions in the research ecosystem of the UPS, as well as the actions of the actors in those positions.
- Information rules to choose what information the council deals with should or should not be shared with the actors of the information ecosystem, and through which media it should be disseminated.
- Scope and aggregation rules that specify the results and also how intermediate or final results are assigned to each actor.
- Payment rules that specify how economic resources will be distributed to actors occupying different positions in the research ecosystem.

The following actions fall within the functions of the Research Council (Robles-Bykbaev et al., 2017):

- Analyze and approve the inclusion of new researchers into research groups.
- Analyze and submit research projects for approval.
- Communicate the policies and guidelines that come from the Vice President for Research, the Vice President for the site, and the Headquarters Research Coordination.
- Follow up the research projects on a quarterly basis.
- Evaluate the researchers.
- Decide on the relevance of the participation of UPS researchers in national and international conferences.

- Follow up the fulfillment of the activities of the Annual Operational Plan.
- Assign research coordinators to facilitate the decision of the Vice President regarding approval of expenditures and investments according to the objectives of the projects.
- Communicate to researchers the calls for publications and organize their participation in the courses.
- Grant economic incentives to research groups by indexing their scientific output in scientific repositories such as SCOPUS.
- Analyze procedures for patents, publications, prototypes, etc., and for working on projects with the participation of external institutions.
- Establish cooperation agreements with external entities that participate in the research projects.

In the praxis of the research council of the UPS, consensus has been reached that establishes rules and regulates the action of the different actors and groups of the ecosystem to guarantee appropriation-provision:

- The incentives for scientific production are awarded to the research groups once the publications are registered in SCOPUS. This was agreed because some publications were never indexed in SCOPUS or were eliminated from that scientific data base.
- Whenever a project is presented or closed, those responsible briefly present its most relevant aspects (5 - 7 minutes).
- The groups' research capacity must be taken into consideration. If more than 50% of the project budget goes to external contractors (consultants from one of the UPS areas: Systems, Electronics, etc.), the research is inappropriate since it is practically done outside the university, which appears not to have its own researchers to carry out the process. This does not apply for parts of the work have to be outsourced such as graphic designs, elaboration of plates (with equipment unavailable at UPS), etc.
- When projects are carried by external institutions, it is important to consider aspects related to the contribution of each institution (both in economic terms and in terms of human talent), in order to establish rules of procedure for patents, publications, prototypes, etc.
- Funds for the presentation of articles are not regarded as part of the project budget, and are covered by the analytical accounts of the research groups.

- It is important to establish cooperation agreements with external entities that will participate in research projects.

Through providing contributions, the research council takes into account ethical responsibility, working conditions (C. Felber, 2017), social and environmental conditions, as well as congruence with the rules of appropriation and provision; also the participation in the processes of change and rule making by the main actors. Resource allocation is monitored, and all actors are accountable for the resources they use.

Based on these rules and best practices used in the exercise of each of the Research Councils, different actions are carried out such as: generating mechanisms to define intellectual property, forming rules to present projects, managing resource funds of innovation projects, managing the international mobilization of actors and providing resources in general.

There are several views on definitions and epistemological differences of research that occur in our University Community. The diversity of criteria is most notable when we link research and innovation, research and development of technology, research and teaching, research and linkage to society, among other fields, where research is a component of university work. But the consensus on the collective will for research to define our University is evident. It is from this consensus that this document gathers statements, convictions and ideas that we must translate into organic and operational proposals.

The agreements expressed below have been drawn up by the University Community on various occasions and collected in the Cuaderno de reflexión Universitaria 14 (Herrán Gómez et al., 2014). These agreements are the basis for the regulations made later by the Collective Action Councils, which the UPS calls Consejos de Investigacion de Sede [Research Councils of every UPS site].[281]

- A University capable of responding to the demands of society, of raising new issues and questioning itself.
- University education as a life project of the student, socially responsible and as a main actor able to raise questions and problems to which it offers critical solutions based on ideas and knowledge.
- We understand the University as a place that considers the future of society.

281 Ostrom defines different levels of governance of a Common Pool Resource, among which are the Collective Action Councils that, among other things, regulate the forms of appropriation and provision of the Common Good.

- A University where the formation of competencies and the mastery of science know-how transcends the communication of learned knowledge, going on to the growth of critical and reflexive capacities that build the foundation of the scientific course and give a democratic sense of autonomy in the construction of knowledge.
- Research for us is not a contribution to instrumental reason to solving problems and demands of the business sector or government, but the result of the capacity to question oneself.
- Research for us is a consequence of critical reason. It is necessary, therefore, to maintain in the University the dynamic relationship of conflictive but fruitful dialogue between critical reason (meaning, justification, questioning) and instrumental reason.
- We recognize the impact of research results on university rankings, which we take into account but do not consider to be an objective guarantee of the nature and raison d'être of university performance.
- Research plays a crucial role for personality building and the development of students' capabilities.
- The student not only learns and replicates knowledge, but also discovers the dynamics of how knowledge is produced from research.
- Research develops the critical and creative capacity to establish a distance from knowledge, helping to form moral judgment, which is the basis of free citizens, both at people's workplace and in their private and community life.
- Research is a clear objective that boosts university management and marks its style and model, capable of combining the efficiency imposed by the environment with freedom of proposal.
- Research is a university dimension that permeates and is present in all areas of the University. We have declared ourselves to be a Scientific Community to the extent that, based on our responsibilities and duties, we contribute to promoting research and the activities of those among us who are dedicated to it.
- We are committed to our values of reciprocity and co-responsibility to overcome difficulties and limitations that obstruct the development of research at our University.

School of Mentoring and Change Management

Mentoring has become increasingly popular in training and education management (Daresh, 2004). In fact, it has become an accepted and vital part of the development process in many professional fields since its main function is the production of knowledge, where more experienced people guide less experienced ones (Merriam, 1983).

Far from being a *psychological trainer* (Freire, 2018), the point is to re-value the teaching role in educational training, realizing that the mentoring experience increases student attendance and participation, fostering the development of positive attitudes, creativity, awareness of the political environment, feedback, confidence, development of technical skills, cohesion, responsibility and sense of belonging (Jekielek et al., 2002); Allen and Eby (T. D. Allen & Eby, 2011) also see the benefits for the mentors and for the educational organization.

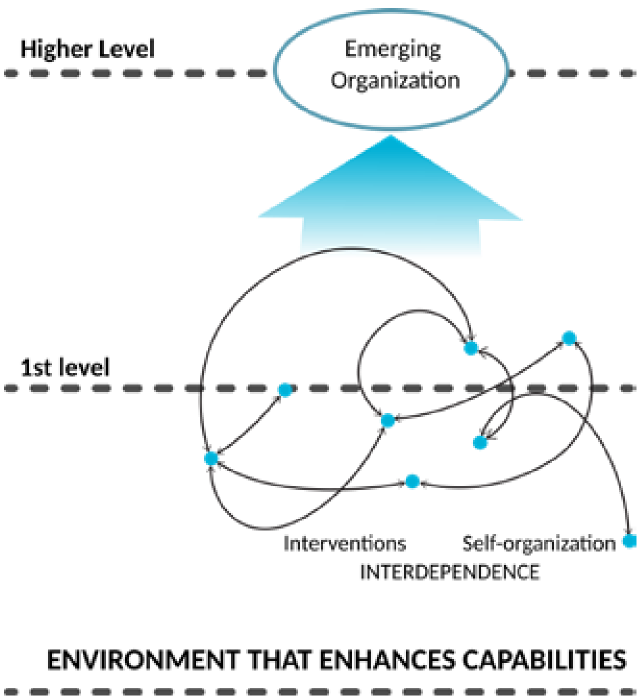
Both the mentor and the learner expand their creativity, sense of purpose and fulfillment, find a partner in learning, generate new knowledge and cognitively rejuvenate; simultaneously, the organization strengthens synergies, improves performance, productivity, job satisfaction, enthusiasm, collaboration, motivation, development of a talent pool and promotes organizational communication. Therefore, the mentoring school can be commended as a program that offers the construction of identities in addition to adequate opportunities for personal growth and professional development of students and teachers, (Alexander et al., 2014). In other words, the Mentoring Ecosystem action that shapes mentoring changes the way people think and act by sharing a vision of teamwork (Senge, 1990).

Complementarily, following the implementation of the mentoring school, we observe change management is facilitated by creating new organizational contexts defined by the circumstances, conditions and contributing forces that affect the way participants connect, interact and learn (Dominguez, 2012). Against this backdrop, change management is based on the following notions (Kotter, 1996): establishing a sense of urgency and defining the challenges; creating the guiding coalition and bringing together a consolidated group in order to influence change; developing a strategy to direct the change effort; communicating the vision of change, using all possible vehicles to promote the new vision and strategies; empowering employees for action; generating short-term successes and creating new opportunities; consolidating benefits and producing more change by promoting the development of people who can implement a vision of change; and anchoring new approaches in the culture, connecting members to formalize better performance. With this caveat, one can surmise that mentoring schools focused on change management operate as agents for sustainable learning (Hesselbarth & Schaltegger, 2014).

The emergence of shared ambition based on the action of people is the basis for the school of Mentoring and Change Management that will initiate a process of adaptation and spontaneous transformation. This process obeys a cyclical non-linear logic, and is somewhat more complex and much richer than traditional models of planning for change.

Emergent behavior is characteristic of complex adaptive systems,[282] where interactions, self-organization and responses of actors lead to a superior state system (Figure 51). This is also true for human collectives, which are able to share and exchange memories and experiences, transmit knowledge and skills and stunningly advance their collective abilities, which brings out their own specific cultural identity.

Figure 51
Emergence of the organization



Elaboration: Salgado-Guerrero, J. P.

282 Cf. the glossary.

Evolution is responsible for the emerging phenomenon; as a group, its intelligence is greater than the sum of its individual parts; hence, a significant aspect of emergence is that of individual components or agents.

The emergence of the organization leads to values and valorizations[283] that encourage change as these are created in a specific context and are in a state of permanent construction of identities.

By using the metaphor of thermodynamics, we earlier observed that adding energy can increase the entropy[284] of the system. This increase in entropy implies the interaction between the actors and the consequent strengthening of states of knowledge production; [285] to promote this phenomenon, we have set up a series of camps called BootCamps in the UPS, using a custom-made methodology[286] for each event.

As can be seen in Figure 52, university students are invited to participate in Mini-BootCamps, where they are introduced to eco-systemic logics without scholarly explanations or didactic mediation, but rather learn through the experience of being embedded in those logics. This aims to establish the centrality of a project that combines research, innovation and entrepreneurship with the individual's personal circumstances.

Once the possibility of a project has been established, and people have become aware of existing and potential opportunities, those who wish to continue the process participate in a new BootCamp called ReCRÉATE, which develops the vision through ideation techniques. Finally, those who managed to make a concrete proposal will participate in a much more important event, the BootCamp rETHOS, which strengthens the bases of the project through intensive training, taking advantage of the opportunities offered by the Ecosystem Acceleration[287].

283 There is no such thing as a value without a value based on the opportunities that bring about change.

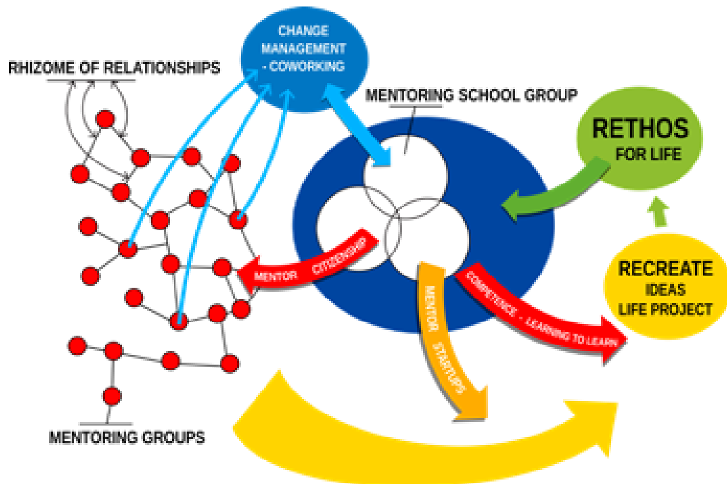
284 Cf. the glossary.

285 Cf. knowledge-organization hurricane in the glossary.

286 The BootCamp methodologies have been created in a strategic alliance between UPS and INTEGRAR Cia.

287 Cf. the glossary.

Figure 52
Cycles for the Mentoring and Change Management School



Elaboration: Salgado-Guerrero, J. P.

A group of students with promising innovative projects or skills to carry out change management will then become part of the School of Mentoring and Change Management, where - based on a participatory action-research methodology (J. P. Salgado et al., 2016) - they activate the Ecosystem by mobilizing the bases of the University with various activities such as Mini BootCamps, thus closing the cycle that sustains the Ecosystem and builds community.

Along with their Mentoring Teachers, students who have participated in the School of Mentoring will manage the StartUPS Co-working spaces.[288] They are part of an environment that enhances capacities, [289] and therefore become the main actors in their training process. In addition, they contribute to optimizing the Ecosystem because, as can be seen in Figure 52, they are the ones who define, together with the Ecosystem Acceleration, the joint policies and agreements that will be developed at the next level of organization.

Change management is continuous and consequently has a different vision:

288 Cf. the glossary.
289 Cf. the glossary.

- Initially provisional and reactive it becomes continuous and assumed as normal.
- Initially a rupture, it turns into a range of opportunities.
- It goes from a linear logic of cause and effect to a non-linear logic of continuous revolution and incremental innovation.
- Initially a specific and planned event, it becomes a continuous, permanent and dynamic learning process.
- Initially seen as abnormal and regulated, it is eventually understood as normal and creative.
- Initially a calamity and therefore necessarily controllable, it becomes accepted as an unpredictable and uncontrollable turbulence.

This perspective is possible only when we face the Change in Community, assuming the creative and undisciplined identity[290] but at the same time creating common agreements, values and valorizations[291], as well as in the norms of appropriation-provision[292] of the Common Good University.

Trust is the value over others that we can perceive in the School of Mentoring and Management of Change; it breaks the cycles of violence, and rebuilds relationships of reciprocity that are the basis for synergies, but trust also raises new values and valorizations that recognize the identity and cen-

290 The University must be capable of incorporating new knowledge thought from different places, languages and logics, to guarantee the universality of science; it is the indisciplines as opposed to the disciplines that liberate the University from the universal conception of a single thought. The capacity to learn in society, opening it up to a world that recognizes the spaces of novelty, the suspected and the unheard of, allows the recreation of the University, and to choose its meaning, understood as action and reason for being, and the way in which it responds to the conditioning of the context. In other words, indiscipline in analyzing, criticizing, identifying, signifying, and communicating is a sine-qua-non condition for university autonomy. Although our aim to understand science will irremediably lead to fragment the indiscipline, the same research spirit demands that we make systemic relations more complex for a complete and non-mutilated understanding of science; it would seem, then, that it is the indisciplines rather than the disciplines that provide the University with the capacity to produce pertinent and transforming knowledge. The mere fragmentation of the sciences into disciplines dematerializes the condition of science, transforming it into a specialized phantom.

291 There are no values without valorization, the self-organization of the ecosystem favors the emergence of these values from the bottom up, so that once are agreed upon, they consolidate and permeate the organization from the top down.

292 The regulation of the appropriation-provision of the CPR depends on the common agreements and responsibilities, product of the Collective Action Councils.

trality of the person, a university for people, where the human BEING transcends and evades any attempt of *reification*.

For the UPS, created with the inspiration of Don Bosco, this process is a rediscovery of the oratory[293] and a redefinition of the concept of preventive action; it is the recognition that the human BEING cannot be reduced to a *stick and carrot*, but that the development of the person makes it possible for him/her to act with critical reason and moral judgment, which is the basis of all citizenship.

We are not puppets in God's hands, but people with responsibilities. Preventiveness takes on a different meaning, the parable of the fig tree clarifies the picture. God is a fundamental gift but this cannot be a substitute for what each person must do – namely recognize that he is unique and that he has an assigned task for which nobody else rewards or punishes him; fulfilling it is the reward and not fulfilling it is the punishment. The task of the human being is not to do something, but to make himself, i.e. to grow in the conscience of his true BEING and to live that project to the fullest; it involves reaching a level of liberation that allows him to do this or that; it is the base of "*da mihi animas caetera tolle.*"[294] S*alvation*[295] does is not mean to do or to obtain something, but to discover and to live the reality of one's true being, which is identified with God.

Don Bosco confronted the society of the industrial revolution, marked by individualism, leading people onto a path of responsibility such as the sense of preventiveness, in the search for the transcendent, accompanying young people to rise above the oppression that impairs their development, helping them to respond to a world that is increasingly immersed in uncertainty, complexity and diversity; for him, this is the way to defeat individual-

293 In the Salesian world, the oratory is the entire cultural environment in which the educational process takes place. It is that system of encounter and academic and pedagogical reciprocity that serves as the bases for the academic community that researches or the scientific community; rather than being structures and institutions, these are ways of being, of relating to one another, of responding to life; they are profound attitudes of each person, they are fundamental choices of life projects (Herrán Gómez et al., 2014).

294 *Da mihi animas caetera tolle* translates as: Give me the souls and keep the rest. This phrase is attributed to Don Bosco and is the motto of the Salesian Congregation.

295 For the Catholic Church, Christ is Salvation, and is summarized in his message "Thou shalt love the Lord, thy God above all things, and thou shalt love thy neighbor just as I have loved you." Pronounced by Christ it means even to give one's life for others.

ism; precaution for him is to put in place all necessary means to achieve what one wants, in this case, saintliness.

What is the challenge of precaution in the current global crisis? We must take into account that it is not only a crisis of the system, but a crisis of education that reproduces the system, because it is education for information and not for understanding, and prepares people for exams and not for thinking for themselves. An exam does not measure the capacity for understanding but the capacity to repeat. An education that is concerned with the emotional aspect and with awareness, that focuses on the part that gives meaning to life; and life requires much more than a forced conceptual education. We need the capacity, for example, to be amazed, to see beauty; we must make sure that the attempt to educate for civility does not bury naturalness and spontaneity.

Precaution based on responsibility today faces a greater challenge than a hundred years ago, since the human being of our time maintains a double individualism: We not only face the selfishness of society that seeks to impose its individual *self* on the collective *we* without affecting coexistence, but the *market society* has created a new selfishness that seeks to impose the *me* over *you*, where otherness becomes secondary and coexistence even becomes an annoyance.

Poverty remains ubiquitous, although it is not only evident in the material. Even worse, the search for material success has led modern man to withdraw and concentrate on himself, producing individualistic egoism that pushes him into even deeper poverty: loneliness or desolation.

However, responsibility-based precaution requires us to believe in the person, in his potentialities and his capacity to free himself from what oppresses him. It does not presuppose that the human being is bad by nature, and it is true, it is not that we were more selfish than before, but the *market society* has made such selfishness a prerequisite for survival. It is common to hear today that in order to *succeed* we need to compete with each other. The logic of the market leads us to *sell* ourselves as dearly as possible and to *buy from others* for as little as possible, which imposes a *win-lose* instead of a *win-win* ethic in relations with society; this selfish isolation of the individual produces as a consequence a *dis-society* where the ruptures of relations are violent and in turn generate violence.

Violence is therefore the heart of the matter from where we untie the knot. Precaution based on responsibility implies that, through *trust,* the person can develop cognitive skills such as critical thinking and creativity, emotional, social and communication skills that facilitate empathy, solidarity, mutual respect, cooperation and restoration of interactions destroyed by violence. Only by breaking the vicious cycle of violence that generates violence can we speak of a society of peace built by *good Christians and honest citizens.*[296]

ECOSYSTEM ACCELERATION

The acceleration of the innovation ecosystem from a complex adaptive systems theory approach (Jucevičius & Grumadaitė, 2014) is based on trying to describe the various actors and the interrelations between them knowing that they are unpredictable. Starting from this diagnosis of the ecosystem, we can enhance, neutralize or change it. One can say that an innovation ecosystem does not depend only on its elements, but even more so on its interactions, interdependencies, identity, culture, meaning, networking and cooperation capacity, where these assertions are aligned with the conception that the whole is much more than the sum of its parts.

Biomimetics of the rules of a natural ecosystem extrapolated to a research and innovation ecosystem helps to have more clarity when generating strategies that drive change actions since they can be mostly positive but unpredictable due to systemic complexity. This systemic complexity within innovation ecosystems is proposed by Jackson (Jackson, 2011) as the relational complexity that is formed between actors or entities whose fundamental objective is to enable technological development and innovation. Knowledge is the heat-energy produced by the work of the actors that interact in the form of biocenosis in the environment surrounding the biotope.

The acceleration of the innovation ecosystem addresses concentrated efforts in three space-time dimensions and five strategies. The first dimension is analogous to the ecosystem's atmosphere and hydrosphere, for our case it will be culture and meaning. The second is the biosphere where life is produced in the ecosystem, in our case, the dimension of cross-pollination[297] and, finally, the lithosphere where the stakeholders and investors are located (Figure 53).

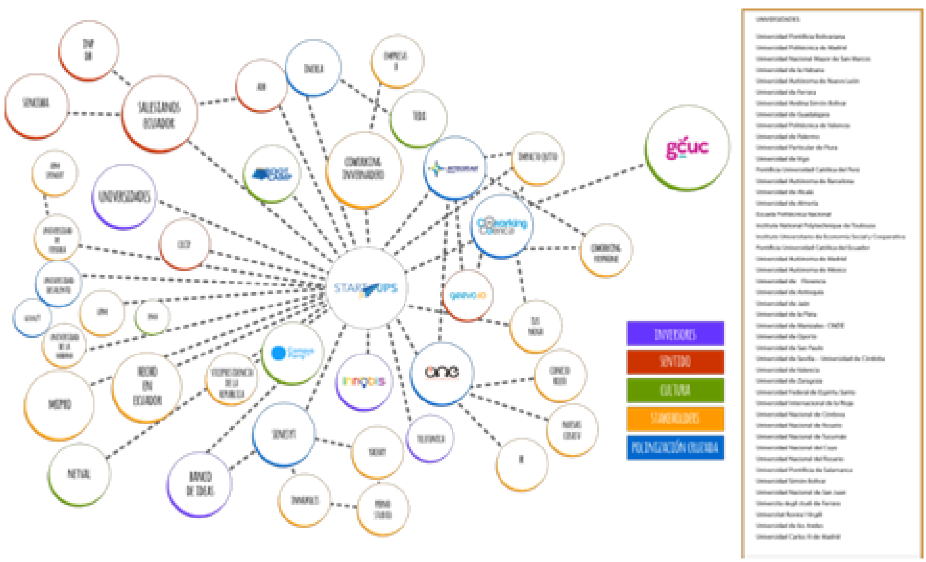
296 The Salesian educational model seeks to confront scenarios of violence by returning young people to society who follow a new concept of humanity: *"good Christians and honest citizens".*

297 A popular folk tale provides the following parable as an explanation for cross pollination: *"There was a farmer who had the best crop of corn that would win him the first prize in the village fair year after year. And yet, each time he would bring one quintal of the most select of his crop to share with all other participants; someone eventually asked: "How can you pass on your best seeds to your competitors? Don't you fear that they might outperform you?" Replied the farmer: "Don't you understand that the bees that pollinate their plants will also pollinate mine?"*

Figure 53
Classification of macro-ecosystem actors

Elaboration: Salgado-Guerrero, J. P.

Figure 54
Example of relationships between actors who intervene as investors, contribute meaning, promote culture, constitute stakeholders, cross-pollinate the open ecosystem of the UPS



Elaboration: Salgado-Guerrero, J. P.

Figure 54 shows the strategies to be developed with the actors:

- Cross-pollination[298]: The biosphere, understood as the place where the life of the university ecosystem takes place, is propitious for promoting networking among the actors, generating the fortunate and casual encounter of two worlds that will produce innovation (Maldonado & Horowitt, 2016). It is a task that demands the exchange of *knowledge-energy* and *resources-biomass* between the different actors. This is where producers, decomposers and consumers come into play, with consumers being those who demand energy from producers - understood as knowledge and biomass in the form of physical and financial resources. Both producers and consumers convert the biomass resources into organic matter (information from knowledge products) which is metabolized by the decomposers (CreaMinka) who recycle this matter and feed it back to the producers. This flow of information helps producers diagnose the ecosystem and execute strategies for consumers.
- Culture:[299] The atmosphere and hydrosphere environments are vital for survival in the biosphere. Within the innovation ecosystem, propagating and cultivating a culture that values the dynamics of innovation and supports the actors is essential for sustainability.
- Sense:[300] Just as culture is presented in the atmosphere and hydrosphere as a vital part that sustains the biosphere, the commitment of the actors involved is developed through the construction of a collective vision that starts from the present and is projected in time with shared values, which calls on different subsets to be part of the whole ecosystem.
- Stakeholders: As a lithosphere, it forms the environment in which the actors of the biosphere live and seek to enhance the system. This translates into the capacity to interconnect the different leaders and stakeholders who are involved in the ecosystem to execute actions for

298 A popular folk tale provides the following parable as an explanation for cross pollination: *"There was a farmer who had the best crop of corn that would win him the first prize in the village fair year after year. And yet, each time he would bring one quintal of the most select of his crop to share with all other participants; someone eventually asked: "How can you pass on your best seeds to your competitors? Don't you fear that they might outperform you?" Replied the farmer: "Don't you understand that the bees that pollinate their plants will also pollinate mine?"*

299 Part I addresses the development of a Culture as a strategy in greater detail. Cf. Index or glossary of terms.

300 Understood as direction and and raison d'être.

change and thus, involve them in the governance of the ecosystem and carry joint actions.

- Investors: Like the stakeholders, they also make up the lithosphere. They play an important role in enhancing the ecosystem as they are able to provide energy and biomass to the biosphere to implement change. In the form of investment capital, this energy can be characterized as: private equity, venture capital, funds and banking.

It is also fundamental to monitor the interactions with the environment, since - as we said before - these make an important contribution of knowledge (energy) and resources (matter) that can increase the internal entropy of the university, and therefore mobilize the flows of the ecosystem in addition to motivating the evolutionary leaps.[301] The CREAMINKA platform performs this continuous monitoring at the UPS. The results of these interactions are shown in figure 55:

Research Valorization

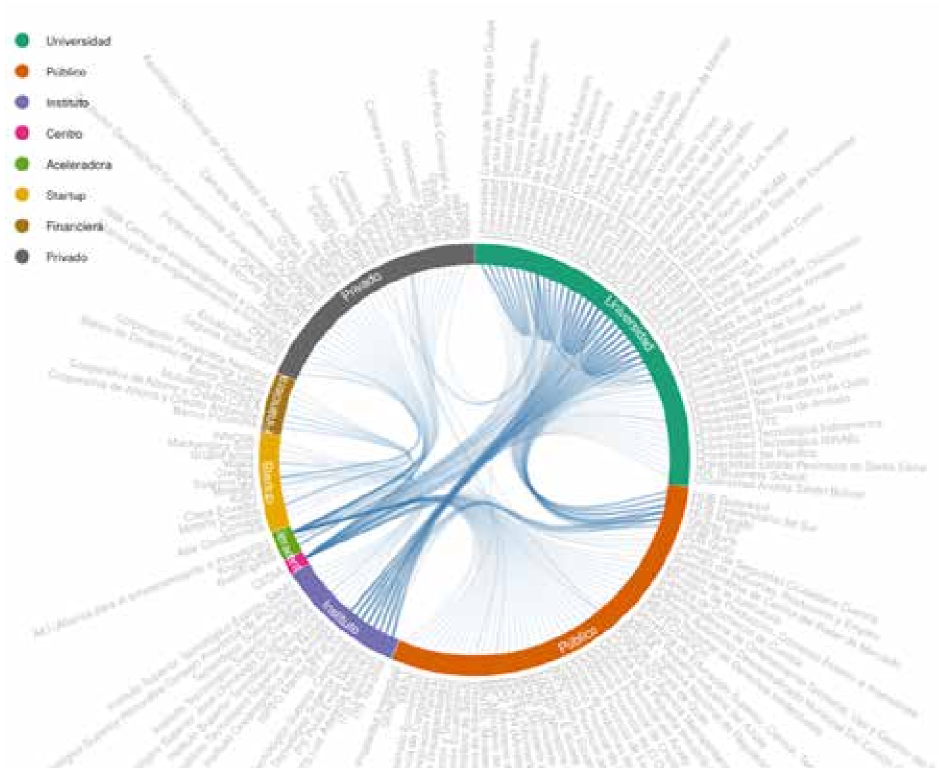
The relations between the university and society are generally understood as university-business relations or productive fabric because of the conditioning of a development model focused on economic growth. On the other hand, the term coined for this relationship is technology transfer, and reduces the scope of applicability to emerging technologies resulting from university research for the industry.

Faithful to its mission, the UPS prefers to speak of the valorization of research that includes not only the technological world but also the world of social sciences. Therefore its scope of application also covers the various social sectors beyond the industry and the productive fabric.

As we said before,[302] knowledge is not only susceptible to transfer from the university to the field, but it can and must also be co-produced with the context in which the university is embedded. Only then can knowledge be pertinent, relevant and transcendent.[303]

301 Cf. the glossary.
302 Refers to the knowledge-organization hurricane, cf. glossary.
303 Cf. the glossary.

Figure 55
UPS external synergies



Source CREAMINKA. Updated 2020.

In recent years, numerous studies have been carried out addressing the relationship between university and industry, especially from three perspectives:

- The studies on intellectual property in the U.S., which are fuelling the controversy of open science. This tendency arises from the 80's due to the influence of the typology of university registers and property, of the Patent and Trademark Act, better known as the Bayh-Dole Act (Jaffe, 2000) (Mowery & Ziedonis, 2002).

- In the 90's, European studies first use the model of the triple helix focused on the triple relationship between university, industry and state (Etzkowitz et al., 1995) (Etzkowitz & Leydesdorff, 2000).
- The recent phenomenon of academic entrepreneurship, spin-offs, startups, etc. has been developed mainly by European-based scholars (Shane, 2004) (Howells, 2006) (Link et al., 2007).

Once again, we are faced with the problem between critical and instrumental reason, which this book has addressed several times. The search for a balance is fundamental, otherwise researchers will run the risk of becoming seekers of opportunity rather than truth.

The fact is that a healthy production of knowledge requires an ecosystem larger than the single university, and where the particular parts converge to form a shared objective (Table 13).

Table 13
Relations between university-state-company/society

Program	University	Society	Government
Research program	Conditions for learning and incentives	Adapt to the demands of the context	Consolidate economic and social development
Property records	Overcome conflict with open science	Need for protection	Useful as a measure of knowledge
Spin-off and startups	Positive management of tension at the university tensions turns into venture	Possibilities of complementarity	New range of businesses
Scientific productivity	Can be stimulated by collaboration with business- company	Greater interest in applied results of publications	A means of knowledge dissemination
Information	Based on business-company requirements	Based on university research capacity	Based on both components
Managerial capacity	Low	High	Depends

Reaction times	Lengthy	Faster with respect to the university	Depends
Competitive-ness	Generally ignored	Main objective	Depends
Knowledge production	Main objective	Can contribute to university research	Can create combined knowledge
Territory	Greater emphasis on local context	Territorial focus	Local focus in international context

Elaboration: Salgado-Guerrero, J. P. on the basis of Poma (Poma & Nicolli, 2011)

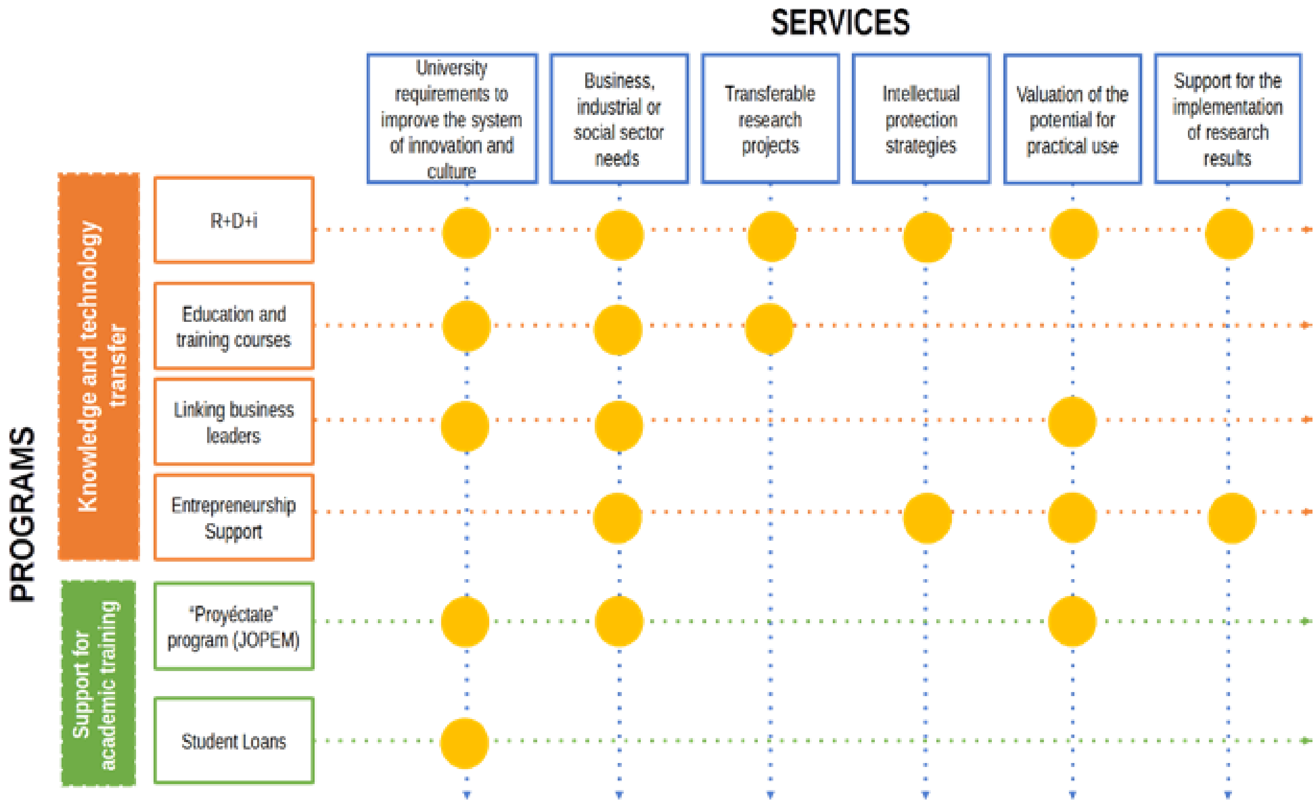
Interacting with the field implies transformations for the university, especially at the action and *bottom-up* level. It requires executing arms that can focus and invest energy in management that can become too bureaucratic for the university; it also requires a network with local strategic allies to help support the territorial implications of knowledge transfer and co-construction.

Although the spectrum of action is very wide and the challenges are multiple, the UPS has devised the active participation of a non-profit foundation with legal independence as a strategy, as a connecting link between university and society, and the mission of serving as a bridge between academia and society.

The Youth for a Better Ecuador Foundation (JOPEM) was resuscitated in 2019 with the objective of promoting synergies between academia and the different actors of society by generating knowledge and technology together with the social and productive sector. To this end, JOPEM has proposed the following services (Figure 56):

- Generate and consider Viable Operational Proposals in response to university requirements to improve the system and the culture of innovation.
- Gather and manage information to identify and accompany potentially transferable research projects.
- Collect information on the needs of business, industry or society.
- Advise researchers on the definition of the best strategy for intellectual protection of their creations or inventions.

Figure 56
Programs and services of the JOPEM Foundation



Prepared: Soriano B.

- Validate the potential usefulness of the invention or creation with potential stakeholders in the business, industrial, public or private sector.
- Search partners who may be interested in implementing the research results; and support negotiating conditions for concluding follow-up transfer agreements.

1. Training and capacity building courses. Seeking to improve business and academic conditions, JOPEM creates training courses on current issues that motivate the development of innovative initiatives within different business areas; seeking support from nationally and internationally recognized experts for these workshops creates multiple benefits. The main objective of these courses is to train participants to create ideas that impact their organizations, applying tools of sustainability and competitiveness.

2. Connecting business leaders. For JOPEM it is important to connect top managers and, therefore, it has devised courses, workshops and meeting spaces that aim to identify and value what the different areas of their companies generate, looking for cooperative innovation of the different sectors of the economy with a view to joint development.

- Innovation programs for CEO's
- Academia as a partner for innovative processes
- Setting up regional networks

3. R+D+I: The Foundation acts as a hub between business initiatives based on its needs and experience, and the knowledge and technologies developed by research groups at a national level. JOPEM facilitates mutually beneficial relationships, where companies from different industrial sectors obtain relevant information for their innovation processes thanks to the work by researchers in different areas; at the same time, researchers have the opportunity to validate their findings and become involved in new issues raised by companies through the following types of links:

- R&D as a shared challenge: Collaboration between academia and industry for a research and development (R&D) project to generate new technologies, products or processes of common interest. Collaborative R&D is a modality used in national and international programs, as well as in public-private consortiums, technological platforms and integrated projects. Funding is provided by the two sides, which have to agree on the modalities.

- R&D on demand: University participation in meeting challenges from external institutions, which provides all or the bulk of necessary funds to carry out related projects.
- Direct transfer agreement: Transfer of legal authorization for the manufacture, use and/or commercial exploitation of technology and knowledge protected by industrial and/or intellectual property rights. Existing university know-how can be sold to the industry.
- Technological alliance: Collaboration between the parties to share assets, risks, costs, benefits, capabilities or resources around the development and exploitation of technology and knowledge. These agreements usually include technological, commercial and management aspects (creation of a holding company to market an innovative product).

4. Support a Project: JOPEM promotes the growth of opportunities for entrepreneurs, providing support and incentives through spaces that facilitate interrelations and mutual contributions that allow the creation of an environment conducive to acquiring the necessary resources for advancing projects:

- Spaces for meetings with entrepreneurs
- Contact with specialized mentors
- Private meetings with potential investors

5. Proyéctate JOPEM Program - For JOPEM it is important that young people link up with industry. Alliances with different companies help finance part of their education and offer opportunities to get to know the world of work. This generates value for them and for the training companies, which add young, proactive people to their teams with new ideas that boosts innovation.

The Program of Proyéctate JOPEM Internships offers qualified and motivated students the opportunity to get to know a company in depth, broaden the scope their academic knowledge and experience in applied research, and improve their skills through working in diverse environments.

The program will be certified by the Chamber of Industries of Azuay, the company and UPS.

Decomposers of the Ecosystem University

The analogy of the role of decomposers in the Ecosystem University is based on their capacity to transform organic matter (financial information and knowledge management in the case of the university) resulting from the process of transformation of energy (knowledge) and biomass (financial resources) by producers and consumers; they recycle all these elements to transform them into inorganic matter (diagnostic information and monitoring of the Ecosystem University) which is part of the elements necessary for the functioning of the processes of producers and decision making of its actors.

In the UPS case, the role of the decomposer is played by the team that works in support of the CREAMINKA platform. This platform analyzes and diagnoses at a micro and macro level the ecosystem of the university and is supported by various techniques of artificial intelligence, data mining and knowledge modeling that provide services understood as a flow of energy as knowledge that is useful to other actors in the system. Based on the analysis of the actors within the different groups of the ecosystem, we can *analyze the development of individuals* through the competencies they obtain by interacting with the ecosystem through creating entrepreneurial projects, and participating in training events or in the processes of scientific production. The work dynamics of the research groups is also reflected by *entropic analysis* that highlights both the *resilience footprint* of the indicators that show the strength and different reality of the groups; adding factors such as scientific production, will produce a picture of the *macro results* of the ecosystem.

CREA MINKA: ECOSYSTEM PLATFORM OF SMART TOOLS

Analysis implies looking at knowledge products and derived concepts not as data, but as results of the interrelations of the fields of knowledge and the nodes of knowledge production, which constitute science. These nodes of knowledge production lead to new fields of specialization and at the same time to complex inter- or trans-disciplinary fields, results of theoretical accumulations or epistemological ruptures.

This vision goes beyond the *organization that learns*[304] with the mind and not the body. Moreover, it values *trial-and-error* learning, which Senge considers to be an illusion. The creation of knowledge in an organization is not a question of accumulating bits of data and information, but rather a process of personal self-realization, which yields organizational benefits. Therefore, the personal relationship (ideals and ideas) with one's identity with the organization and its mission, as well as freedom of action become fundamental.

Creating knowledge means creating organization. It is not the responsibility of a chosen few responsible for strategic planning and R & D & I,[305] but for everyone in the organization.

A production of relevant and transformative knowledge implies:

- Not mistaking information for knowledge, promoting the unique - albeit conflicting - dialogue between critical and instrumental reason. It is important to go beyond the management of data and information that satisfy consumption and utilitarian demands and provoke the production of knowledge with communication and action in society.
- Conceiving knowledge as a potential for human development, which favors its promotion and transforms its environment 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, and reifies it as a commodity producing social asymmetries regarding access and use.
- Understanding knowledge as dialogue between science and know-how, seeking truth not only in what is true but also in what is real, which returns the person the possibility to produce knowledge that responds to specific endogenous epistemologies, privileging systemic logics and going beyond a unidirectional logic, where one person produces and another one uses knowledge.

304 "*Learning organization*" is a concept developed by Senge that reflects the model deeply rooted in the tradition of Western management. From Frederick Taylor to Herbert Simon, it is a vision of the company as a machine to "process" information (Senge, 1990).

305 Research & Development & Innovation

While it is true that novelty alone cannot be a measure for information, it has even less so an exact mathematical relationship with the knowledge that can be produced. The concept of novelty is linked to uncertainty and this in turn, to the entropy of the Ecosystem. The latter has a great potential to describe what happens in the Ecosystem. Its dynamics is related to the processes of self-organization, resilience, development areas, knowledge production, innovation and sustainability[306].

Novelty implies the potential for the creation of new states of knowledge production. The monitoring of its variance is an indicator of the behavior of the group that produces knowledge. This is possible because the data assumed for the modeling refers to results of events that we call *states* that are cognitive in nature, which means that all of them are related to knowledge production processes.

Knowledge Management becomes possible if we can identify the moments with potential for novelty to influence the transformation dynamics of the tacit-explicit continuum (Ikujiro Nonaka & Takeuchi, 1995), i.e. to understand and manage the relationships between *data, information and knowledge*[307] (Hey, 2004).

The concept of information and its relationship with entropy links the world of data with knowledge production; it is therefore essential to understand its dynamics in the Ecosystem. For this purpose, we have to resort to Information Theory since, according to Campbell (Campbell, 1989), otherwise we cannot standardize its concept. Based on the scientific definition of Information with respect to the mathematics of probability, Campbell therefore even maintains that information *"specifies the peculiar character of living forms and helps to determine, by means of special codes, the models of human thought"* (Campbell, 1989).

To monitor and model the dynamics of knowledge transformation in the continuous tacit-explicit cycle in the epistemological and ontological dimensions based on information (Salgado-Guerrero et al., 2017) we need:

- Predictive devices based on information content products.
- The characterization of knowledge products that provide information content.

306 This terminology has been addressed throughout the book. Cf. glossary.
307 Cf. the glossary.

- A model of knowledge transfer that is able to suggest the choice of strategic mechanisms to foster the tacit-explicit cycle in real-life circumstances and time.
- Systems that suggest improbable pairs in the midst of diversity and make strategic mechanisms viable in the tacit-explicit cycle.

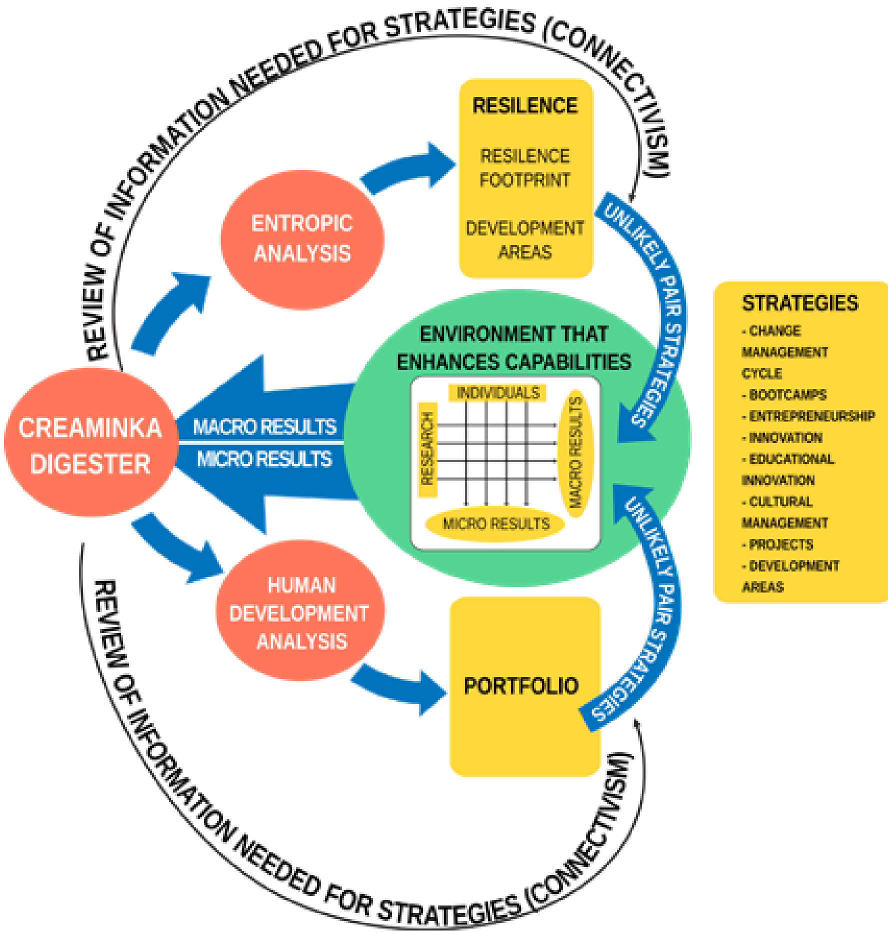
Starting from the analysis of the actors within the different groups of the ecosystem, we can *analyze the development of the individual* through the competencies the individual obtains by interacting with the ecosystem by participating in training sessions, creating entrepreneurial projects or participating in the processes of scientific production, feeding the knowledge base of CREAMINKA. This offers a micro vision of the ecosystem of its actors, which is reflected in the learning results through evaluations making available the *E-Portfolio* with the profile of the individual. This can also be analyzed with techniques to form *improbable pairs* to promote scientific production and entrepreneurship and innovation as part of the *strategy to accelerate the ecosystem.* Yet, the work dynamics of research groups is also reflected in the *entropic analysis.* It will show the *resilience footprint* of the indicators that demonstrate the strength and different reality of the groups facilitating the diagnosis of the groups that use factors such as their scientific production to provide an overview of the *macro results* of the ecosystem (Figure 57).

CREAMINKA is an ecosystem that is supported by various techniques of artificial intelligence, data mining and knowledge modeling to support useful services to managers and those responsible for managing research, entrepreneurship and knowledge at the university.

The CREAMINKA system aims to manage and accelerate the scientific process that produces knowledge. Actors from the university's research groups, the StartUPS entrepreneurship group and other external institutions participate in this process and constitute a support tool for decision-making related to the university's R&D&I division.

CREAMINKA supports all its processes in ontologies, while its semantic repository is populated with information from different internal and external information systems (APIs) of the university. These semantic data enable CREAMINKA to analyze and integrate information from actors (researcher, entrepreneur, etc.) of the ecosystem in different contexts and processes. The results of CREAMINKA include traces of resilience and university entropy, quartile indices of researchers, generation of networks of researchers according to the affinity of their research results, analysis of student origin from schools to the university, statistical analysis of research results, identification of themes and knowledge areas of prominence in university research and analysis of the interactions of participants in entrepreneurial events.

Figure 57
Relations and functions of CREAMINKA



Elaboration: Salgado-Guerrero, J. P.

The resilience footprints that show the multiplicity of states in which the research groups develop, and which are based on the knowledge management indicators that the UPS has taken into consideration. As its name indicates, the resilience footprint makes it possible to determine and analyze the resilience of a research group and/or the university in different contexts. If governing bodies or external evaluators in a given case, for example, decide to evaluate or weight a "university ranking" at the national or international level on the basis of a single indicator or a set of indicators, the UPS will develop relevant strategies to promote, maintain or improve results in those indicators.

Distributing researchers by quartiles is based on the idea of university resilience footprints that have been studied for the dissertation "Organizational Innovation for the Valorization of Scientific Research. The case of the Universidad Politécnica Salesiana (UPS)". The resilience footprints show the multiplicity of states in which the UPS research groups develop, and which are based on the knowledge management indicators developed for the UPS.

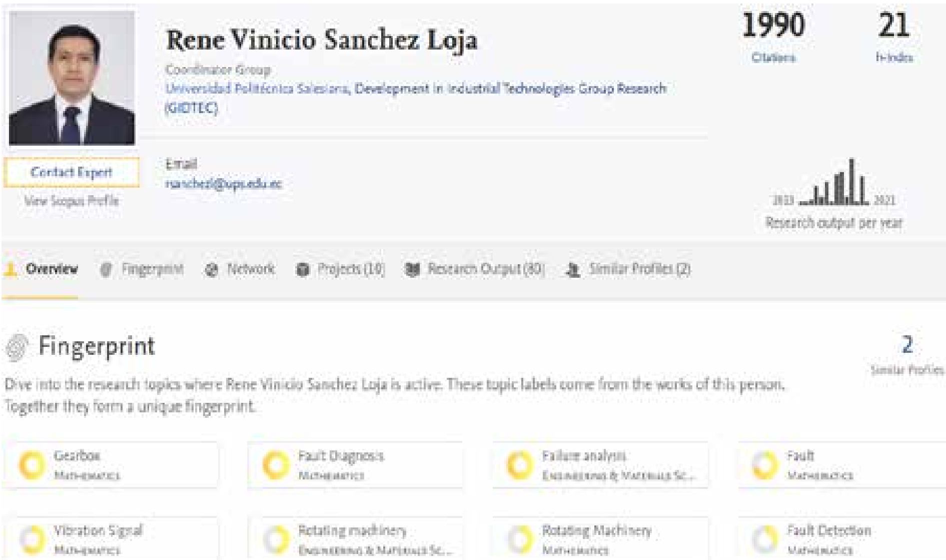
The functioning of these footprints and their indicators can be extrapolated to describe the redundancy of researchers. This creates the possibility to observe and analyze the resilience of a university researcher in different contexts, such as in publications (SCOPUS, Web of Science, Scielo, etc.), mentoring and innovation processes, patenting processes, internal, national and international collaboration, work in research projects, etc. Meanwhile, the values of these indicators can be standardized and weighted to yield a ranking by quartiles, which denotes the importance of the work carried out by UPS researchers.

Services of the CREAMINKA platform: The services offered by CREAMINKA are the knowledge base for measuring and analyzing the traceability of the actors in the UPS research and entrepreneurship ecosystem.

1. Automatic search of scientific articles SCOPUS, Web of Science, EBSCO, SCIELO, Mendeley, CrossRef, and others that have been produced by the UPS, as well as the presentation of information related to them: authors and co-authors both internal and external, institutions with which the elaboration of the article was shared, h index h of authors, quartiles and journals where the article was published, etc.

2. *Semantic analysis of research results The fingerprint* shows the research concepts per unit and researcher: knowledge areas in which they carry out their research, indicators such as citations or h index, number and types of publications, contact details. (Figure 58).

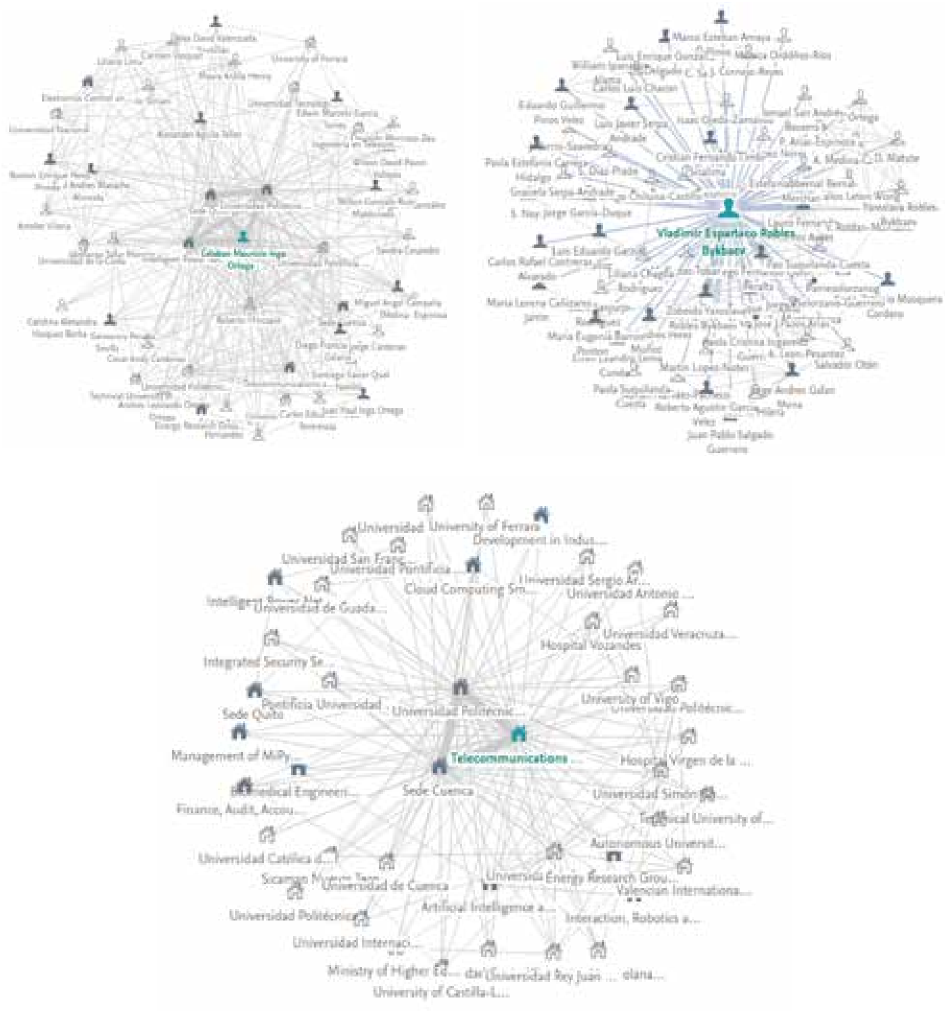
Figure 58
Example of a fingerprint with the information of a UPS researcher



Source: CREAMINKA - PURE

3. *Information necessary for forming improbable pairs*, in other words, connecting people who are unknowingly working on similar or complementary topics, which enhances collaboration between national and international researchers (Figure 59).

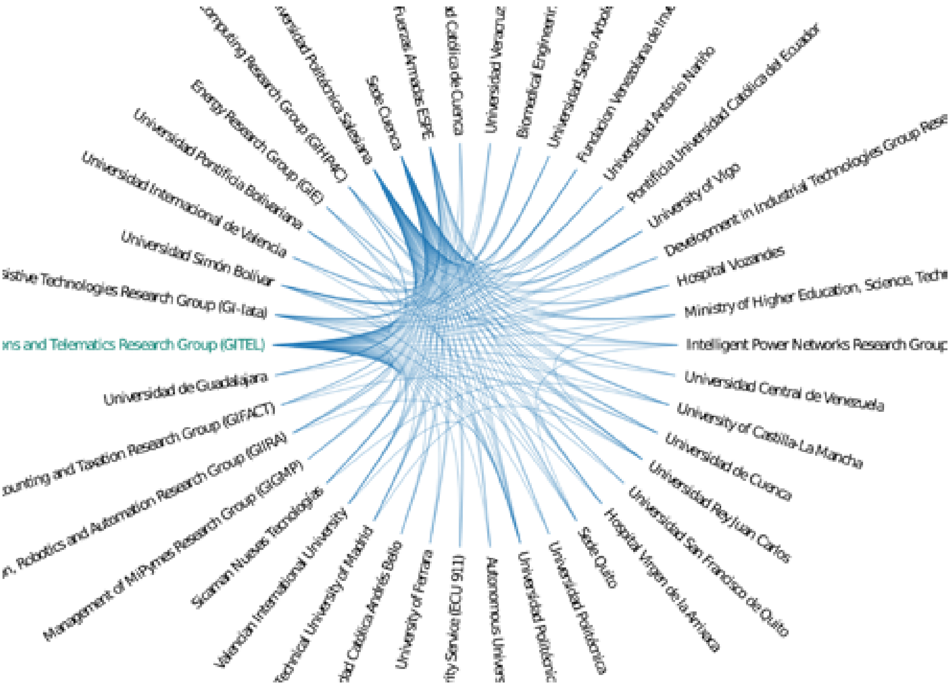
Figure 59
Examples of relationships and synergies created around two researchers and a research group from the UPS



Source: CREAMINKA - PURE

4. Inter-institutional cooperation: Mapping of collaborative networks with national and foreign institutions (figure 61).

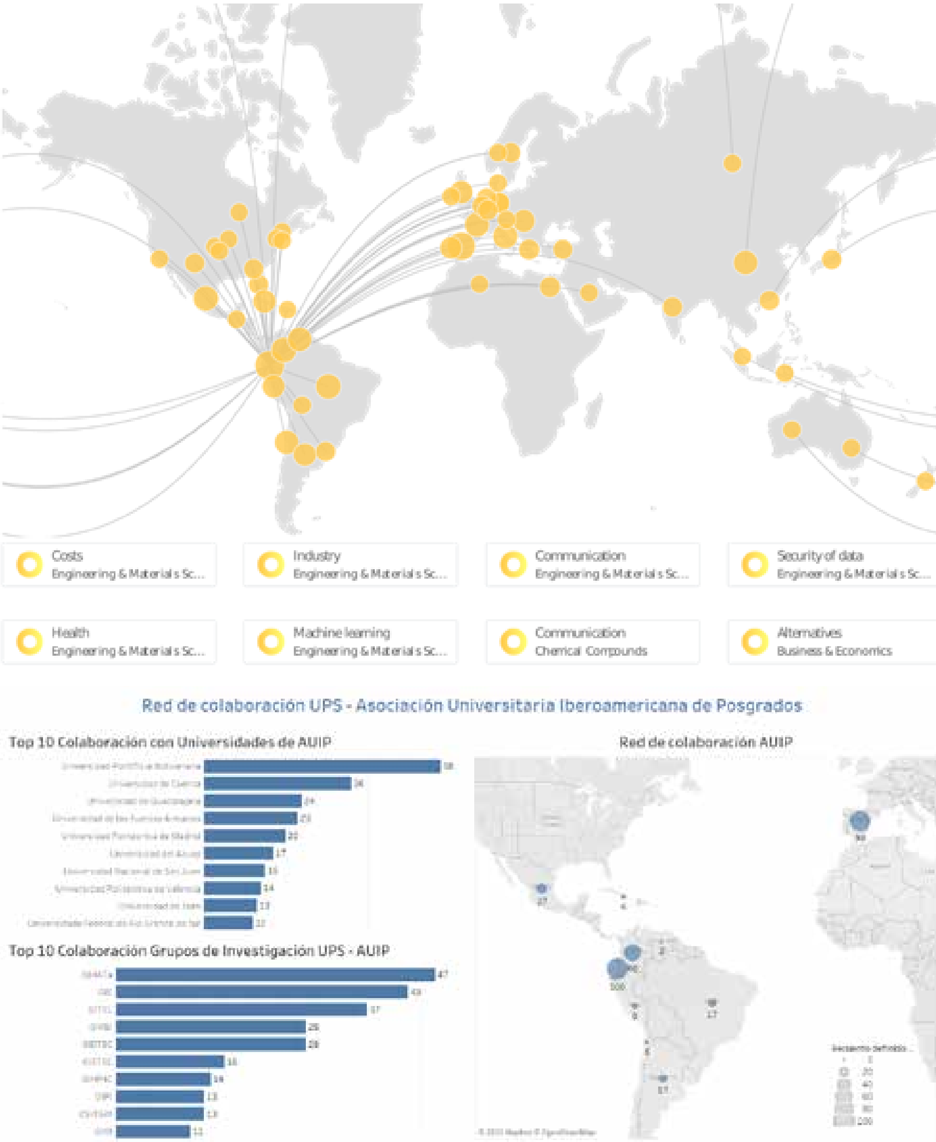
Figure 60
Example of collaborative networks



Source: CREAMINKA

5. Visibility of research results at the international level (Figure 61)

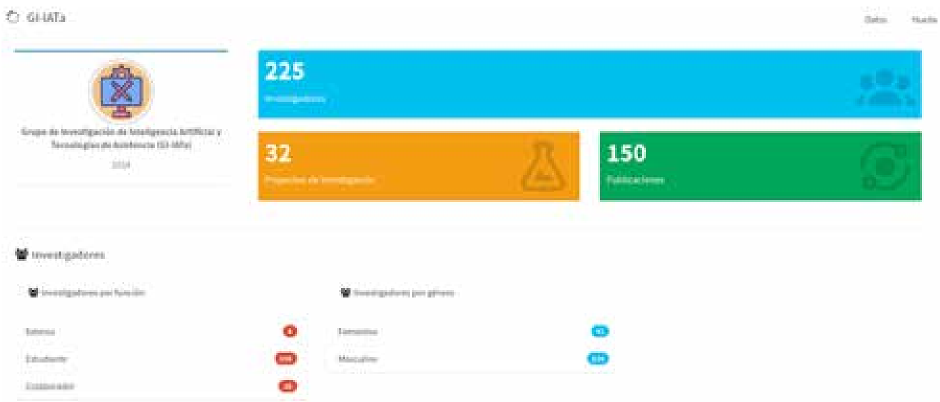
Figure 61
Example of international networks
by knowledge area or cooperation network



Source: CREAMINKA - PURE

6. *Traceability of research results* (scientific articles, awards received, activities, prototypes, participation in events, patents, etc.) (Figure 62).

Figure 62
Example of a results traceability dashboard



Source: CREAMINKA

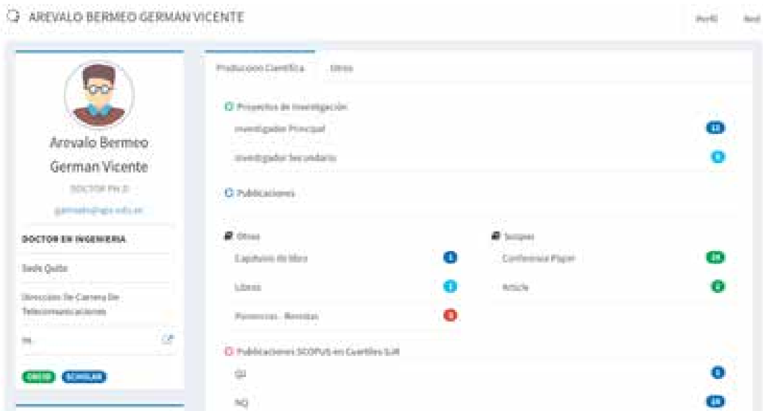
7. *Web services* for information consultation (Figure 63).

Figure 63
Example of a portal screenshot

Source: CREAMINKA

8. Public and private CVs, profiles of researchers (Figure 64).

Figure 64
Example of a UPS researcher's CV/profile



Source: CREAMINKA

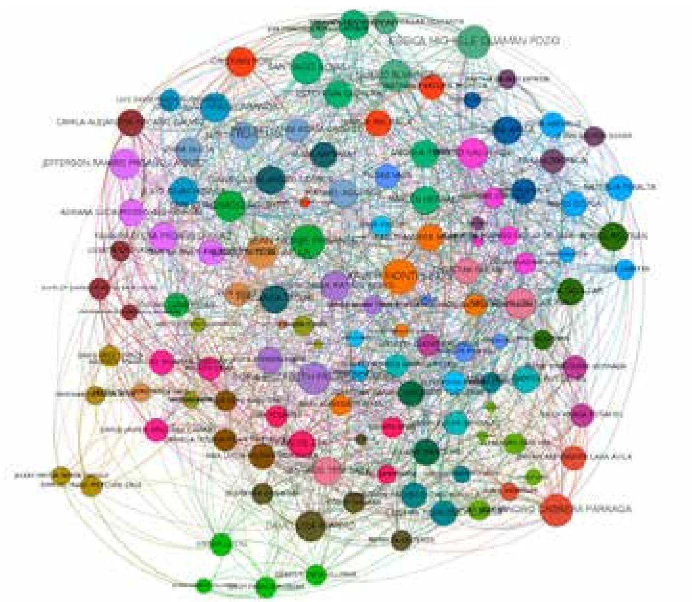
9. Generation of intelligent dashboards and reports on research results (Figure 65).

Figure 65
Example of dashboard

Source: CREAMINKA

10. Managing and monitoring of activities, projects, events and actor profiles of the StartUPS Entrepreneurship Ecosystem. Reveals cooperation networks among the actors of the innovation and entrepreneurship projects (Figure 66).

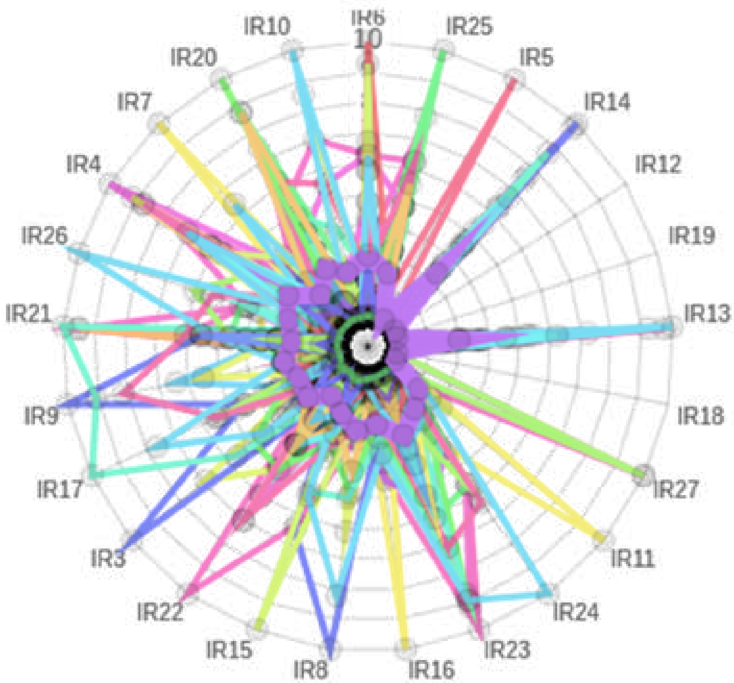
Figure 66
Example of cooperation networks for startups



Source: CREAMINKA

11. University resilience and entropic footprint based on an analysis of knowledge management indicators. Measures the UPS's capacity of resilience and adaptability to change based on the diversity of its scientific production (Figure 67). Every group obtains different results from each type of knowledge product. These results constitute an discrete footprint by group, and the aggregate of these footprints makes up the UPS footprint. The aim is not to contrast merit-based results but to respect the individual identity character of each group.

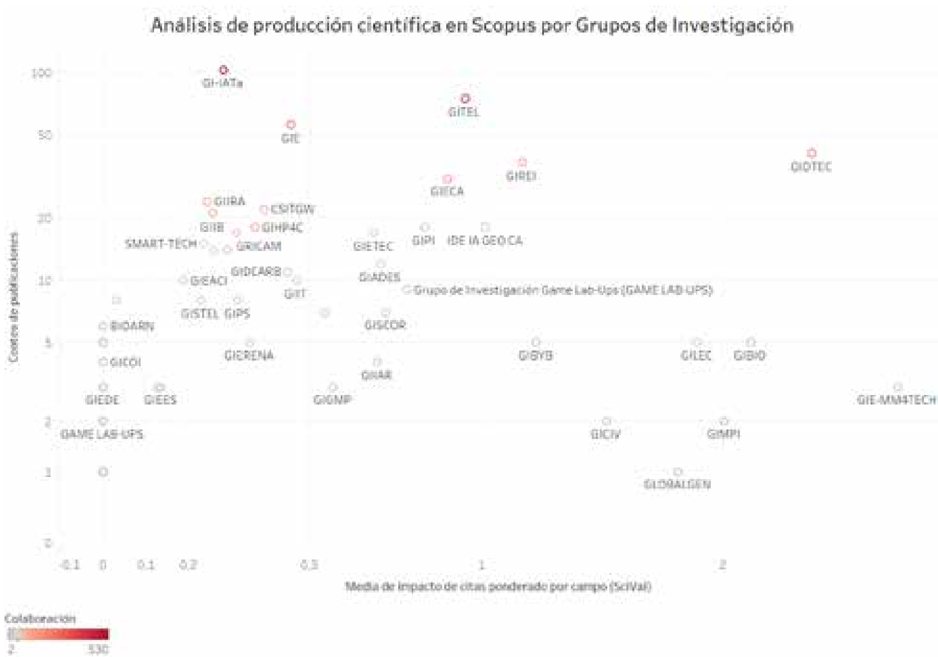
Figure 67
Example of a resilience footprint according to the different results of scientific production



Source: CREAMINKA

12. Measure scientific impact of researchers and groups (Figure 68). Locates on a map the most relevant groups and largest number of citations, which helps to establish communication strategies of knowledge generated in the groups, as well as strategies for the exchange and socialization of knowledge.

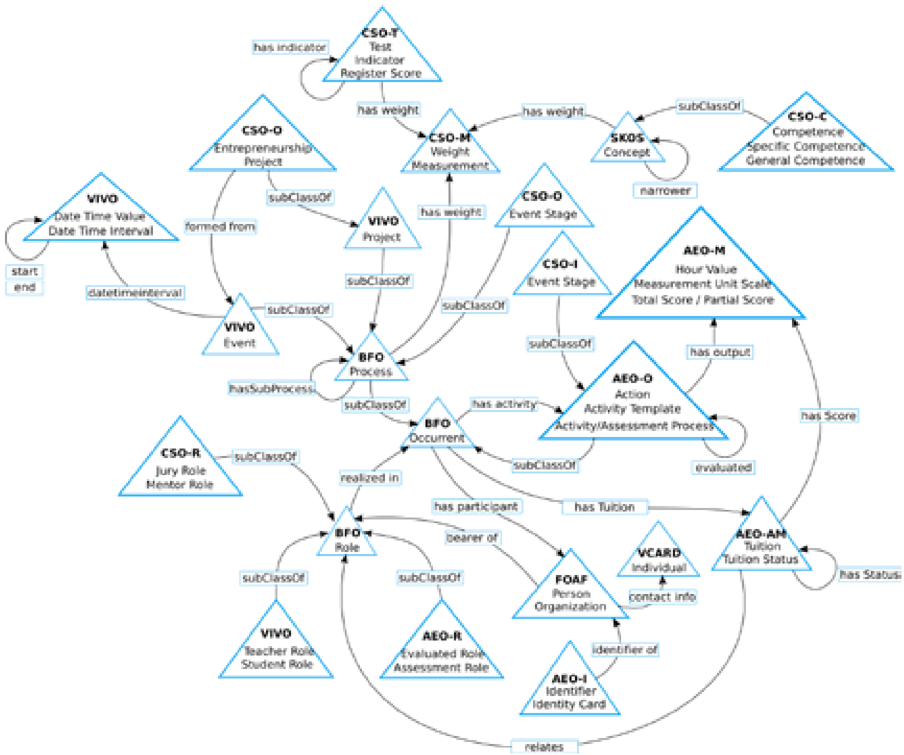
Figure 68
Example of a panel on the impact of the groups' publications



Source: CREAMINKA

13. Traceability of the research ecosystem actors and mapping of the activities of the actors within the entrepreneurship and research ecosystem (Figure 69). The aim is to accompany the development process of the initiatives and projects to identify the key management and acceleration points in the ecosystem.

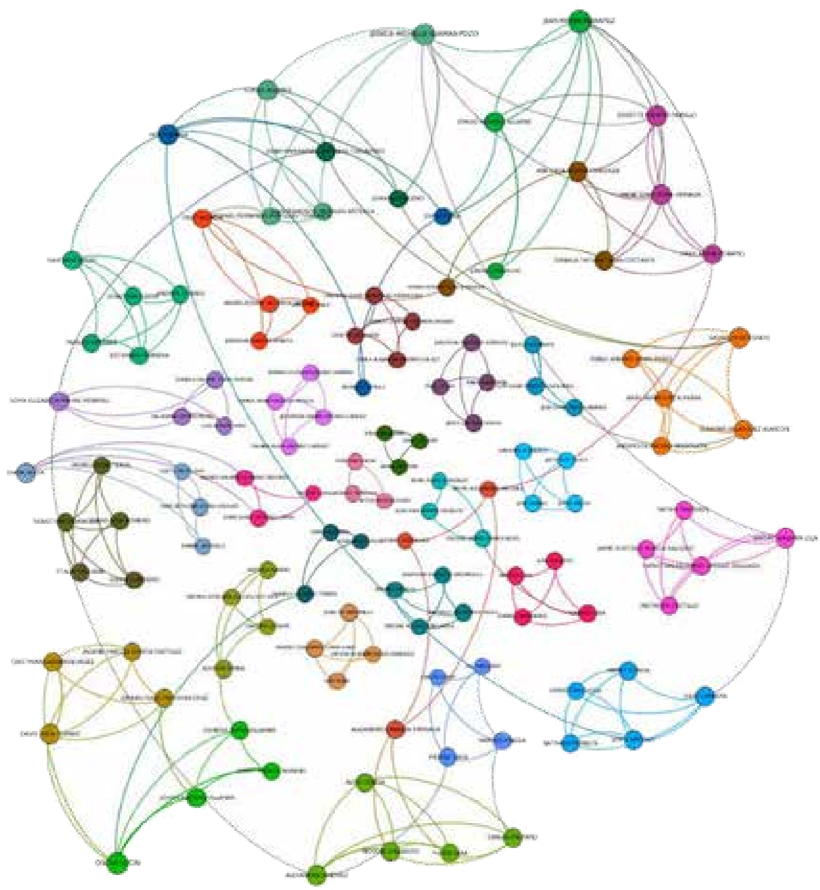
Figure 69
Ontology to establish the traceability of UPS actors



Source: CREAMINKA

14. Identify trends in entrepreneurship within the StartUPS ecosystem (Figure 70). We all know that any entrepreneurial process involves many changes of rudder or *pivots* depending on the opportunities that are in the market or the context in general. This function is used to track the interests of the community and the partnerships that occur over time to better guide the strategies of mentoring, accompaniment and support needs.

Figure 70
Example of startup enterprise trends

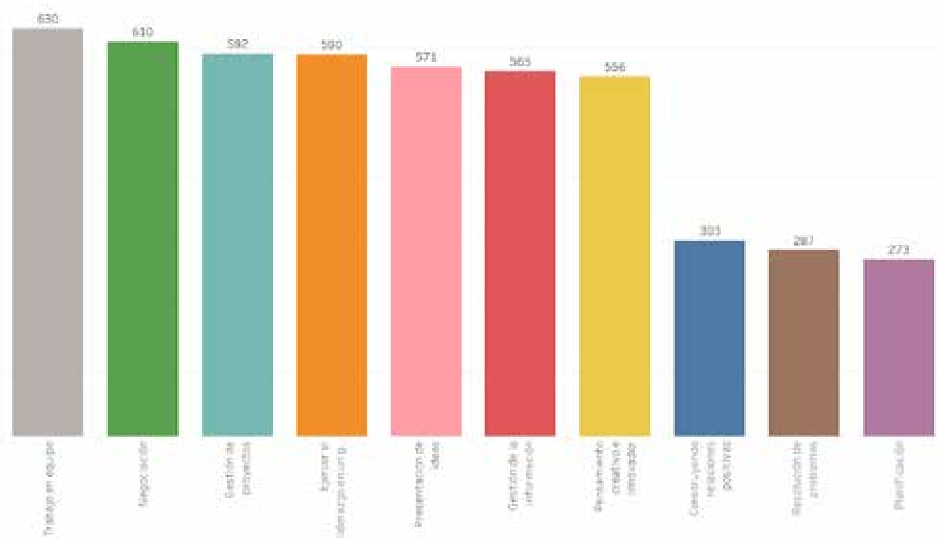


Source: CREAMINKA

15. Traceability of functionality development of StartUPS ecosystem actors (Figure 71). The centrality of the person as fundamental actor in this process prepares the person (Amartya Sen, 2001) for human development as the ultimate goal of society and to understand economic development as an instrument of the former (M. Nussbaum, 1997). Yet, it is also fundamental to propitiate training for the freedom to direct one's own life and good living

(Amartya Sen, 2001). Thus, it is possible to speak of the *Capability approach* as expression of active development in *function* of the capacity to be and *do*, beyond the economicist *functionalism*.

Figure 71
Monitoring the development of functionalities in a StartUPS event



Source: CREAMINKA

From the vantage point of human development and the formation of a potential student profile in a UPS, the university has outlined a set of functioning[308] (a set never finished and determined from the internal capacities but not imposed as requirements from outside) that are freely chosen to BE and make one's own life project, and not only determined as competences required by the context. Moreover, functionings go beyond competencies because they are chosen to achieve fundamental life objectives and do not al-

308 According to Sen, functionings are states of "being and doing", such as being well fed, having shelter, etc. and should be distinguished from the means employed to achieve them (Amartya Sen, 2009). Sometimes the functionalities coincide with some competences, but what differentiates them is the formation process that is born with different purposes, in the one case in an endogenous way to respond to life and in the other as a labor requirement imposed from outside.

ways coincide with generally pre-established competencies. Moreover, functioning can be put into practice in many areas of life and belong to the human being who has chosen them not only for work. The environment that promotes internal capacities as discussed at the UPS, is propitious to develop a set of functionings:[309] personal, ecosystemic and intra-enterprise (UPS, 2019).

16. Semantic metadata repository (Figure 72). These metadata are obtained from indicators of knowledge production, the Ecosystemic perspective, the centrality of the person and its supremacy with respect to evaluation mechanisms. A proposal for indicators was drawn up (J. P. Salgado & Patera, 2017) and considers the following principles (J. P. Salgado & Herrán Gómez, 2017):

Beyond adapting to the requirements, give priority to innovation. We must substitute certain precepts that have immobilized the University for decades. Being an institution that adapts to its surroundings means responding blindly to social pressure and acting in accordance with them, while as an intelligent institution, the university must replace adaptation with innovation, where it assumes a dynamic and transforming position.

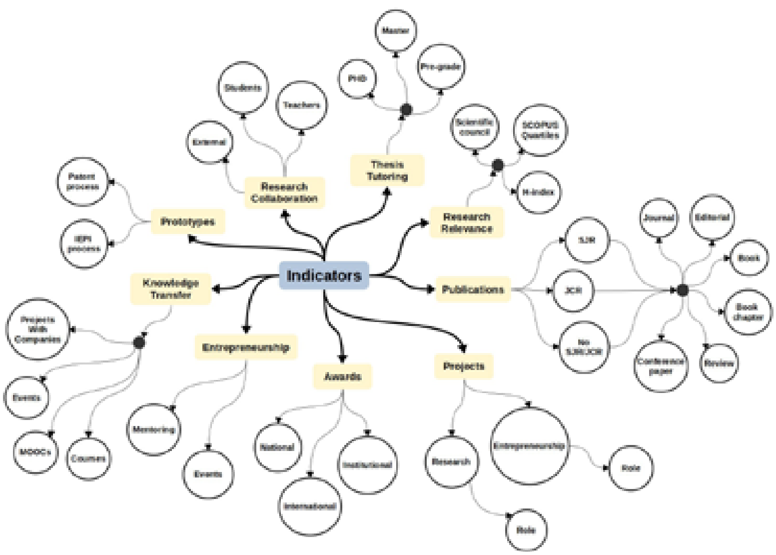
- *Stop planning urgent things and project important ones.* We must not regard the university as an institution that reacts to incentives imposed by criteria that are often biased by the results of evaluation processes for accreditation purposes, but as an institution that acts with standards and indicators based on models where quality emerges in the search for solutions to social problems.
- *Indicators suitable in an environment of uncertainty rather than certainties*. Uncertainty permits experimenting in the external and internal habitat. It means that the University must innovate by proposing new relationships with the environment. Uncertainty opens the way to solutions that are not considered by the rules, and encourages learning that is open to change and crisis. Project management from the perspective of flexibility promotes the replicability of best practices and encourages dialogue for communicating results.
- *Non-linear and systemic-complexity.* The Ecosystem University is complex and its organization can only be understood from the systemic point of view. It is an open and dissipative Ecosystem that involves

309 The following features have been developed by a significant group of UPS teachers in the framework of the mentor project. Some functions are transversal and can be enhanced in the three areas and involve within them others needed to develop the general one.

both, academia and society at large. It is not a one-way process that only seeks to solve essential problems, but an interactive and relatively continuous learning process that analyzes the roots of the problems seeking to modify the work strategy if necessary. The indicators should facilitate the monitoring and management of the spirals of the tacit and explicit continuum that transforms knowledge.

- *Indicators based on diversity rather than homogenization*. Acting in an inclusive world requires responding to both human and environmental needs. Intercultural dialogue and respecting the other comes from within oneself and from the encounter with the other. The university for the persons promotes synergy in diversity and values it as a potent factor for knowledge production. Evaluating individuals will not aim at homogenization, but focus on the promotion of unique and distinctive human development and recognition through the ecosystem and not meritocracy.

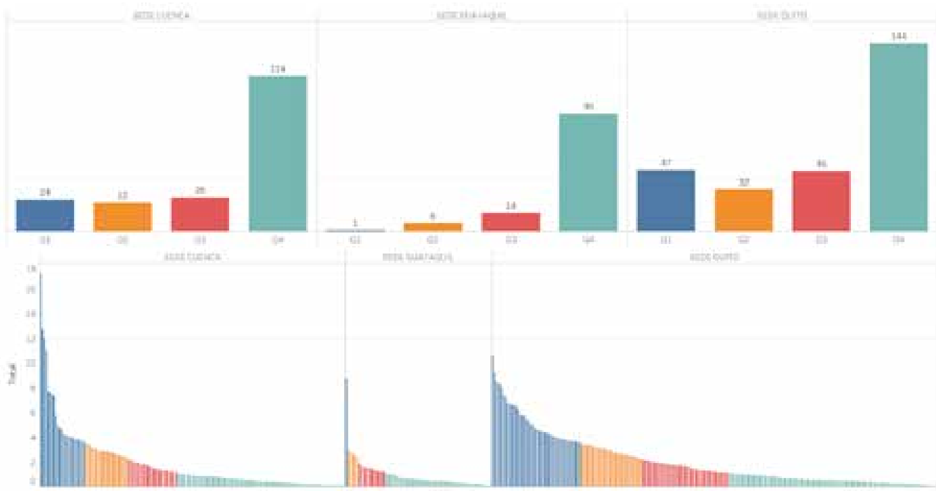
Figure 72
Indicators for UPS knowledge management



Source: CREAMINKA

17. Index of researchers for the social organization of work. The optimization of work and the type of workload in the university balances out the scientific production index of each researcher in the preceding two years (Figure 73). The social organization of work eludes the commercial logic and is subordinated to the dynamics of appropriation-provision of the common good, which does not mean that the university community[310] operates outside the market (Juncosa Blasco et al., 2019), but rather that it interacts with it, maintaining its autonomy and privileging the sustainability and self-sufficiency of the university community. This helps sharing the teaching and research load in a more equitable way among all UPS professors.

Figure 73
Example of distribution of teachers according to the indicator of UPS scientific production

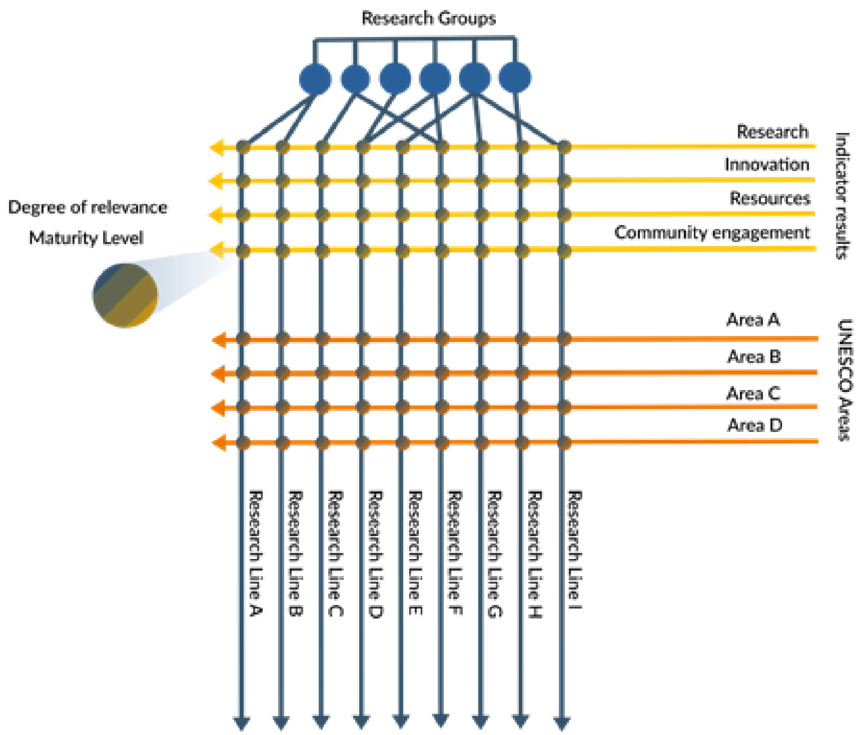


Source CREAMINKA

18. Determining lines of research and areas of knowledge as a result of the emergence of research and not of a simple imposition. The lines consolidate over time if they are sustainable, if an academic community is involved in developing them, and if they are relevant for their social context (Figure 74).

310 Communality involves decision making often in search of balance and often in crisis. Community implies a set of previously defined values.

Figure 74
Matrix relationship between the lines of research and the fields, areas, disciplines and subdisciplines of science



Source CREAMINKA

The capacity to be and to do (Amartya Sen, 2009) involves a social dimension of learning as a continuous and participatory process, thus promoting overcoming specialization in an environment that enhances people's capacities and, in turn, produces social meaning and response to the context.

As stated before, over-specialization impedes adaptability and transdisciplinarity, the vulnerable effects of unrecoverable costs (Janssen et al., 2003), as well as the lack of diversity (Crawford S Holling & Meffe, 1996).

Analysis implies thinking about and treating knowledge products and derived concepts not as data but as results and products of the interrelations of the fields of knowledge, and of the nodes of knowledge production that constitute science. These nodes are the result of the encounter between the processes of specialization of science and the research action of the lines of research. This matrix produces knowledge that leads to new areas of specialization and at the same time to complex inter- or trans-disciplinary fields, results of theoretical accumulations or epistemological ruptures.

Result lines of researchof collective construction

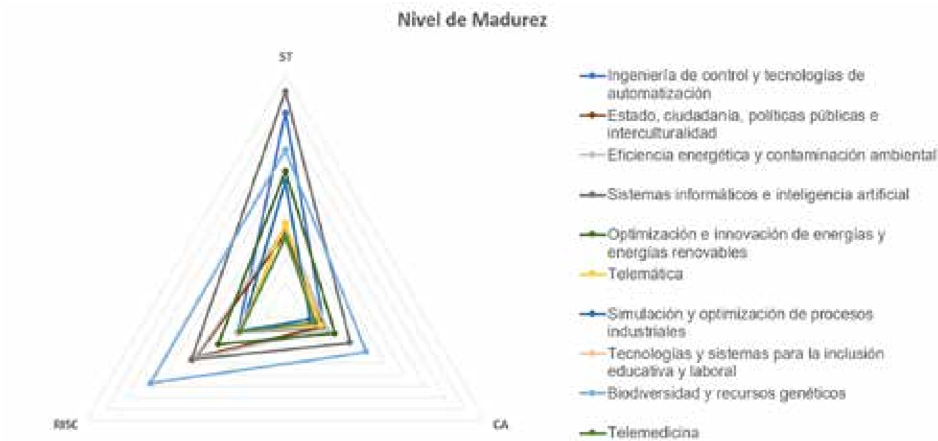
The lines of research allow for complex situations that are sustained by science, but whose strength does not lie in the specific discipline but rather in the "indiscipline" with respect to the "rules of good science". This knowledge emerges disorderly and transgresses the characterization of the fields and disciplines in the search for its own rules to understand science from complexity.

The relationship between the dynamics, the experience of lines of research and the fields, areas, disciplines and sub-disciplines[311] is matrix-based, i.e. it does not repudiate them as divisive categories of knowledge, but rather attributes them the place that corresponds to them to subsequently transversally generate a scientific project that identifies with the life project of the person who learns science by doing science in community.

To measure the level of maturity of a line of research, one must first of all determine the values of each of its axes: sustainability over time (ST), (ii) relevance and impact within the social context (RICS), and (iii) the academic community involved in its development (CA), by adding up the corresponding indicators. The values are arranged and represented within a three-dimensional surface, and the maturity level metric is represented by the value of the area formed by these three points (Figure 75).

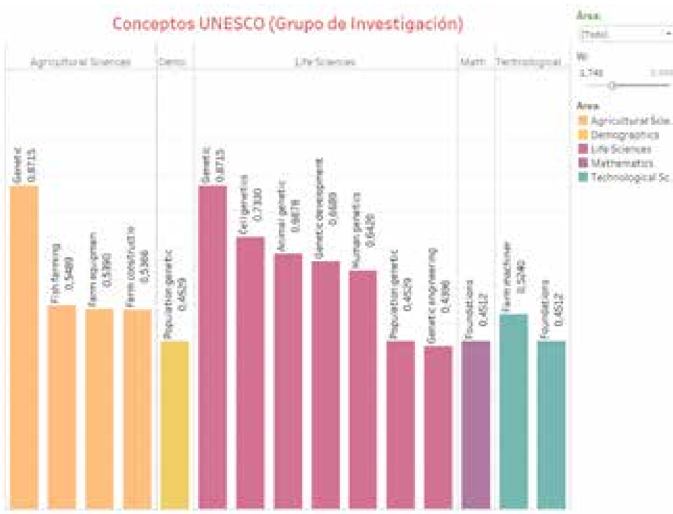
311 "UNESCO nomenclature for fields of science and technology was proposed in 1973 and 1974 by the UNESCO Science Policy and Science and Technology Statistics Divisions and adopted by the Advisory Commission on Scientific and Technical Research. This knowledge classification system is widely used in the management of research projects and doctoral theses. The categories are structured in three hierarchical levels: Fields, which refer to the most general sections. They are coded in two digits and comprise several disciplines. Disciplines, are a general description of groups of specialties in Science and Technology. They are sections coded with four digits. Despite the fact that the disciplines with cross references are different from each other, or within the same field, they are considered to have common characteristics. Subdisciplines, are the most specific entries in the nomenclature and represent the activities that are carried out within a discipline. They are coded with six digits. These must correspond to the individual specialties in Science and Technology". (Pastor Sánchez, 2018).

Figure 75
Weighting of knowledge areas for a Research Group based on the valorization of its research results on an indicator structure



Source: CREAMINKA

Figure 76
Example of knowledge areas with a higher incidence of research



Source: CREAMINKA

Figure 77
Example of a research group and its lines

Coordinador:

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Contacto: einga@ups.edu.ec

Lineas de Investigación

- Operación y control de sistemas eléctricos
- Comunicaciones en sistemas eléctricos
- Confiabilidad y calidad de la energía eléctrica
- Microredes y energías renovables
- Optimización en sistemas eléctricos
- Planeación y gestión de sistemas eléctricos
- Transmisión y distribución de energía eléctrica
- Redes eléctricas inteligentes
- Estabilidad y compensación en sistemas elétricos
- Fallas en sistemas elétricos

Source: CREAMINKA

Chapter 2

Ecosystem Pillars

Biocenosis: Environment That Enhances Capacities

As a Salesian University, the UPS derives its charismatic identity from Don Bosco.[312] The Ecosystem University that this book envisages and many things of which have been put into practice, is also enlightened by the actions of the Salesian Saint. Don Bosco had a privileged relationship with young people and created the oratory to bring the preventive system into action.

The Environment that Enhances Capacities, which we addressed in Part I of this book, seeks to re-signify - after 200 years and in a university context - the meeting place[313] for the search for truth and the meaning of what surrounds us. Oratory is the whole cultural environment in which the educational process takes place (Peraza & Jimenez, 2011), it is the *ecosystem of encounters and of academic and pedagogical reciprocity*.

Looking at the Oratory does not necessarily imply feeling committed to its forms but rather develops its potential and creates new horizons. It is not only a matter of recognizing the values lived in the Oratory, but also of discovering the creative capacity of the “futures of yesterday” to project perspectives, learn what happened in the Oratory and create and re-create possibilities.

---

312 John Bosco, or Giovanni Melchiorre Bosco in his native Italian, and better known as Don Bosco, was born in I Becchi on August 16, 1815. He was a priest and educator and founder of the Salesian Congregation. He was canonized by Pope Pius XI on April 1, 1934, only 46 years after his death. Pope John Paul II awarded him the title “Father, teacher and friend of the young”. He died in Turin on January 31, 1888.

313 Don Bosco’s pedagogical practice has always combined the personal word *“in the ear”* with the fact of being together in the courtyard. He incorporated personal dialogue in pleasant atmosphere and educational relations in the proximity of everyone. The objective of this *pedagogical approach* of *“one by one”* is personal authenticity (Don Bosco University & Dicastery of Juvenile Pastoral, 2014).

In Don Bosco's experience, the oratory and the preventive system - rather than structures or institutions - are ways of BEING, of relating to each other, of responding to life. They are the profound attitudes of every person and fundamental life choices. Prevention, far from being the "anticipated announcement of a punishment," is the perspective that puts into play all the criteria, the style, resources and contents to liberate the person and develop the capacities or functionalities necessary to opt for a life project (Peraza, 2011).

The Preventive System – as a legacy of our founder - implies that we must not start from the assumption that we are all *bad* and therefore need strict regulations and rules to prevent us from leaving the *path.* On the contrary, the system is based on confidence in our *potential to be good* so that we can create a life project that does not stray off the *path,* and even if it does, permits us to return to it.

That way, the environment that enhances human development and its capabilities center on the person and the permanent search for the meaning of transcendent experience and knowledge articulated with life. The UPS is committed to non-dual, transpersonal, intuitive, ecosystemic thinking that facilitates the development of life-compatible logics.

It is essential to believe in the person, his potential and capacity to free himself from what oppresses him, just like Don Bosco created confidence in his youngsters. Every human being is unique and with an assigned task that no one rewards or punishes her/him for; meeting the task is the reward and failing to do so, punishment; a person's task is not to do things, but to find himself, i.e. to develop in the awareness of his true being and to live that project to the fullest and achieve the freedom to choose between things we want to do. This is the basis of *"da mihi animas caetera tolle."*[314] Transcendence does not mean to do or achieve something, but to discover and live the reality of the true BEING.

The UPS is committed to an education that has nothing to do with teaching the truths of the teacher, but seeks to develop the capacity (of both: teacher and student) to live without the presupposed lies, that is, to free oneself in order to liberate. In this way, finding the meaning of life, the person can face and respond not only to daily problems but also to the joys of life, from the freedom that makes us aware (even minimal) of the true BEING.

314 *"Give me souls, take away everything else"* motto on the Salesian coat of arms (Sáenz, 2017).

Finding meaning in the midst of uncertainty, complexity and diversity, induces hope, confidence and love.

> "Do you know what this poor old man, who gave his entire life to his dear young people, wants from you? Nothing more than when you have done your duty, you return to the happy days of the old Oratory. The days of love and Christian trust among the young and the superiors; the days of the spirit of condescension and suffering for the love of Jesus Christ for one another; the days of hearts open with all simplicity and candor, the days of charity and joy for all…. I need to some comfort, hope and promise that everything will be done that I wish for the good of their souls. You don't know well how lucky you are to have been received in the Oratory. Before God, I assure you: a young man only needs to enter a Salesian house and the Blessed Virgin will immediately take him under her special protection" (Bosco, 1884).

In the axiological order, the main problem of education is to identify and position its values. What are they and where are they? From the vantage point of university axiology, *the good Christian and honest citizen,* can be interpreted as *humanist culture and scientific culture,* and this affirms the risk of axiological disorder, which results from the gap between scientific and humanistic culture.

If looking at the Oratory from the Salesian University vantage point facilitates the construction of the Pedagogical Model and its Navigation Chart, looking at the Salesian University from the Oratory evidences the risk of axiological disorder produced by the gap between scientific and humanistic culture. A world divided by the technological gap leads us to think that one task of the universities - if not the main one - is not to delay the time of technological culture at the cost of increasing the loss of humanistic culture.

In the "Oratorian heart," the UPS discovers the key to the axiology of values: "The centrality of the young Oratorian and his attention are the convergence of a paradigm of interpretation" (Rodríguez, 2018, p. 17), which finds in this experience the elements of intervention, evaluation and innovation that allow it to build an epistemological model to "understand itself as a university community that animates, accompanies and projects the presence of Don Bosco" (Rodríguez, 2018, p. 17). It is the Oratorian axiology that unites in a single formative process the scientific and the humanist culture, as they combine in an Oratorian life project the slogan of "*good Christian and honest citizen*" (Herrán Gómez & Salgado Guerrero, 2018).

With a referenbce to Walker and Nussbaum, Ellerani (Ellerani, 2014) describes the characteristics of this intentional environment according to their abilities:

- Practical reason, the capacity to develop choices in an informed, critical and intellectually sharp way, building a socially responsible life project in the middle of an uncertain world.
- Educational resilience, the ability to negotiate risks, preserve the educational path, use educational opportunities, adapt and respond to difficulties. Being self-resilient by possessing aspirations and hopes.
- Knowledge and imagination: Be able to use critical thinking and imagination to understand the complexity of science and to form a moral judgment.
- Willingness to learn: Be able to arouse curiosity and a desire to learn, therefore to be aware of limitations and ignorance, maintain the latent capacity for surprise, be an active researcher.
- Social networks and relationships: Be able to have respect for oneself and for others, show empathy, compassion, honesty and generosity, interact through dialogue and listen to others.
- Emotional integrity: Be able to develop emotions in order to imagine, understand, be empathetic, to discern and be aware.
- Physical integrity: Security and freedom from all forms of physical and verbal abuse.

An Environment-Oratory that Enhances Capabilities develops the above characteristics not through *instructions* but in accordance with the ecosystemic organization that allows us to experience this culture, where everyday life permeates the way people act (agency[315]) and makes them grow from within, like a plant that no one *makes grow*, but that grows by itself using its environment.

315 The term agency can be understood in the pedagogical or social development literature as the capacity to do or to act. It is directly related to *autopoiesis*, which for Aristotle is the *productive action* (poiesis) that focuses on results (Aristotle et al., 1970). Plato defines the term poiesis as *"the cause that converts anything we consider not to be into being"* (Crespo Güemes, 2007). Sen "refers to what a person can desire - since he puts value on it - to do, to be" (Amartya Sen, 2014). The value of *"activation"* (agency) implies the concept of freedom to act, the agency inherent to the action starts from the subject, but it is generated within social and learning contexts (Massimiliano Costa, 2014).

The UPS is committed to the *Oratorian heart* to avoid the paradigm of the university of calculation, or entrepreneurial university, or rather the university of instrumental reason. The Ecosystem University identifies experience by its dedication to learning for oneself, and to the development of character. The Oratorian university environment develops through sharing common values and producing cooperative learning.

The Oratorian atmosphere of affection and familiarity, diversity and complexity of issues, under the imperative of science and technology, help the university to overcome conflicts. It is the praxis of the *Oratorian heart* that appears precisely as an alternative to the imperialism of *instrumental reason*.

In the Environment/Oratorium that enhances capacity, the human being is the at the center of the created knowledge; the scientific culture and the humanistic culture are Experienced Reason validated by the values of the praxis of the *good Christian and honest citizen*.[316] These offer the opportunities that lead to the construction of a life project the student chooses and which is far from the imposed profile of graduation, whose logic resembles more that of factory production.

The reason experienced at the UPS creates learning conditions for building knowledge by going beyond capacities and transforming them into functionalities.[317] In the University, discourse becomes action and the reason of being of the present (Michel Foucault, 1988), where reason is applied to the point that the objectivity of thought must be measured by its possibility of action.

The Salesian Youth Pastoral Reference Chart (Universidad Don Bosco & Dicasterio de Pastoral Juvenil, 2014) establishes four dimensions (Table 14 develops these dimensions according to an Environment that Enhances Capacities) on which the Salesian Youth Pastoral Educational Project (PEPS) is based and which support the development of a young Christian, with an organic variety of responses and a broad understanding of a pastoral open to all. The educational pathways project education into practice and turn it into a pastoral exercise.

316 A very Salesian binomial because of its close association with Don Bosco: "Good Christians and Honourable Citizens". It has been extensively addressed by Pietro Braido (Braido, 1994).

317 According to Sen, functionings are states of "being and doing", such as being well fed, having shelter, etc. and should be distinguished from the means employed to achieve them (Amartya Sen, 2009).

Table 14
Salesian Educational Pastoral Dimensions and the proposal of an Environment-Oratorium that Enhances Capacities

Liberating the person to discover the role of God for her/him, which enables the person to discover and live his/her vocation in an environment that develops life skills and helps building values in community			
Factor of associative experience: Welcoming home	**Vocational factor: Parish that evangelizes**	**Educational-cultural dimension: School that prepares for life**	**Factor of education for faith: Patios of encounters**
Physical integrity: Security and freedom from all forms of physical and verbal abuse. Openness to all young people who not always manage to integrate into other educational structures and proposals. Appreciation of the family and what young people can contribute .	*Practical reasoning:* as the ability to develop choices in an informed, critical, intellectually sharp manner, building a socially responsible life project in the midst of an uncertain world. *Emotional integrity:* To be able to develop emotions that further imagination, understanding, empathy, discernment and conscientiousness. The sense of duty and responsibility in the concrete forms of personal commitment and service to others. Ability to analyze reality and stimulate attitudes of service and solidarity. Ability to think in terms of the common good rather than only one‘s own or that of the local community. Capacity for moral judgment based on critical reason, but through the search for valid and real arguments.	*Educational resilience:* ability to negotiate risks, persistence in one’s studies, assumption of educational opportunities, accepting and meeting challenges. Self-resilience based on aspirations and hopes. *Knowledge and imagination:* Ability to use critical thinking and imagination to comprehend the complexity of science and make a moral judgment. *Willingness to learn:* Being able to arouse curiosity and the desire to learn to become aware of one‘s ignorance and limitations, maintaining a latent capacity for wonder, being an active researcher. Creativity and a spirit of innovation that challenges routine, indifference or conformity. Ability to reason about political problems and reach conclusions.	*Social Networking and relations:* Being able to have respect for oneself and others, show empathy, compassion, honesty and generosity, interact and with and listen to others. Joyful atmosphere that favors optimism and a positive approach to life. Sensitivity to one‘s surroundings, overcoming conformist passiveness and indifference. Participation in wider contexts to actively and critically engage with social situations. Ability to see one’s community as part of a larger, even global, complex order, and therefore understand the need for interaction.

Source: Vice-rectorate for Research. UPS

The UPS Navigation Chart, under the headline "The Meaning of the festive UPS Oratory states that:

> "The Oratory is a global project of human and Christian growth with itineraries for the various ages and situations of young people" (Peraza & Jimenez, 2011) (...) Today the oratory content has moved from an identity by the recipients to an identity by a model of doing in the educational process. According to Peraza, "Oratory is the perspective that puts into play all the criteria, style, resources and learning contents". Don Bosco proposed that every educational center, project, school or Salesian house should also be a hospitable home, a parish that evangelizes, a school that leads the way to life, and a patio for meeting friends and having a good time." (...) The Ecosystem University is an Environment that Enhances Capacities, where freedom of action and self-organization is understood in the light of nature, of understanding another way of competing based on BEING, and not from the perspective of competition for using human development as a paradigm (UPS, 2019)."

And also:

> "If we take into account the context in which the UPS operates today - probably like Don Bosco in his time - we are responding to the needs of young people with a new way of practicing Oratory, where people meet and personal interests become shared ones, and where academic and pedagogical reciprocity have created what we call Ecosystem University. Without any doubt, Don Bosco's most important legacy is that educational relationships characterize every structure to create fraternity, filiation, and inspires and encourages family." (...) hence, according to the *capability approach,*[318]developing people's capabilities plays an important role and is achieved through: *functioning,* i. e. activities with great value that contribute to a person's "well-being;" *capability*, i.e. individual freedom to carry out the activities (*functioning*); and *agency*, i.e. the ability to achieve goals and be agents of action and change (Amartya Sen et al., 1991, p. 31). In addition to the same skills and competencies, the values of each person must be fostered in his or her daily life. The university cannot merely be a place where we receive knowledge; it must be a place where we experience and learn to live values, where the students are the protagonists of their decisions and can develop them because they function[319] better in an

318 The capability approach is an economic theory conceived in the 1980s as an alternative to welfare economics. Amartya Sen combines a number of ideas that were previously excluded from traditional approaches to welfare economics (Amartya Sen et al., 1991).

319 According to Sen, functionings are states of "being and doing", such as being well fed, having shelter, etc. and should be distinguished from the means employed to achieve them (Amartya Sen, 2009).

environment that enhances their capabilities. From the perspective of human development and the formation of a potential student profile in a Salesian University, it is necessary to delineate a set of *functionings* (a set never finished and determined from the internal capacities, but not imposed as requirements from outside) that are freely chosen to BE and make their own life project, and not only determined as skills required by the context. *Functionings* go beyond competencies because they are chosen to achieve fundamental life objectives and do not always coincide with pre-established competencies. Moreover, *functionings* can be put into practice in multiple areas of life and belong to the human being who has chosen them not only for work. For the current context and from the potential of the UPS, our students can develop the following *functionings* (UPS, 2019):"

Table 15
Functionalities in the UPS. These have been developed by a significant group of UPS professors within the framework of the mentor project

Personal	Ecosystemic	Intra-entrepreneurship
Critical reasoning	Conflict resolution	Entrepreneurial spirit
Communication	Self-organization	Project design and management
Conflict resolution	Critical reasoning	Leadership
Self-directed learning	Project design and management	Communication
Research	Leadership	Conflict resolution
Identity	Identity	Identity
Resilience		
Inclusion		
Creativity		
Innovation		
Ethical commitment		

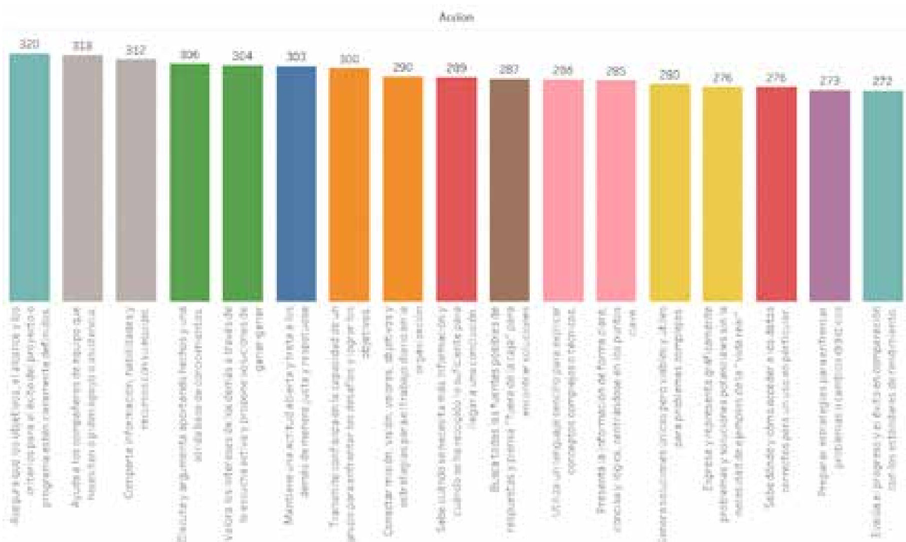
Source: Navigation Chart (Salesian Polytechnic University, 2019)

This book will not go into great detail of the strategies and mechanisms for evaluating capacities and functionalities that the UPS has been developing for some time. Below are some exemplary images showing participants' performance in the *Rethos*[320] event of June 21, 22 and 23, 2019:

1. Actions evaluated at the event

The graph represents the count of evaluations made of different participants, categorized according to actions (Figure 78).

Figure 78
Actions evaluated at Rethos 2019



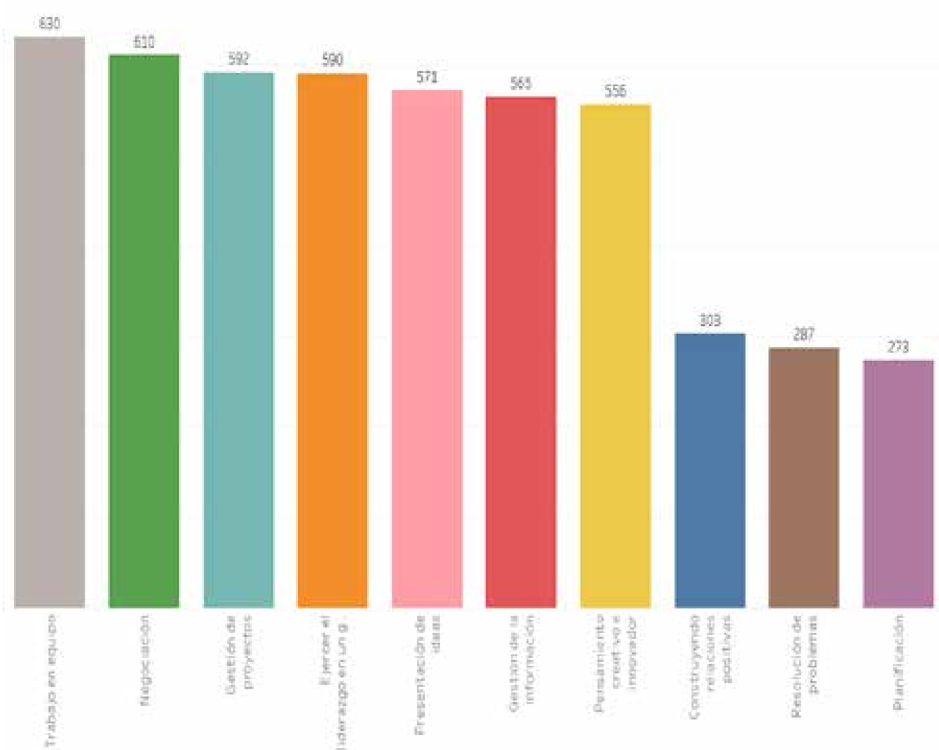
Source: CREAMINKA

320 Rethos is an entrepreneurship camp that constitutes one of many strategies of the Environment that enhances Capacities. This specific case was carried out in 2019 and evaluated a total 88 participants of 30 entrepreneurship teams.

2. Evaluated activities

The graph represents the count of evaluations conducted on different participants, grouped according to the evaluated activities (Figure 79).

Figure 79
Evaluated functionings at Rethos 2019

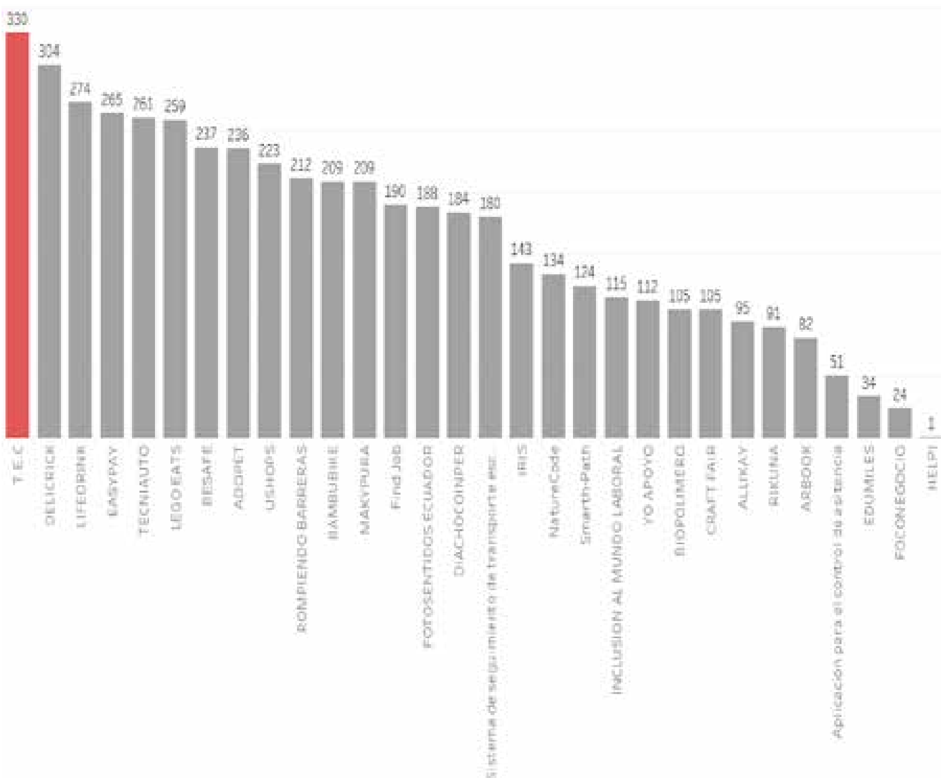


Source: CREAMINKA

3. Aggregate of activities per team

The graph represents the count of evaluations per activity performed on the teams participating in the event, listed in descending order (Figure 80).

Figure 80
Actions evaluated per team at Rethos 2019

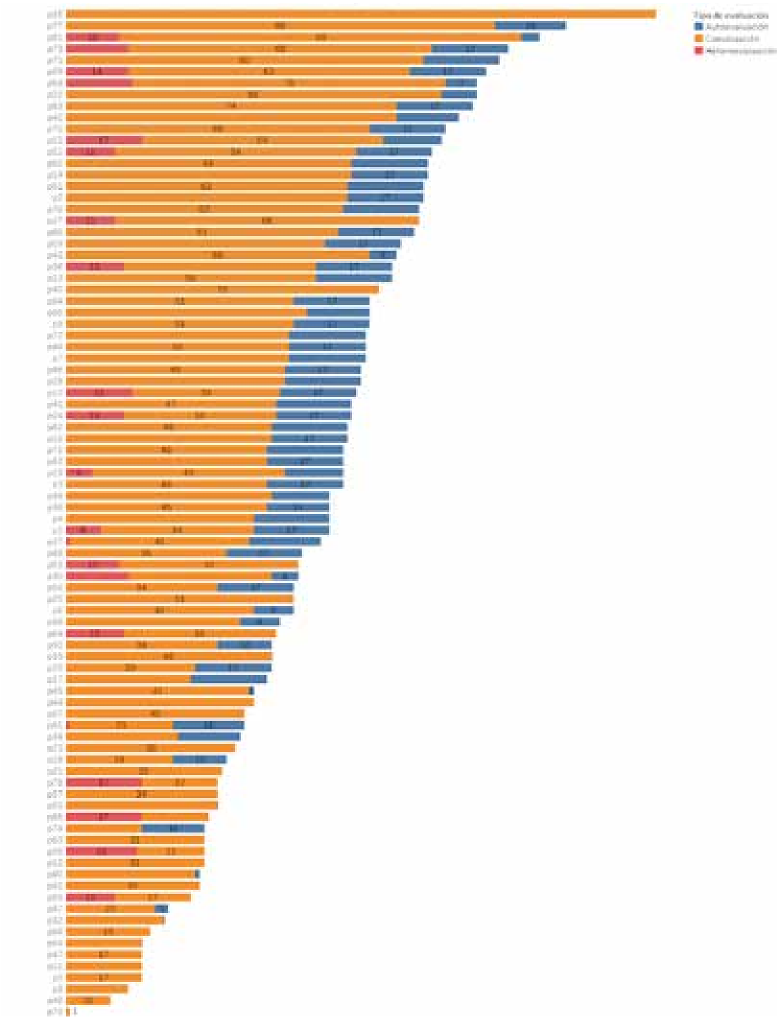


Source: CREAMINKA

4. Evaluation per participant

The graph represents the count of trifocal evaluations per participant (Figure 81).

Figure 81
Trifocal assessments per participant at Rethos 2019

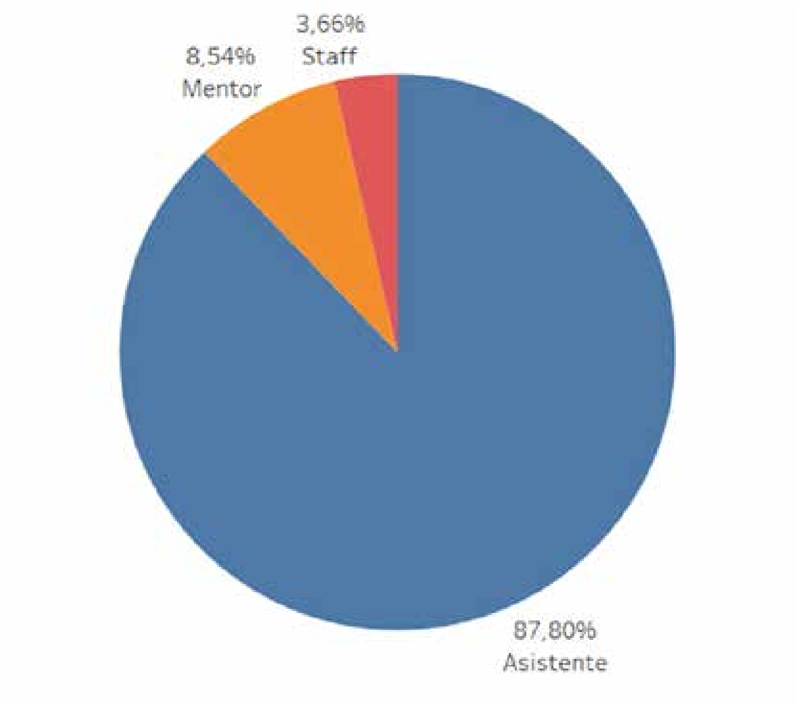


Source: CREAMINKA

5. Percentage of participation

This represents the percentage of people by role in the event who participated in the performance evaluations (Figure 82).

Figure 82
Participation and roles at Rethos 2019

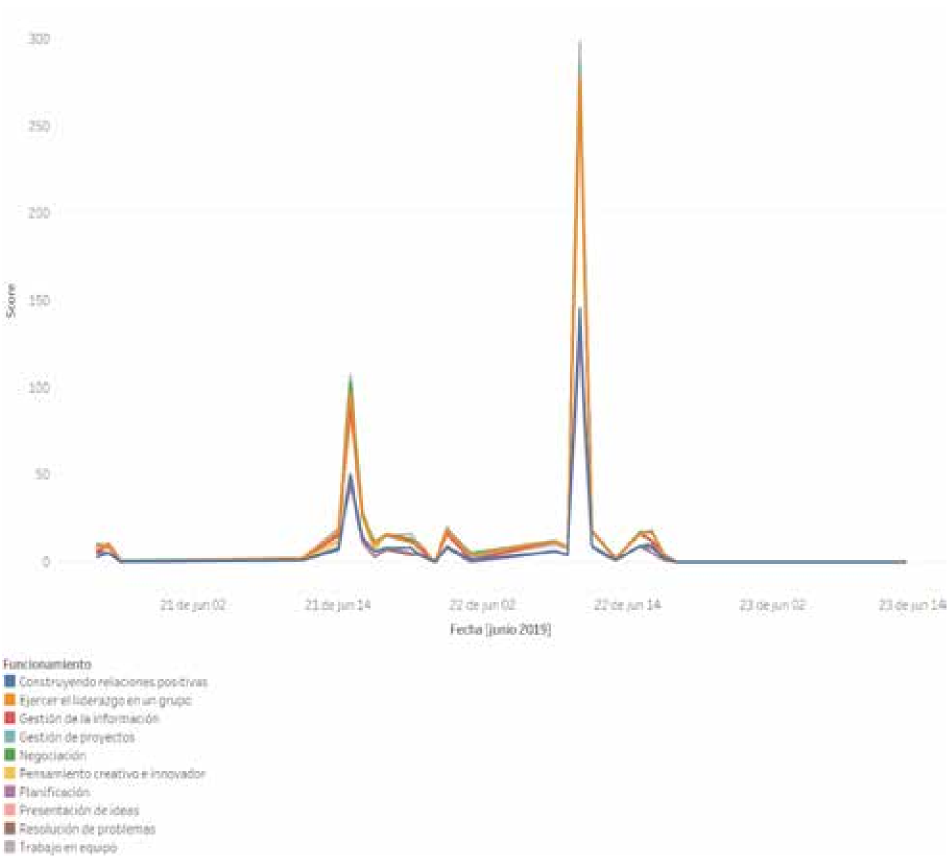


Source: CREAMINKA

6. Evaluation time:

Represents the number of evaluations per operation over the course of the event.

Figure 83
Evaluation times at the Rethos 2019 event

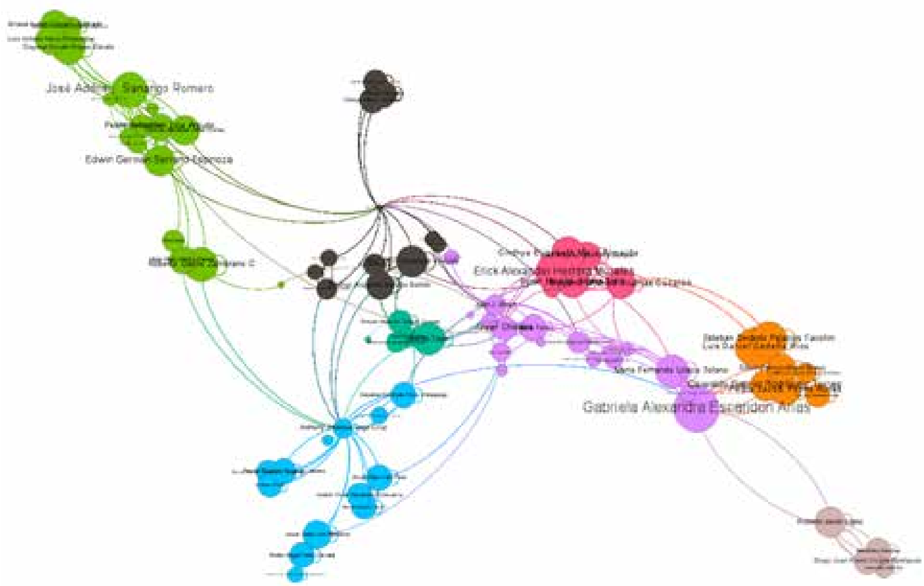


Source: CREAMINKA

7. Evaluation graph

Represents a graph driven by the evaluations in the event, where the nodes are the participants and the edges are the evaluations of actions. Edge thickness represents the number of actions evaluated, the size of the nodes represents the number of evaluations made to the node (Degree), and the color of the nodes represents the communities grouped according to the edges that form the network through a method of grouping using modularity (Figure 84).

Figure 84
Evaluation network at Rethos 2019



Source: CREAMINKA

Coworking: Another Environment That Enhances Capacities

This space offers a unique opportunity to the University to accompany young people to recover their identities built from recognition and identification with others, where in everyday life we can explore love as the most elementary form of recognition, where diversity is not a reality that is tolerated or discarded, but a source of enrichment.

The term coworking has often been heard in the UPS corridors, but is somewhat difficult to explain to people outside. This is precisely why we are committed to a culture of *confidence*. Otherwise, words like disruption, synergies, serendipity, entrepreneurial project, shared leadership, etc. would sound rather ethereal.

The coworking culture combines key elements for social innovation, promoting change in the logic of education, the conception of ethics, the formation of values, the structure of a *society with a market* rather than a *market society*. It favors awareness and the development of critical reason, promotes responsible citizenship, always starting from *trust,* discarding *doubt* about others and excessive efforts to verify that one is not being deceived.

For Adela Cortina working on projects based on the culture of coworking is like "*sealing a pact with others to preserve the biological and the commercial life... create the conditions of stability and confidence that permit the development of affective life, to successfully carry out the political activity, to continue with the exchange*" (Cortina Orts, 2003), which Sen refers to as "*the expression of freedom*" (Amartya Sen, 2014).

Acting in real life and putting into play elements such as *talent*, both *innate* and *learned*, *collaboration* as a guarantee of *multidisciplinary innovation*, with a clear objective of *personal, professional and local and regional socio-economic development,* carried out in a framework of *shared leadership*, make this space a Salesian patio for education with a Preventive System based on responsibility.

For Don Bosco, *trust* is the key element around which others are built. Trusting young people means starting from the assumption that they are good, and preventive action takes a salvific turn when it accompanies the young person to live the reality of his true being, which liberates him and makes him responsible for his decisions.

The point is not to approach entrepreneurship from an academic angle like teaching science in the classroom, but of achieving education for entrepreneurship in actions that produce innovation in areas of regular life or production.

The UPS uses a propositive approach built on three aspects:

- Attitudes of self-confidence and sense of initiative.
- Skills of creativity, planning, resource management, assertiveness, teamwork.
- Knowledge to evaluate opportunities and detect options.

The results should reflect in the constant search for quality, flexibility and diversity. This area offers students the opportunity to adapt their skills to their academic program by creating new knowledge and learning how to solve problems and manage communication.

The major increase in the number of entrepreneurship education programs in universities suggests that entrepreneurship can be taught (Huber et al., 2014), hoping that institutions of higher learning will promote entrepreneurship. Programs in entrepreneurship training can, thus, rapidly spread in universities and colleges around the world (Corbett, 2003) (Karimi et al., 2010) (Almeida & Chaves, 2015). Teaching and learning was identified as a major issue in the international debate on rethinking project management (Winter et al., 2006) (Hodgson & Cicmil, 2006). That is why our society needs new methods to develop a wide range of skills or competencies and train more engineers, who in addition to their professional skills, are also familiar with teamwork, communication, project management and have financial skills. (International Engineering Alliance, n.d.).

The *action* is articulated in the development of an entrepreneurial project, which eventually links up with the personal life project that works as a catalyst for the development of competencies and early professional experiences (IGNACIO De los Ríos-Carmenado et al., 2015) (Chinowsky et al., 2006) (Padmanabhan & Katti, 2002). Through interaction with others, the project encourages the creation of new knowledge based on people's knowledge and experience (Gijselaers, 1996).

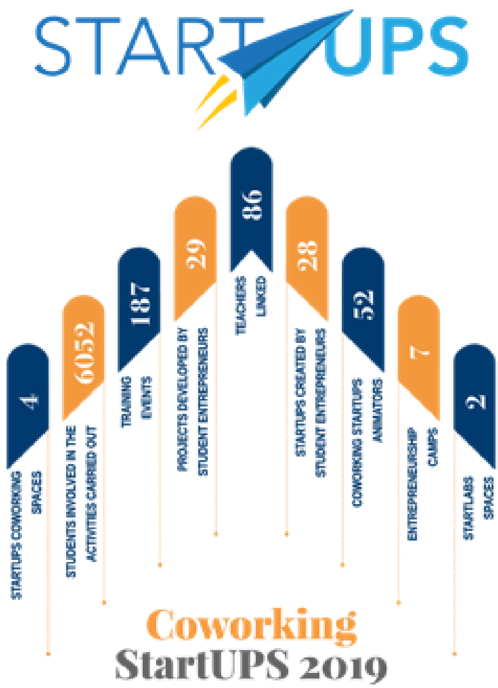
The entrepreneurial strategy is part of the UPS approach guided by the needs for an innovative and research-oriented university. The document "Cuaderno de reflexión universitaria 14 - Hacia una comunidad académica que investiga"[University Reflection Notebook 14 – Toward an Academic Research Community] (Herrán Gómez et al., 2014), considers innovation and entrepreneurship "levers of change" with the strategy and potential to guide new institutional policies whose implementation will help the university to effectively transform in the short and medium term.

Along with the development of the entrepreneurship project, the people who participate in this process will assume the values (Cazorla et al., 2013) (Ignacio De los Ríos-Carmenado et al., 2014) (Ríos Carmenado et al., 2015). The actors involved in this innovation project are the university agents (students and teachers) and the society involved in the design and implementation of projects (del Mar Alarcón et al., 2015) (de los Ríos-Carmenado et al., 2016) (Stratta Fernández et al., 2017). This methodological framework integrates the processes of problem-based learning (PBL) for the construction of entrepreneurship initiatives considering three dimensions of competencies: social-ethics, technical-business and political-contextual, based on (but always going beyond) the standards of the International Project Management Association (Schmehr & Knoepfel, 2012) (AEIPRO, 2006) and ISO 21500 (Stellingwerf & Zandhuis, 2013). The socio-ethical component considers the personal competences of the students and teachers who participate in the innovation processes. The actions of the Coworking StartUPS Project developed competences related to creativity, leadership, teamwork, communication and negotiation, etc. The technical-business component integrates competencies for the formulation and evaluation of entrepreneurship projects, providing technical and business competencies and tools to support entrepreneurs. The political-contextual component allows entrepreneurial projects to adapt to the needs of society in the contexts in which they work, developing contextual competence for project management. Finally, the integrative component or social learning aims to develop a network of university entrepreneurs, supports them and facilitates interaction mainly in the Coworking spaces.

Coworking StartUPS has introduced a UPS educational innovation strategy as a point of reference for prospective business competence development. A model for establishing a governance strategy model guided by the

UPS's mission, vision and values seeks to foster an entrepreneurial culture and ensure project success by creating a community that participates in the PBL process for competency development. The PBL process has incorporated 46 elements of the necessary entrepreneurial project management competencies. This process is reflected in the participation of students in real entrepreneurial projects that address real issues and in a dynamic educational process that allows them to see themselves as entrepreneurs and cooperate with research groups. With the creation of Entrepreneurship Centers or coworking spaces, student entrepreneurs can interact and find a physical space and the necessary advice to connect their ideas with national and international markets. The UPS currently has four such co-working spaces, one each at the campuses in Cuenca, Guayaquil, and two in Quito (Girón and Sur).

Figure 85
Coworking StartUPS figures



Source: CREAMINKA

Thanks to the collaboration agreements between UPS and the public and private sectors involved in the project, a consolidated approach has been developed to adapt methodological problems in teaching real problems; this is based on the notion that students are not passive recipients, but must engage in experience with real content. Therefore, all actors have participated in external and internal university events, including BootCamps. As spaces for accelerated learning, BootCamps are defined as programs that seek to transfer tools to innovate and develop entrepreneurial skills.

Although it is necessary to specialize in a certain science to be able to study it, understanding it would be impossible without complexification. In order to create an environment that enhances skills, the university must, therefore,not succumb to the *phantom of specialization*. Moreover, an environment characterized by freedom of action and self-organization could not be understood from the perspective of *competition for having* as a paradigm of human development. It is therefore necessary – from a perspective of nature - to understand another way of competition that is based on BEING.

The educational challenge of the UPS lies in mediating between the emerging instances of the different levels of participation, both in the educational and social spheres. This implies resorting to the Teaching-Research Fabric, whose fundamental value is freedom and the ability to choose a life that values the commons for furthering one's own objectives (Amartya Sen, 2014). The University Community focuses on developing people's capacity and recognizing their ability to promote and organize themselves.

The Environment that Enhances Capacities generates an organizational *fabric* with the following characteristics:[321]

- 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.
- The understanding of "responsibility" as a field not solely limited to rights, obligations and methods (problems are not seen as other people's responsibility).

321 Burns establishes differences between mechanistic and organic organization;, the characteristics listed were developed on the basis of his work *Innovation Management* (Burns & Stalker, 1961).

- Acommitment to the organization beyond any technical relationship.
- A network structure of authority and communication. The sanctions that apply to the conduct of individuals in their work function derive from the interests of the community and the survival and growth of the organization, rather than from a contractual relationship, represented by an immediate superior.
- Knowledge can be located in any part of the network; that part becomes the *ad-hoc* center of controlling authority and communication, and is not only in the hands of the organization's head.
- Lateral and not just vertical communication; in addition, it is more akin to consultation than giving orders.
- Communication content consisting of information and advice, rather than instructions and decisions.
- Commitment to the organization and the "*technological ethos*" of progress and growth is more valuable than loyalty and obedience.

Participation as a process of increasing learning in social life must be designed and evaluated with respect to the achievement of common goals and services by the community. In other words, it is necessary to define the criteria and procedures for the co-production of knowledge/decisions/actions in the design/implementation/evaluation of policies, actions, projects, services in educational and social areas.

For this purpose, a Participatory Action-Research model has been developed[322] to arrange for an environment that enhances capacities at the UPS. This model will provide guidelines for researchers, teachers and students to co-project and co-evaluate educational initiatives within the framework of social innovation by improving the teaching-research links with the support of Information and Communication Technology [ICTs]. It is a model of design and participative evaluation focused on the student and the teacher in a program or an educational intervention in the evaluation/design practices.

322 The participatory action-research for developing an Environment model that Enhances Capacities has commissioned a joint work under the coordination of the Rectorate and Vice-Rectorate of Research of the UPS with the contribution of: Prof. Piergiuseppe Ellerani and Prof. Salvatore Patera - University of Salento, Prof. Amauri Laurencio- University of Havana, Prof. Ignacio de los Ríos - Polytechnic University of Madrid. Prof. Lucio Poma -Università degli Studi di Ferrara and Fabian Bermeo from INTEGRAR Cia. Ltda.

The latter are characterized in terms of tools for assuming a conscious attitude toward the problems that need to be addressed, of the objectives for defining the solutions and also as a stimulus for defining and monitoring of the project for which researchers, teachers, and students work.

The promotion of an Environment that Enhances Capacities integrates the academic-extra-academic contexts (process), and improves the Teaching-Research nexus (product); specifically, by sharing an innovation model through ICT-supported teaching-research, i.e. a model oriented towards teaching with authentic skills and tasks and research linked to social problems.

Hence, the point is to promote a virtuous circle between research and teaching for social innovation, facilitating organizational learning processes in terms of self-mutual knowledge construction/decisions/actions. This means providing different members (with different modes and time of access) with information on a given topic (domain knowledge) and then develop shared decisions and implement actions for change in processes that involve the same members.

The importance of the Environment that Enhances Capacities for the UPS lies in:

- Defining opportunities for encounter (meeting places) to strengthen dialogue between teaching and research and the corresponding production of transformative and relevant knowledge.
- Supporting the development of youth enterprises (life projects) linked to the priorities of the local context.
- Deepening emancipatory knowledge as a source of innovation and development of alternative forms of production.
- Strengthening the planning of competencies through active socio-constructive didactics to facilitate effective and successful evaluation for *learning to learn*" in the UPS.
- Guiding research as an engine to promote social innovation and as a tool to improve self-realization in sustainable development as required by the context.

The production of new knowledge relevant to the field ends the supremacy of knowledge imposed by the major developed nations, which alienate the new learners from the knowledge of their community, eroding cultural identity and human diversity, with the consequent loss of their values.

''Amorevolezza" or loving kindness (Sáenz, 2017) constitutes a fundamental pillar in Salesian education. It manifests affection and care in the educational and formative process in and outside the classroom. An Environment that Enhances Capacities is similar to the Valdoco Oratory, where young people were grouped together managing their own times and learning styles, as well as their interests ins specific disciplines. Everything that has been learned is structured in terms of awareness of reality and future projects. The innovation and research groups in the CreaMinka community are an optimized scenario with respect to the Salesian approach: opportunities to create learning communities, as well as opportunities to develop joint teacher-researcher-student-local community knowledge.

Entrepreneurship can be understood as a catalyst for initiatives, emotions and life projects that encourage learning in a real context. In other words, Coworking is an environment capable of relating *cognitive knowledge* to *emotional knowledge*. *Cognitive knowledge* can be understood as a thought, belief or knowledge that evolves into a physical sensation and triggers an emotion. Boekaerts (UNICEF & others, 2016) summarizes cognitive work on motivation by establishing four principles: (i) if the person feels competent[323] to face a challenge, (ii) if he or she understands the purpose of what he or she is willing to do, (iii) if the person understands the environment as conducive[324] to learning, (iv) if the person experiences positive emotions that motivate learning. People can use cognitive resources when they have control over the intensity, duration and expression of their emotions.

In other words, tacit knowledge is "*deeply rooted in a person's action and experience, as well as in the ideals, values or emotions that he or she embraces*" (Ikujiro Nonaka & Takeuchi, 1995). The dynamics of knowledge can be explained from the cognitive and emotional nature of knowledge and the decision-making process can be better understood in terms of rationality and emotionality.

Emotional knowledge is characterized by content and intensity. For the same emotional content, we can have different levels, and this is really the main difference of cognitive knowledge. Peirce (Charles Sanders Peirce, 1998) defines as *abduction* the process through which the receiver through

323 Feeling competent does not imply knowing everything about a subject, but rather understanding oneself as capable of executing a learning process, which implies accepting ignorance about the subject, but being sufficiently motivated to face the challenge.

324 Even crises may be an environment that is conducive to learning.

his own logic (which is unique) establishes his own hypotheses to explain what he has perceived as novelty (intensity). This process begins simply by receiving the signal (content) of some data that carry a novelty that needs explanation. In search of this explanation, the person generates, classifies, selects and connects information to give meaning to a new belief, a new creation of knowledge – consistently against the backdrop of surprise caused by novelty.

As was explained above in a *Liberating Environment,* more and more researchers agree that there is a cognitive sense of emotions. Alessandrini (2017) maintains that emotions *not* only sustain the psychological mechanism of a human being that reasons but also form a constitutive part of the person's reasoning capacity. In other words, it is through emotions that the human being attaches importance to what surrounds him, creating values and valorizations, giving meaning and value to knowledge. Ellerani argues that being able to develop emotions in order to imagine, understand, be empathetic, be aware and differentiate, i.e., emotional integrity, is a sine qua non for learning (Ellerani, 2017).

Figure 86
Emotion - Cognition - Creation and Research - Participatory Action

Elaboration: Salgado-Guerrero, J. P.

Analyzing Nussbaum's capability approach, Moschini (Moschini, 2017) concludes that the issue of *capabilities* is loaded with feelings, sensations, emotions, desire for happiness and the eagerness to safeguard one's own environment and the future of one's loved ones. Abbate agrees with this principle and further argues that positive or negative emotions (pity, compassion, love, pleasure, or negative ones such as fear, anger, displeasure, or neutral ones such as shame) give meaning to existence (Abbate, 2017). The same author maintains that recognizing a *cognitive content to emotions* means not only abandoning the concept of irrationality, but also understanding that mere intellectual activity may not have the sensitivity to capture or communicate these emotions.

Another important factor that must not go unnoticed is that emotions are a major factor in taking action. Costa (M. Costa, 2017) comments that emotions sustain *agency*[325] processes, insofar as the *telos*[326] of action establishes a directionality of values constituted by a system of principles that can go unnoticed by the cold intellect. The emotions as well as the motivations favor or subvert the decision to act according to principles, so they can be considered as a constitutive part of the system of ethical reasoning, the foundation of any process of participative social innovation.

Entrepreneurship is an emerging field, in constant evolution, and attracts the attention of academics, politicians and professionals in different branches of science. The concept of entrepreneurship has expanded in recent years; people are no longer only concerned with success and economic benefits, but also welfare and personal development. So is it possible to teach students through being entrepreneurs? There is no clear-cut answer, but in the educational field, many efforts have been made to increase the number of programs with similar objectives. Furthermore, as societies become more entrepreneurial, tasks and project work have become more modular. Therefore, the competencies required by our staff to perform their activities need a

325 The term *agency* can be understood in the pedagogical or social development literature as the *capacity to do or to act*. It is directly related to *autopoiesis*, which for Aristotle is the *productive action* (poiesis) that focuses on results (Aristotle et al., 1970). Plato defines the term poiesis as "*the cause that converts anything we consider not to be into being*" (Crespo Güemes, 2007). Sen "refers to what a person can desire - since he puts value on it - to do, to be" (Amartya Sen, 2014). The value of *"activation" (agency)* implies the concept of freedom to act, the agency inherent to the action starts from the subject, but is generated within social and learning contexts (Massimiliano Costa, 2014).

326 Telos from the Greek τέλος is a Latin word referring to an "end", "purpose" or "objective" used in philosophy.

broader background that inccludes not only technical, but also social skills. Much has been written about entrepreneurship, but universities are still looking for practical tools and methodologies to accelerate their students' mastery of *learning-by-doing,* so that they are able to respond immediately to the needs of a changing global context.

In this context, the UPS proposes the Coworking StartUPS as an alternative among others as a strategy to develop an Environment that Enhances Capacities. This initiative also involves the need to *turn the UPS into a research and innovation university* through the progressive implementation of these policies and/or strategies for its effective transformation in the short and medium term. The process of change has been accompanied by UPS agents (teachers and students) and other partner institutions[327] to develop a culture of entrepreneurship and project management skills. The reason for promoting entrepreneurship is to create an *Ecosystem of Innovation and Entrepreneurship* that involves *Innovation Groups, Research Groups (RGs) and Educational Innovation Groups (EIGs)*.

The links between *epistemology and pragmatics* remind us to consider how science leads us to reflect on our actions and transform them, as well as to conceive that scientific production translates the complexity of the world as we perceive it. These links necessarily require a cycle of action-research-decision-social regulation (Morín & Le Moigne, 2006).

How can we monitor an environment that is so dynamic and changing that it combines a number of variables? The interaction with the context produces a series of subjectivities. Stake (Stake, 1995) argues that monitoring or research must respect the continuous dynamics of change, and therefore be empathic, i.e. respond to emergence and develop progressively. Only this type of research produces organizational knowledge, created from guidelines and strategies of action, facilitating sustainability, flexibility and the capacity to learn.

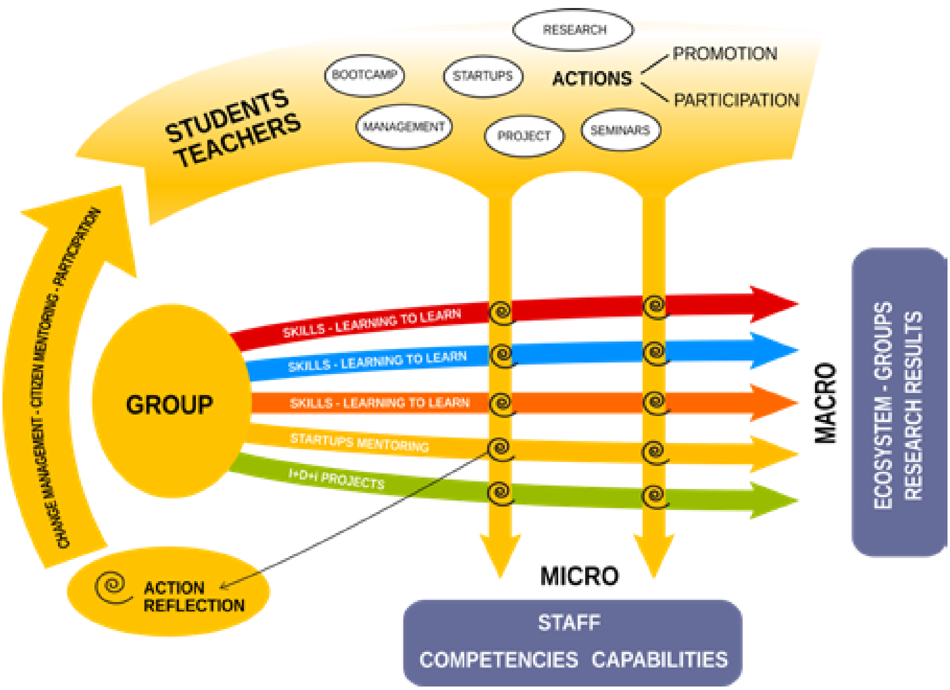
Action-research knows multiple methods that depend directly on the information that needs to be generated (Banister, 2011). *Subjectivity* should not be seen as a problem that has to be eliminated but as an essential element to be understood (Stake, 1995). Learning is not limited to the development of specific *skills or know-how*, but takes into account the system as a whole that interacts

327 INTEGRAR Cía. Ltda. (Ecuador), Universidad Politécnica de Madrid (Spain), Universitá del Salento (Italy), Universitá degli Studi di Ferrara (Italy). The term emergence refers to situations that emerge from within the organization.

with the context (Senge, 1990), where the biggest problem is not the way the university produces but the gap that may exist with the context. Interaction with the environment alone favors the transformation of knowledge into a tacit-explicit continuum and then people also *learn to learn* and above all *learn to be*.

As shown in Figure 87, the groups of actors who share responsibility for the project carry it out in real contexts accompanied by processes of mentoring and change management on a path that, although diverse, shares the same bases of transformation and project management. The tangible results of project implementation produce macro indicators related to the production of relevant knowledge. On the other hand, the people who carry out the projects transform their lives through a process of Participatory Action Research, thus learning to learn and develop their capacities, which in turn shape the micro results. These results are subject to analysis by the ecosystem digesters (CreaMinka).

Figure 87
Participatory action-research, macro and micro results



Elaboration: Salgado-Guerrero, J. P.

People involved in entrepreneurship projects adopt new values or skills in the process. Working With People (WWP) integrates several Problem-Based Learning (PBL) processes to generate entrepreneurial initiatives along the socio-ethical, technical-business and political-contextual axes of the International Project Management Association and ISO 21500.

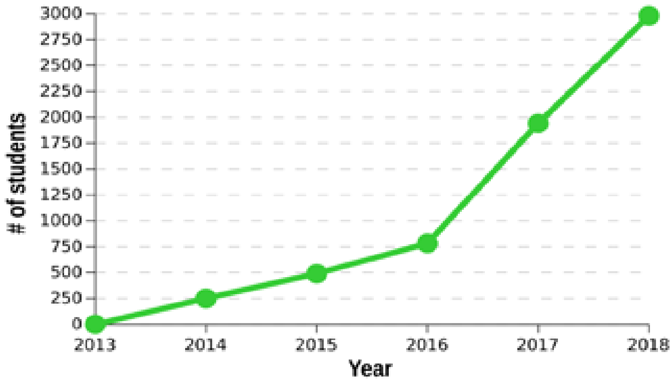
The socio-ethical axis considers personal competencies (behavior, attitudes, values) where actors interact to change ideas and new entrepreneurial initiatives, socialize experiences, seek advice and funding opportunities. The competencies to be developed involve leadership, creativity, teamwork, etc. The technical-business component integrates competencies for generating goods and services for society - instruments that help entrepreneurs to define, propose, plan and budget their projects, products or services in their respective business model.

The political-contextual axis is useful for providing context. The business model when checked against the real world, and the competences to be developed involve activities to implement and evaluate the projects, establishing stronger links between university and society. Finally, the Coworking spaces are an integrating component within the UPS environment, places to generate synergies between the different actors in the ecosystem, set up new collaboration networks, discuss new ideas, share experience, provide feedback to generated knowledge, etc.. These spaces are also meant to be the hubs that connect the UPS entrepreneurial ecosystem with the local, national and international context.

BootCamps: Accelerated Entrepreneurship Camps

A BootCamp is a program that transfers tools and techniques to innovate and develop business skills. In these events, entrepreneurs meet to present their prototypes and sustainable business models for innovative projects. They also have a chance to analyze their entrepreneurial profile, generate alliances with other entrepreneurs, investors or businesses, and acquire new knowledge through intensive practical experience, and thus identify more clearly the chances of their projects.

Figure 88
Participants in events, innovation and entrepreneurship activities



Source: CREAMINKA

The objectives of this activity are: exploit creativity focused on production, technology, human talent, futuristic vision and entrepreneurship of students; give students the opportunity to present their projects; create links between students from different universities; create an interdisciplinary community (J. P. Salgado et al., 2017); enhance their skills and knowledge.

In short, they are spaces for accelerated learning. Connecting with others facilitates the development of creative ideals for problem-solving. This model highlights the figure of the mentor as an individual who connects with entrepreneurs and accompanies on their journey, without responding to their concerns, but helping them to respond to themselves (J. P. Salgado et al., 2017).

For analysis purposes, this book takes into account the experiences gathered in the April 2016 "BootCamp Science, Technology and Culture," which aimed to consolidate the UPS innovation ecosystem and determine the progress of the various projects that are part of the ecosystem, in addition to generating feedback based on the analysis of their states. This BootCamp counted with 24 national and international mentors and more than 100 entrepreneurs from all over Ecuador.

Figure 89
Bootcamp Rethos image

Source: Vice-rectorate for Research. UPS

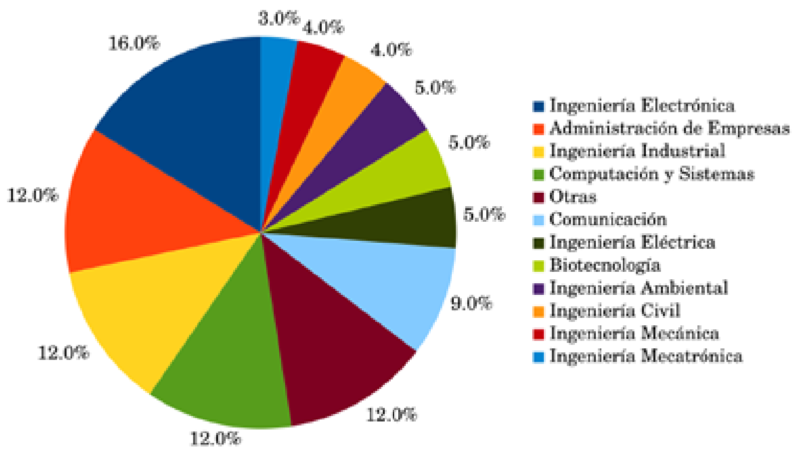
Figure 90
BootCamp reCREATE image

Source: Vice-rectorate for Research. UPS

It also uses the information produced in the "Teacher-Mentor BootCamp" in August 2016. Various activities were developed to train and motivate the university teachers and guide the mentors towards the UPS Innovation and Entrepreneurship Ecosystem. These mentors will be the people in charge of following up and supporting the StartUPS projects. Some 60 teachers from all three UPS sites participated in this Boot Camp, and even as many as 80 in the second edition in August 2017. The BootCamps ReCRÉATE and RETHOS were established in 2017 and will be continued as a permanent strategy for the Acceleration of the Ecosystem.

The ReCRÉATE BootCamp is a space created for student entrepreneurs who want to change the world. It is designed to provide accelerated entrepreneurship tools to boost students' creativity, allowing them to identify solutions to regional, national or international problems and present them in an appropriate and coherent way to potential entrepreneurs and investors. ReCRÉATE is the ideation of your innovation project, your life project. Three ReCRÉATE BootCamps were held at the different UPS sites with the participation of some 600 students.

Figure 91
Participation of the various departments in the events



Elaboration: Salgado-Guerrero, J. P.

The rETHOS BootCamp marks the beginning of a new stage for UPS entrepreneurs. While ReCRÉATE is dedicated to the ideation process, the various construction stages and the appropriation of the innovation project, rETHOS challenges entrepreneurs to defend their idea and convince investors that their business model and their idea can solve a problem. In April 2017, the rETHOS BootCamp was held in the city of Cuenca and included 40 innovation projects, international mentors (P4S from Colombia, INCREA from Chile), brand entrepreneurs (PayPhone, etc.), and even delegates from the Sub-Secretariat of Higher Education, Science, Technology and Innovation (SENESCYT). The winners were the teams of ventures Comfy, NewGlass, and PAK.

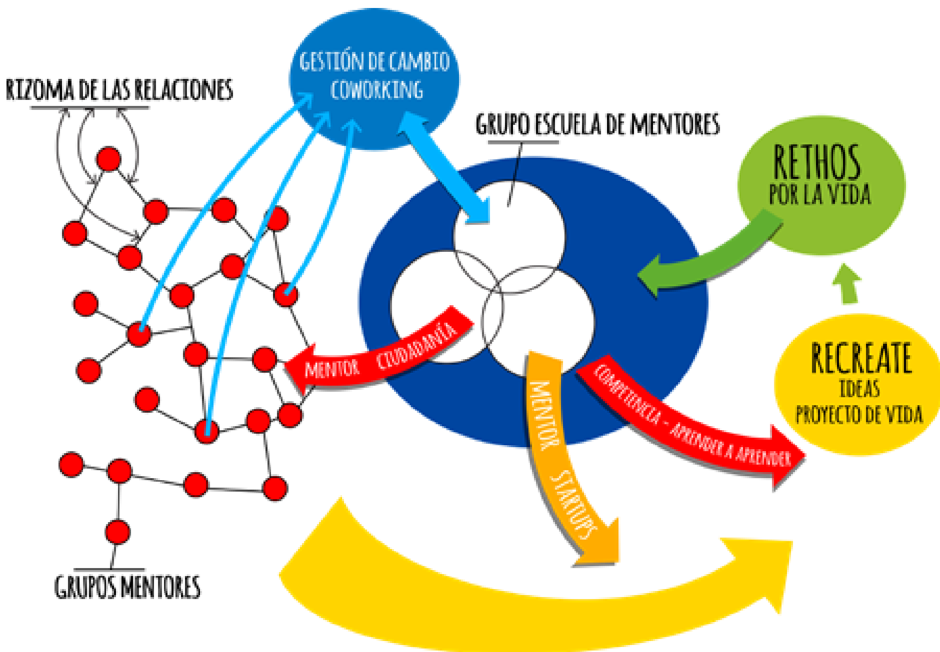
As can be seen in Figure 67, the students of the University are invited to participate in Mini-BootCamps, which offer an induction to eco-systemic logics without too much theory, but rather learning through the experience of coexisting with those logics. That experience establishes the centrality of a project that combines research, innovation and entrepreneurship with a person's circumstances of life.

Once the potential of a project has been established, those who wish to continue the process participate in a new BootCamp called ReCRÉATE, which develops the vision through ideation techniques. Finally, those who managed to present a viable idea, will participate in a much more important event, the rETHOS BootCamp, which solidifies the bases of the project through intensive training, taking advantage of the opportunities offered by the Ecosystem Acceleration.[328]

Students with promising innovative projects or change management skills can enter the School of Mentoring and Change Management, where - through a participatory action-research methodology (J. P. Salgado et al., 2016) - they activate the Ecosystem by mobilizing the bases of the University with various activities, including Mini BootCamps, thus closing the cycle that feeds the Ecosystem and generates community.

328 Cf. glossary

Figure 92
Cycles for the Mentorship and Change Management School

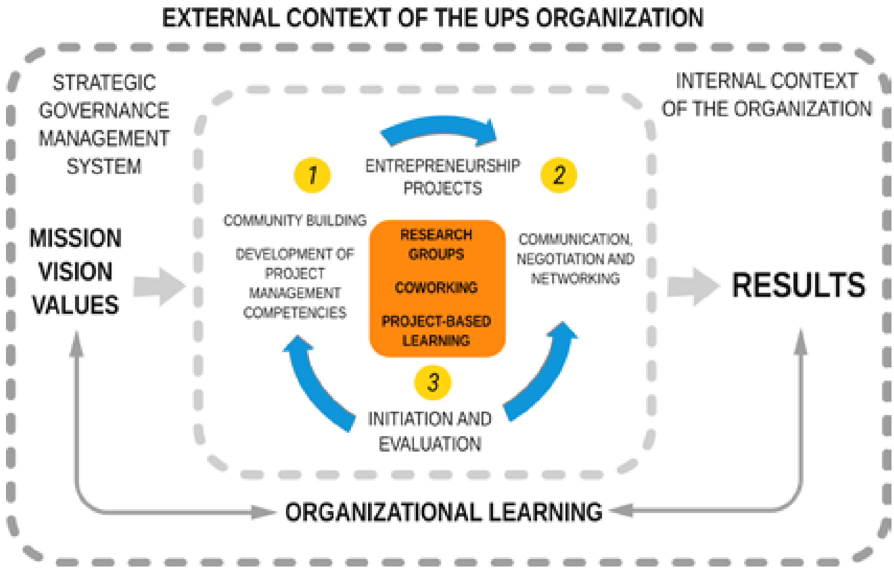


Elaboration: Salgado-Guerrero, J. P.

PROJECT IMPLEMENTATION

The UPS introduced the Coworking project in 2015 as part of its S*trategy Towards a Research and Innovation University* (Herrán Gómez et al., 2014). It uses the development of entrepreneurial skills as stipulated by the IPMA (International Project Management Association et al., 2006) (Schmehr & Knoepfel, 2012) for project management as a point of reference. Figure 93 depicts the implementation of the model.

Figure 93
Competence development cycle



Elaboration: Salgado-Guerrero, J. P.

Phase 1: Community Creation and Developing Project Management Competencies: PBL Process

The first phase integrated actions to implement teaching processes for developing project management skills. Based on the PBL method, students were assigned to small groups to plan, design and evaluate an entrepreneurial project that meets a customer's real needs. In this process of approaching reality, a number of group activities and workshops were carried out using active learning-by-doing methods to generate direct interest from the students.

In the work sessions, the teacher acts as a mentor and provides students with a set of methodologies and techniques to manage a project from Initiation, Planning, Execution, Monitoring and Control, to Project Close. After the training period (Figure 93), students must develop and defend a feasibility study of innovation projects in conjunction with teachers and managers. Participating in projects with real content enables students to get in touch with external agents and solve real day-to-day problems and develop their skills as they see themselves as entrepreneurs. According to IPMA, teamwork involves a group of people who cooperate and interact and are responsible for developing a project or activity that yields the expected results.

As mentioned before, the projects are completed with assistance in five periods. The initialization period outlines the scope of the project, the business plan and the expectations of the stakeholders, and identifies possible proposals to solve the uncertainties and the current situation. Planning and execution details the schedule, cost and benefit estimates, resource management, project organization, etc. Monitoring and control analyzes the economic, social, environmental and technological feasibility of the project. Closing includes the results, final reports of the project, analysis and the steep increase in competences.

A total of 827 UPS students and 79 teachers participated in the project management training sessions and proposed 103 innovation projects in different areas such as applications, prototypes, etc. The resulting projects were followed up in support and feedback workshops, as well as in meetings with different groups at the university such as the entrepreneur's club, research groups, etc. The main objective of this stage was to create a community and a link between students and teachers to motivate them to be part of the innovation ecosystem through:

- The explanation and dimension of the co-working project.
- The sharing of tools for managing entrepreneurial projects and personal growth.
- The creation of cooperation spaces where people can develop their creativity.
- The transformation of the university culture towards the common good.

These five assisted periods are independent of the stages of development of each of the projects, which are (Silverstein et al., 2013):

- Identification of the opportunity
- Ideation
- Solution to the problem
- Demonstration of innovation

Phase 2: Establishment of Coworking Spaces

At this stage, spaces for entrepreneurship or collaborative work were created to support entrepreneurs and facilitate interaction. These physical spaces offer the facilities that allow the entrepreneurs to develop their creativity and receive advice for how to promote their ideas and connect them to national and international markets.

UPS has four coworking spaces at the national level: Cuenca, Guayaquil, Quito (Giron and Sur campuses). These spaces are managed by coworking coordinators, who are student entrepreneurs. The facilities can be used by all people inside or outside the UPS who are committed to learning, exchanging ideas and carrying out innovative projects. In addition, the spaces are open for workshops, tutorials, trainings, fairs, talks, networking, brainstorming, etc. that generate value for the ecosystem and the student. Currently, participants work permanently on 48 projects in these spaces, and on and off on another 62. They receive an average 80 visits per month from people interested in finding out more about those spaces, how they work, and how one can become a part of them, and what role they play within the innovation and learning ecosystem.

Phase 3: Communication, negotiation and networking

In the third phase, specialized workshops were held to intensify the learning process about the business culture and its complex management. During this process, the students presented their innovation proposals to investors. The demonstration typically consists of an oral presentation (pitch) that describes the problem, the solution and the business model. The participation of these investors (entrepreneurs - research groups) in these workshops increases innovation and learning, it establishes interdependencies and links between teaching and research activities and entrepreneurship, and enhances the skills of entrepreneurs.

Cooperation agreements were signed between UPS and public and private entities for implementing the best entrepreneurship projects. This approach has permitted students to be recipients and active actors of knowledge by being involved in project management with real content.

PHASE 4: IMPLEMENTATION AND EVALUATION

Assessment for empowerment has clearly educational purposes (assessment of learning). It aims to train those involved in educational programs on practical evaluation, notably by identifying room for improvement for the next stages of participatory planning.

Such practices are seen as tools to help increase awareness of the problems that need to be addressed, useful ideas for solutions, and as a stimulus for the ongoing definition and revision of the project. The evaluation is therefore participatory, as it involves the stakeholders in a process of negotiation of views, representations, interests. It is also useful to define a shared vision from which to plan, and it is a participatory process of improving practices, services, and projects.

Evaluating Coworking StartUPS Project begins with students' self-evaluation with the help of the IPMA certification process (International Project Management Association et al., 2006) questionnaire. A problem with self-assessment is that students find it difficult to reflect on their own experience and knowledge. In addition, a major effort was made to sensitize teachers to the need to change the system and the assessment approach, evaluating their competencies rather than their knowledge. The evaluation process is carried out in two steps: individual evaluation of the students as well as a collective evaluation that contrasts the individual evaluations. The results of the assessment by competences from a before and after perspective indicated that the students improved in technical, behavioral, and contextual competencies by 22.81%, 15.81% and 27.68% respectively (regarding experience), and 24.42%, 13.48% and 27.19% (knowledge) as shown in Table 16.

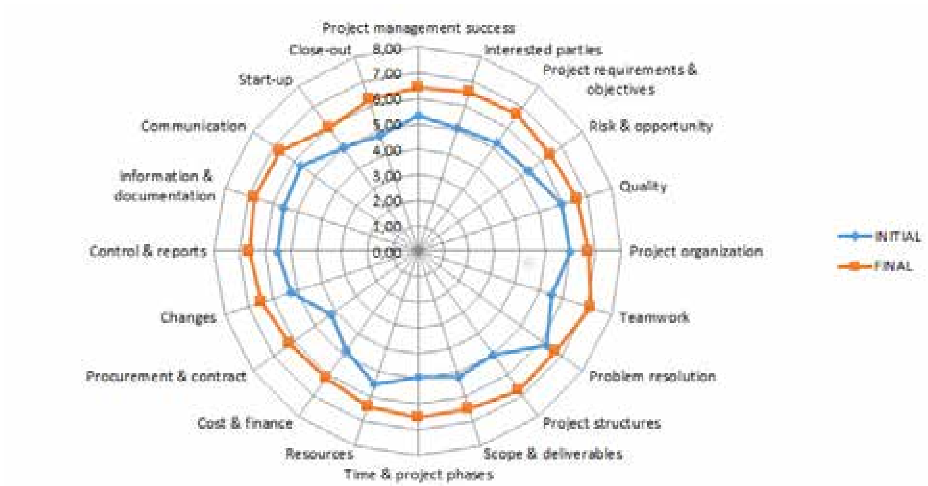
Table 16
Development of entrepreneurship competences

	Mejora del conocimiento promedio (%)	Mejora de la experiencia promedio (%)	Promedio: experiencia + conocimiento (%)
Competencias técnicas	24,42	22,81	47,24
Competencias de comportamiento	13,48	15,81	29,29
Competencias contextuales	27,19	27,68	54,87

Elaboration: Salgado-Guerrero, J. P.

Figures 94-96 compare the different results obtained in terms of assessment by competences from the beginning to the end of the learning process of project management.

Figure 94
Comparison of contextual competences

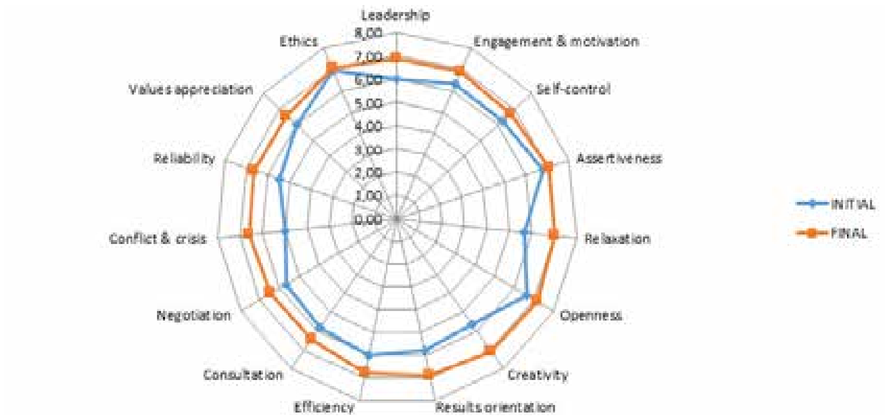


Elaboration: Salgado-Guerrero, J. P.

Figure 95
Comparison of technical skills

Elaboration: Salgado-Guerrero, J. P.

Figure 96
Comparison of behavioral skills



Elaboration: Salgado-Guerrero, J. P.

The competence-based approach links teaching with professional backgrounds and is based on cooperation, active participation and interaction, which offers a range of possibilities for the development of competences. The advantage of this methodology is that it regards the student as an active actor and recipient of knowledge who is directly involved in managing projects with real support. This encourages the integration of new knowledge that can be implemented in new companies or projects.

> The development of personal competences through the organization in work groups, and the challenge of facing complex real situations are part of the processes and activities integrated in the methodology and necessary to promote entrepreneurship in the university environment. These processes encourage the creative capacity and innovative research, and generate new knowledge and boost students' enthusiasm and motivation to solve problems. (J. P. Salgado et al., 2017)

The Coworking StartUPS project has proved to be an environment that enhances skills and offers educational innovation that works towards the university's objective: an innovation and research university that does not neglect the personal growth of its participants. StartUPS links students, teachers and external actors in research projects, and makes these projects the focal point for developing and enhancing capabilities.

Biotope: The Common Pool Resource

The term *common resource* denotes a resource a community has access to, uses and looks after with a certain normativity and organization. In other words, it means a way of life, and involves not only rights but also responsibilities (Helfrich, 2008, p. 23). The term *commons* highlights the common points that "are intended to strengthen or create" rather than to homogenize "the common" (Ulrich, 2008). Resources are used only if they make sense to society; the management of these goods is based on ensuring the existence, stability and resistance of resources and systems, as well as guaranteeing equitable access, use and distribution.

As mentioned above,[329] Ostrom distinguishes the public good from the common good and links the latter to the Common Pool Resource (CPR).[330] A person who contributes to the provision of a public good is not concerned with those who use it the most, as long as it is available to everyone. However, a person who contributes to the provision of a Common Pool Resource is interested in how many people use it, when and where, and especially if others also contribute to its provision (Elinor Ostrom & others, 2000).

The UPS is a resource that responds to the interest of a specific community, it is a common good that has the capacity to exclude users and define how many use it, when and where, and how they contribute. It is an exclusive good in which all users participate under certain norms and conditions, it is formally and constitutively linked to the Church (John Paul II, 1990). The UPS is neither a public good nor a common good of general use.

Moreover, the UPS is characterized by the existence of a religious community promoter: The Salesian (Sacred Heart of Jesus Inspectorate); this external authority ensures the fulfillment of the mission and vision through monitoring processes and ensuring the standards previously accepted by the appropriators and providers.[331] "As long as there is *no monitoring there* won't be *credible commitments; without* credible *commitments, there* is *no reason* to *propose new rules."* (Elinor Ostrom & others, 2000, p. 100).

This external authority regulates private interests with regard to the management of the commons. Individual interests must converge in commu-

329 Cf. Part I The Common Pool Resource as a Biotope

330 This book understands the term Common Pool Resource as including not only material but also immaterial goods.

331 Cf. Part I The Common Pool Resource as a Biotope, or check the glossary.

nal ones, which is why the community that appropriates the common good must develop agreements and regulations to this effect. The external authority intervenes to regulate individual interests to make the CPR sustainable.

Those who are part of the UPS have an interest in appropriating something that the university offers: knowledge, salary, prestige, profession, etc. However, they also need to provide something in return to sustain the university: work, economic resources, etc. Hence, the university community resorts to practices that guarantee the preservation and improvement of the university as a CPR.

At the governance level, the UPS - managed as a CPR - is controlled by the academic authority, formed with self-government, and the external authority of the founding institution that evaluates the self-government within the framework of the institutional identity and mission.

It is clear that further research is needed to strengthen the management of the university as a common pool resource (CPR). Furthermore, any framework for collective action must respond to its identity and mission, and it is necessary to consolidate social practices based on a culture that results from organizational action and knowledge.

As the university is a complex organization-system and also shares *common resources*, the question is how to understand the shared resources in the university? For Ostrom *social capital*[332] is equally important as *physical capital*[333] for institutions, and considers the process of building the institution to be profoundly sociological and political.

Cooperating in the management of an asset implies *economic know-how* that belongs to the social group that deals with the *common* and requires political conditions that allow and stimulate self-government as a result of agreed decisions, negotiations between users and suppliers - and all of it governed by the imperative of sustaining the common good.

In order to make this possible, it is necessary to interlace the economy, society and politics at the same level. These are at the same time science and action, and therefore they must be in balance. As for the economy, one needs a dynamic balance in the cycle of *economic know-how* and *knowing how to*

332 While one can criticize to use the term capital for social-related issues, Ostrom's concept is useful for analysis

333 For Ostrom, establishing rules is an investment in social capital that pays off (Keohane & Ostrom, 1994).

act economically.[334] Acting economically as an end in itself would subordinate politics to economicist reason, where the community appears to be self-regulated and autonomous, but in reality it would be progressively dominated and governed by the forces of supply and demand. Also, if there is no policy of the *common*, governance is less permeated by *economic action* of the community and limited to administer and manage according to market needs and results, and, thus, being reduced to a simple regime.

These forms of action in accordance with a common pool resource turn the UPS research community into a kind of commune[335] (Juncosa Blasco et al., 2019), that is more than a form of social articulation, a social-contractual model of systemic organization[336] that endows value so that the economic exchanges can be made in a noncommercial political dimension within the community. To *act economically* would be impossible in a commercial university because it privileges the market value and propitiates individualism, reducing the contributors to simple consumers of supply and demand.

Prioritizing self-sufficiency and the sustainability of the common good, the economy of the communal UPS is a unity of appropriation/provision and uses strategies of the production of goods and knowledge. These strategies are related to the tangible good and therefore limited, and they value the action as work and care. The strategies developed in the UPS are based on the values of the common and therefore non-commercial, reinforcing the identity and autonomy of the community which is at the same time capable of interacting with the generally commercial context.

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334 Acting economically starts from the experience and knowledge produced by the very experience, in other words, it is a rationalization of the activity (discernment of the opportunities, options and possibilities). This rationalization leads to a new action (the logic or practical rationality calculates and rationalizes the action). Thus, *practical action* articulates *scientific know-how* of *economic activity; economic action* (applying that knowledge in action) is based on economic science.

335 Communality involves decision making often in search of balance and often in crisis. Community implies a set of previously defined values.

336 For Morin, the concept of system has three facets that he considers indissoluble: *System* (the complex unity and phenomenal character of the whole, as well as the complex relations between the whole and the parts), *Interactions* (the set of relations, actions and retroactions that are carried out and woven into a system), *Organization* (the constitutive character of these interactions -what forms, maintains, protects, regulates, governs, regenerates- and which confers the backbone to the idea of system) (Edgar Morin, 1984).

This is not meant as a eulogy of the management of the commons or repudiating market participation in the organizations. Although the market economy can use the production of the common good for its interests, it is equally true that the economy of the common good uses the production of the market economy for its own purposes.

Non-Commercial Strategies for the Common-Good University

The community that acts according to a common pool resource requires strong ties of reciprocity and interchange that are based on *acting economically*, which implies that the human being is at the center of the economy. The important thing is not to produce more but to produce to live well. We must empower the UPS community vis-a-vis its economy (Schuldt, 1997), give priority to what is necessary rather than to what is commercially efficient, and focus on sufficiency rather than capital accumulation.

Every community,[337] and even more so the university community, is obliged to interact with the – globalizing – context. It is necessary to think how the institutional arrangements can evade the conditioning of capitalism regarding its organizational forms (Laval & Dardot, 2015). This implies that there are difficulties to overcome, and therefore the UPS has developed strategies[338] to assure its sustainability and self-supply while maintaining its autonomy and identity.

Below are some strategies based on the practices[339] that have been observed - some emerging and others constituted - in the UPS university community. These practices are derived from the identity characteristics that

337 Communality involves decision making often in search of balance and often in crisis. Community implies a set of previously defined values.

338 The Center for Andean Communication and Development (CENDA) defines as Andean complex the set of historically developed strategies, the productive and ritual practices as well as the physical and structural conditions in which the community has to develop (Calvo et al., 1994).

339 These practices are transversalized by the ideal values (Juncosa Blasco et al., 2019), these are not only related to "good life", with nature or social bonds, since that would require a mere moral mention about how to manage the common goods, and these practices are: "(i) Sustainable and tenable management. (ii) Consensus management. (iii) Management that shares benefits. (iv) Collective action management. (v) Management of self-government. (vi) Management of reciprocity. (vii) Management of the economic model of non-market exchange. (viii) Management of organized sociality. (ix) Management of voluntary participation"

have historically marked the Salesians in Ecuador - their openness to interculturality, work for the person from the person, and the religious mysticism of life - in addition to the very Andean context in which the UPS has developed (Figure 97):

Figure 97
Non-commercial strategies of the UPS

Elaboration: Salgado-Guerrero, J. P.

Reciprocity and Redistribution:
Non-Monetary Production Strategies

The aggregate of available or potential resources is directly related to a network of enduring relationships, knowledge and mutual recognition that form an instituted whole. This means that non-monetary production strategies beyond tangible resources to recognize the community network that mobilizes them (Bourdieu et al., 1995, p. 38); that way, they depend on relationships of reciprocity and redistribution.

Human capacities and productive resources in a community lead to corresponding self-control of accumulation and centering of consumption patterns, which Acosta calls "self-centering of endogenous productive forces" (Acosta, 2012). Reciprocity occurs in the sphere of production and redistribution in the sphere of consumption, and these are always complementary.

Redistribution has to do with social control that a community exercises to avoid social differentiation and to favor equity based on social justice. In this regard, the UPS currently maintains a differentiated scholarship system, which grants access to university education to those who have less and takes from those who have more.

The logic of redistribution and reciprocity paves the way for a different kind of wealth: social wealth. The UPS remuneration system follows the criterion of sustainability. People may not get rich, but will be able to lead a respectable life, and are linked to students' capacity to pay (main funding source).

The UPS' autonomy from market logics is based on the mentioned *social wealth* and is possible because of the community's *economic know-how* as it prioritizes the sustainability of the common pool resource and the self-sufficiency regarding covering all needs.

The relations of reciprocity not only exist for access to work but also regarding comprehensive access to the appropriation-provision of the common pool resource: physical and economic resources and produced knowledge.

Access to socio-productive resources[340]

The centrality of the person in the UPS implies a dignifying dimension of work, as well as understanding that we not only work with others but also for others. This includes the need to establish strategies to ensure that access to the resources needed to produce in society is based on reciprocity, redistribution, exchange, barter trade, inheritance and other non-market values that reinforce a community sense of identity based on synergistic interactions.

In the UPS some non-monetary strategies for the production of knowledge have been devised as community practices (Juncosa Blasco et al., 2019):

1. Community Work: Work without direct redistribution or remuneration. Establishing close relations between people produces an effective obligation of solidarity that is spontaneous because the exercise of solidarity does

340 Not the commodification of labor but the supremacy of man over capital. "It is understood, just as the analysis of human labor made in the light of those words, which refer to the 'dominion' of man over the earth, penetrates to the very heart of the ethical-social problem. This concept should also be central to the entire sphere of social and economic policy" (John Paul II & Caffarra, 1981).

not foresee planning (Churuchumbi, 2006); therefore, more than institutional it is instituted and not regulated.

2. Minka:[341] Participation in work sharing. In the UPS case, it has to do with *harvesting* knowledge produced and the economic consequences for the university. This form of work is non-commercial because it is about results rather than pay. It reinforces synergies in the community and links individual and common interests (Amartya Sen et al., 1991) (Acosta, 2012). Minka has stimulated production, minimized the costs and stimulated the work. [342] In the communal-university complex, which will be addressed later, it has also been a space of exchange of sociocultural norms, cohesion and a call to share responsibilities.

3. Alternative forms of money. Money does not have a conception of profit and is constituted in an instrument of mediation in the community (Schuldt, 1997); it is used for the organization based on the dynamics of appropriation-provision. At the UPS, research groups can receive economic incentives and resources from outside that are managed for the development of the group and its research processes. This money is used in a symbolic way, i.e. it is not used directly by the group but by the university community; it is allocated following a collective decision by the research group. The possibility of deciding on these resources strengthens the members' sense of belonging to the community and develops their management capacities.

4. Solidarity. Consists of subsidies[343] provided by research groups to needy students who collaborate with the group. This aid is based on reciprocity and follows a strategy of access to alternative forms of money.

5. Assistantship. This kind of labor relation is not one of a "worker" who an employer seeks as a "wage-earner." Although the assistantship implies a certain retribution, the assistant rather aims for recognition and more stable bonds in the group, and it has to end after a previously agreed time.

341 Although the term minka originates in the Andean culture, its meaning is generally recognized. Minka is a form of community work seen as a necessary condition for social coexistence, since material goods for Andean communities are conceived in a family order (Pilataxi Lechón & Ortíz, 2014). The minka is an institution of mutual assistance, it ensures the work destined for the common good of the community (Acosta, 2012). It is a form of counting on labor or offering it whose payment is made in kind, for example, if everyone tills and sows the land, the harvest is somehow the reward for everyone.

342 This becomes evident in the Rector's reports related to knowledge production.

343 In this sense, helping the poor with money should always be a temporary solution to solve emergencies. The great objective must be to assure them a dignified life through work (Francisco, 2015).

6. Work for work. This strategy does not refer to the exchange of working time for pay, but rather any work done gives access to the benefits of participating in a group constituted in the UPS community. This provides the group with work force from outside the group. It fortifies and stabilizes the implicit contractual relations in the long term.

Appropriation-Provision

As we could see before, the complementarity between an individual and the common pool resource is expressed in the relationship of appropriation- provision. The awareness that a common pool resource is limited and therefore does not resist unlimited appropriation, conditions the commercial logics and establishes new management values.

In contrast to the logic of accumulation of wealth, the UPS community is committed to optimization rather than maximization. The objective is the confluence between efficiency (groups with primary economic interests, Wirtschaftsgemeinschaft) and equity (groups with secondary economic interests, wirtschaftende Gemeinschaft) (Weber, 2014), the perspective of ecosystem complexity drives a vision where these are not only opposed but also complementary.

UPS favors agreement and consensus, even though this implies more discussion. The collective action councils (Research Councils, Academic Council, Superior Council, Career Council, etc.) (Table 17) use everything in an optimal way as long as it supports the forms of production. Considering whether or not the use of a resource is optimal depends on the sustainability of the common pool resource.

The rules necessary for the appropriation of the common pool resource (CPR), as well as those that regulate the forms of production and the corresponding provision, are immersed in a relationship of complementarity. The care and the work (Boff & Valverde, 2002) expressed in the appropriation-provision give cohesion to the UPS and allow it to maintain its autonomy and develop within the market society.

The rules are consensual and therefore can change over time; yet, flexibility does not mean laxity, and any modification takes into account the following:

- Changes in the rules 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 implement, which increases the stability of mutual expectations between individuals who interact according to a set of rules.
- Changes in the rules at lower levels under the auspices of those at higher levels are more flexible and therefore favor community action without contradicting the objectives of the common good.

Table 17
Levels of the governing councils of the UPS community-university

	Academia	Research	Management
Monitoring level *Constitutions* *Analysis of Constitutionality*	Directorate of the Salesian Society of Ecuador		
Superior government level *Collective election analysis* *Institutional government councils*	Superior Council		
Collective level *Analysis of collectivity*	Academic Council	Campus Research Council	Economic Council
Operational level Action councils *Analysis of Operationality*	Career Council, academic senates	Research Group, Educational Innovation Group	Campus Coordination Assembly
Note: The feature of community outreach is understood as the product of teaching and research activities as well as economic activities; this feature, therefore, spans all action levels and all possibilities of two-way interaction with society. If any level of government disregards the outreach function, it would be undermining all pretensions to the common good because it would break the cycle of the university as a product and producer of society.			

Elaboration: Salgado-Guerrero, J. P. (Salgado J. P. et al., 2019, p. 115)

The social organization of work.

According to Boff, work and care constitute the basic essence of man's interaction with his surroundings, which demands complementarity and not predominance. After all, care implies living together.

Work combines the dimensions of life: "Creativity, projection of the future, development of capacities, exercise of values, communication with others, an attitude of worship" (Francis, 2015, p. 127). If the human being is "capable of being by himself an agent responsible for his material improvement, for his moral progress and for his spiritual development" (Paul, 1967), the meaning of work will be more than a right, because it is a social duty, and more than the utilitarian concept, because work is dignifying.

Work, as any type of action and therefore of creative transformation, cannot be disengaged from the subject-matter bonds, because as an action that implies living with what surrounds a person, the bonds are subject-subject, avoiding the subject-object reification.

Boff raises two basic ways of "being in the world": work and care, from which arises the entire "process of construction of human reality" (Boff & Valverde, 2002, pp. 24-25). Work and care are complementary and exclude the predominance of either.

This perspective of the common good that implies work and care in the UPS has affected the political, social and economic logics of the university community (Juncosa Blasco et al., 2019, p. 124):

- The logic of work-care implies that *human action* is not guided by the accumulation of wealth and maximization of results, but is rather immersed in optimizing resources with relationality and reciprocity to ensure that the common pool resource is sustainable and tenable. Consciously welcoming the other is to bring out the value of life. The need for relation and the emergence of life forces an ecosystemic interconnection (Maturana & Varela, 1987). If economic rationality prevails (guided by the ends) over economic acting (ethical praxis of the means), the relationship becomes a "forced aggregation of domination and violence of some against others forced to coexist" (Boff & Valverde, 2002).
- The optimal use of resources that recognizes the limits of the common good lends sensitivity and contractual logic to all phenomena and forms of resource production. Consequently, *social justice* emerges as

distribution and social conscience. People learn this communal reality that includes the optimization of the common good by rationalizing the economic action of communal work and in the course of their lives.

- The third consequence has to do with community autonomy in the relationship between the *rationality of ends* (*Zweckrationalität)* and the *rationality of values (Wertrationalität)* (Weber, 2014), that is, to what extent work and care manage to combine these two factors within the university community. It is more a question of reasonableness than the rationalism of community life, of being able to encompass both, human and community condition, of combining the functional economic means without superimposing the commercial ends.
- The work-care dimension organizes *coexistence* in accordance with its social ends and not only with production. Coexistence implies a balanced combination of the social aspects and the sustainability of the common pool resource. Therefore, what governs the activity of work is the self-limitation proceeding from the optimization between appropriation-provision and not the maximization of the ends that reifies and exploits work submitting it to productive ends. This perspective surpasses the polarized and limited vision of work from the capitalist and the trade union perspective, because the community aims to achieve sustainability and self-sufficiency[344] beyond labor rights, which are obviously included.
- We always work with others (Linhart, 2013), but we also work for others (Durkheim & Posada, 2012), which implies a sense of social utility of what is produced, a personal sense of contribution to society, cooperative learning and shared knowledge. Therefore, there is a community agreement for the *social organization of work* under a principle of complementarity in the organization that involves two others: correspondence and relationality (Estermann, 1998) of the whole and its economic products.

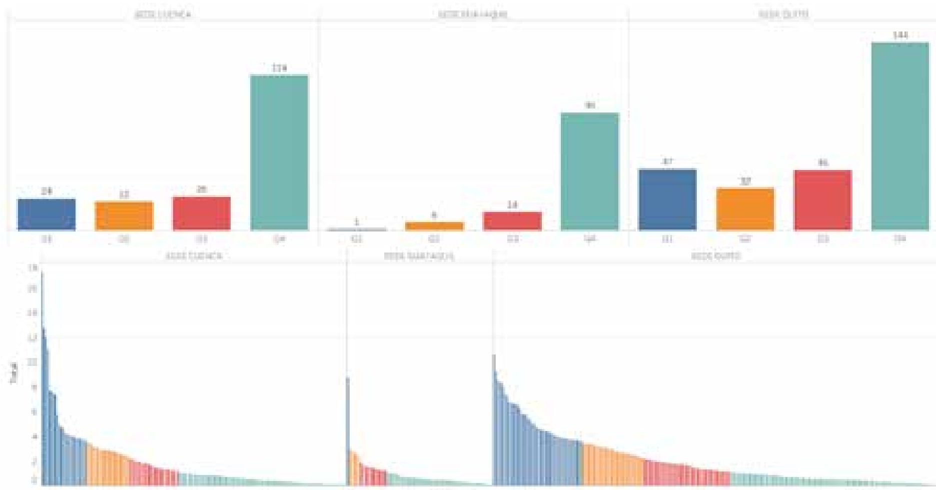
From this perspective, work is a space of freedom, of personal development and certainly support, since individual development is linked to the development of others. We must understand the communal nature of capital to understand the communal nature of the worker.

344 The doctrine of the Catholic Church states that "the Christian truth about work should be opposed to the various currents of materialistic and 'economistic' thought" (John Paul II & Caffarra, 1981).

In contrast to a machine organization, the social organization of work in the UPS bears the following characteristics (J. P. Salgado, 2017):

- It optimizes the work of the community members according to the social value of work. Thus, for the UPS, teaching and research[345] are the most relevant[346] activities to guarantee the community' sustainability and self-sufficiency. Hence, the teaching load of university professors[347] is dependent on their research results (Figure 98).
- It promotes the growth of people as the center of the organization.
- It puts knowledge production, be it general or organizational, before the production of goods and services.
- It articulates knowledge (the real) with the true (scientific).
- It is based on the transformation of knowledge into a tacit-explicit continuum[348] (Ikujiro Nonaka & Takeuchi, 1995).

Figure 98
Example of distribution of teachers according to the UPS scientific production indicator



Source: CREAMINKA

345 The linking function is the result of the teaching-research product.
346 Other activities are not neglected, but for sustainability and self-supply, teaching and research have the greatest social value are:
347 It should be emphasized that all UPS professors are considered teachers and researchers.
348 Cf. glossary.

- Trust in self-organization and the consequent development of organizational values that emerge bottom-up and are then consolidated top-down by consensus.
- Knowledge exchange, which reduces the organization-society gap, and gives relevance and a transforming potential to the organization's knowledge.

We must recover the sense (understood as meaning and direction) of work and not submit it to business logics, recovering its social, moral and cultural values. We must recover the supremacy of the person over capital and of society over the market, without negating capital and the market, working from the cultural sustainability, from the determinant qualities of the commons that point to *being* rather than *having*.

MANAGING HIERARCHIES-HETERARCHIES[349]

It is essential for the community to recognize the dynamics of government in the power-truth dialogue (Michel Foucault et al., 1992) that are immersed in its capacity of self-organization and hierarchical dynamics subjected to group networks; we therefore speak of a polycentric government system (Elinor Ostrom, 2010a) of the organization.

The polycentric rhizomes of the ecosystem organization to which the UPS is committed permits it to self-organize in dynamic structures that do not necessarily respond to necessarily hierarchical orders (Elinor Ostrom, 2010b). These nodes-rhizomes appear and disappear, since they exist as long as there are relations of common interest, reciprocity and complementarity. The rupture of a rhizome does not mean death but quite the opposite, as it preserves its other-unit reconnecting any point with any other when it reconstitutes.

The ecosystem organization of the university community is not a tree with branches that divide and form other units but rather has dimensions that change over time. The hierarchy tree does not always favor autopoietic work[350] and often limits creativity and action.

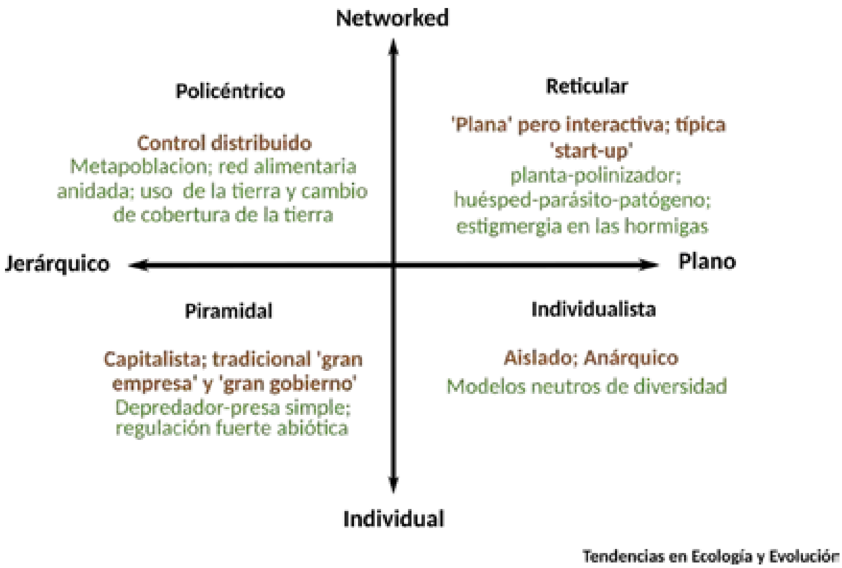
Each rhizome autonomously develops its relationship with the trunk, transcending in a vertical way every level of the university (departments, centers, careers, areas). The *fabric*[351] that results from this objective interaction

349 Cf. glossary.
350 Cf. glossary.
351 Cf. glossary.

with some and subjective with others produces diverse initiatives for generating knowledge and forms of production. This will encourage cooperation and not manipulation.

The rhizome creates interconnections by lines that establish dimensions and flows that do not necessarily possess territory. That way they can be modified, challenging hierarchy to give way to heterarchy[352] (Figure 99). Then, depending on the maturity of the group's organization, as well as on the work conditions and diversity of production forms, the organization of each group can change over time in the following ways: reticulated, polycentric, individual or pyramidal.

Figure 99
Classification of heterarchical networks according to Cumming



Elaboration: Salgado-Guerrero, J. P. From Cumming

352 The term heterarchies, coined by Cumming, better represents the rhizome dynamics of the commune, since it reconciles the concepts of networks and hierarchies resulting in the possibility of combining these two concepts and better representing the hierarchical dynamics of the commune (G. S. Cumming, 2016). See glossary of terms.

DIVERSIFIED PRODUCTION BASED ON REDUNDANCY AND DIVERSITY MANAGEMENT

The concept of efficiency often leads to specializing production forms until they become highly efficient, but at the same time, everything becomes dependent on it. Although it decreases efficiency, having several forms of production increases organizational resilience. Thus, diversity[353] is fundamental to the sustainability of the common good.

Diversified production offers perfect conditions to the university community (Amartya Sen et al., 1991), different to the commercial enterprise logic, which aims for a highly specialized environment to maximize competitiveness and capital. The communal logic is based on the diversification of its production modes to optimize the mechanisms, taking advantage of the opportunities and parallel management.

Elmqvist (Elmqvist et al., 2003) establishes "response diversity" as a quality attributed to the ecosystem organization. The UPS has various forms of production[354] (Figure 100) that aim at diversity and redundancy to ensure better responses to external complexity (Low et al., 2003). The high diversity of groups in the UPS, as well as the diverse forms of production may seem repetitive or even unnecessary, but they are essential for reorganizing and self-organizing the communal university (Folke et al., 1996).

By the same token, interaction in a cross-functional structure (Figure 101), the appearance of novelty and the discontinuous processes of knowledge production, help find answers to external demands because they provide the university with resilience and sustainability (Chapin et al., 1997).

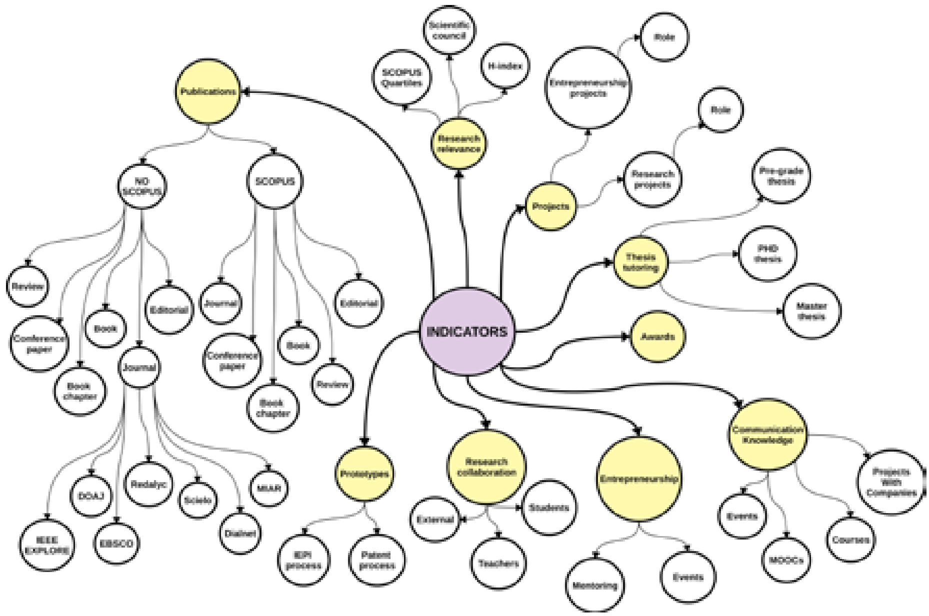
The evaluation of the groups in the university-community does not seek meritocratic classifications; on the contrary, it uses the diversity and specificity of each group to combine their potentialities and achieve the resilient capacity necessary for development in a non-equilibrium balance, which characterizes the university ecosystem. The capacity for resilience is important because it facilitates dialogue with the context, for which het-

353 Ashby argues that internal diversity can satisfy external complexity, the value of heterogeneity (W Ross Ashby, 1961)

354 A list of about 67 knowledge products has been made for the UPS (J. P. Salgado & Patera, 2017) (Figure 100).

erogeneity or diversity are essential variables (Levin, 1998). Hence, meritocratic concepts are useless for an innovative culture guided by continuous change.

Figure 100
Example of semantic metadata networks

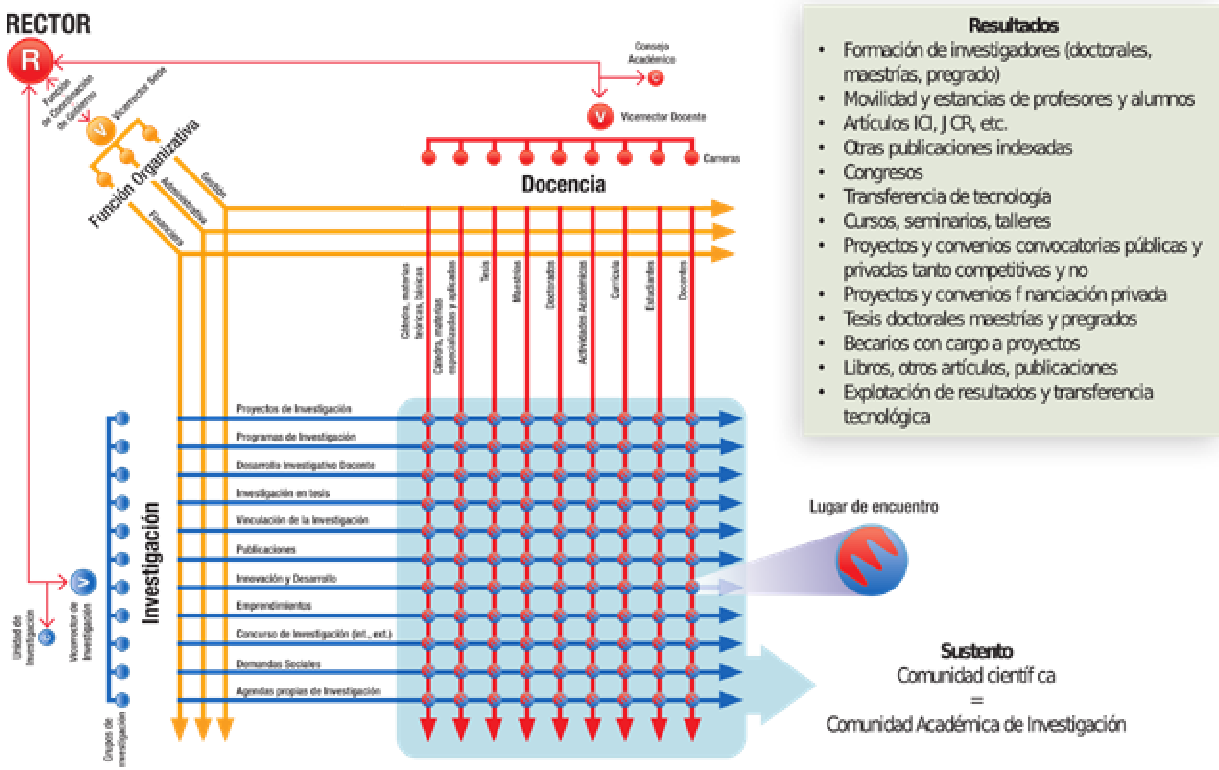


Source: CREAMINKA

Each group has its own *resilience footprint*[355] (Figure 102) that specifies particular potentialities and weaknesses. These group imprints do not compete with each other and risk homogenization them, but rather define each group's identity. The aggregate of the particular footprints generates the UPS *resilience footprint* (Figure 103). It should be stressed that these footprints are subject to a constant dynamic development and therefore require monitoring.[356]

355 Cf. glossary.
356 CREAMINKA, cf. glossary.

Figure 101
Teaching-Research fabric of the UPS



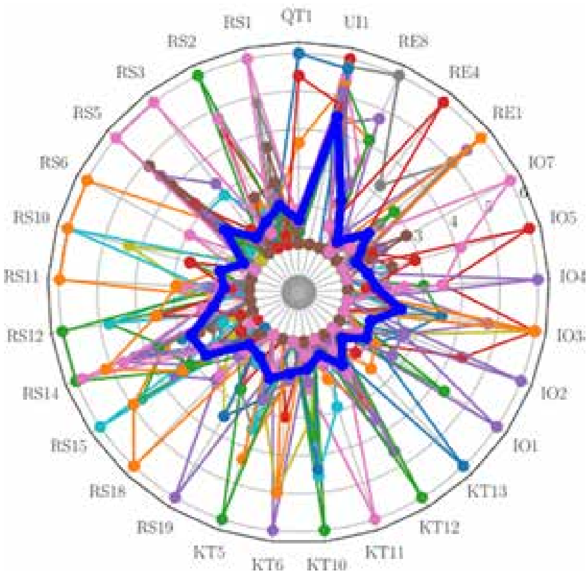
Source: (Herrán Gómez et al., 2014)

Figure 102
Resilience footprints of three research groups

Source: CREAMINKA

The cycle of the university as a product and producer of society is sensitive and requires high resilience, which can be ensured only through diversity in production, redundancy of the university's producer groups, and similar factors. This book defines university resilience as *the capacity for continuously developing self-organization based on the diverse production forms to interact with the changing environmental conditions, permitting the university to give a proactive and transforming response, which imagines, thinks, creates and acts according to the characteristics of its identity.*

Figure 103
Resilience footprint of the UPS



Source: CREAMINKA

KNOWLEDGE MANAGEMENT

The UPS understands knowledge as the result of its repositories of collective memories, shared experiences and individual and collective perspectives. Therefore, knowledge production requires communication, and communication implies self-organization (Broekstra, 1998). The wonderful thing about the university is that communication does not only take place within the university but also with the environment, which narrows the gap between university and society.

This complex cycle, which we previously referred to as *hurricane of knowledge-organization,*[357] ensures that the knowledge produced in the university will be relevant, pertinent, transform society, and also sustain knowledge production.

357 Socialization, Externalization, Combination, Internalization. Cf. glossary.

The knowledge produced by the UPS is also understood as a common resource (Hess et al., 2016), which means that the UPS's policy rejects the exclusive enclosure of knowledge. Knowledge is not only what is articulated in the form of notions, concepts, theories and paradigms but also includes the ways of thinking that we call *methodologies*. Methods as ways of thinking are as essential as conceptual constellations, and we often witness the failure of transformations based on conceptual changes without providing a path - a *method* - to guide thinking and decision making.

The SECI process of knowledge production (Ikujiro Nonaka & Takeuchi, 1995) implies knowledge resulting from action, learning by doing and reflection develops people's capacities because community action is involved in defining what to do and in decision making. Collective action to produce knowledge is not necessarily egalitarian but reciprocal (Hess et al., 2016); shared ambition will help achieve shared results.

Knowledge management cannot be understood without understanding the action that is essential for producing experience-based knowledge. It is not a question of action for action, but of action that can communicate and produce organizational knowledge in the SECI process. Far from *activism*, knowledge management should encourage action that communicates what is understood and validates what is experienced. Knowledge management neither means to manage theoretical repositories, but to push people to produce novelty. Theory cannot replace first-hand experience, but without theory, experience becomes weaker. Knowledge management, therefore, seeks to develop both aspects by easing tensions and increasing other unresolved tensions between theoretical and experience-based knowledge.

Knowledge management in community implies:

- The promotion of conflictive but fruitful dialogue between critical and instrumental reason, taking into account that information is not knowledge. The objective is to go beyond the simple management of data and information used to satisfy utilitarian demand and consumption aimed at relating knowledge production to communication and social action.
- The conception of knowledge as a potential for human development because it promotes the transformation and promotion of the environment, in an environment that enhances people's capacities in the interest of the common good. Knowledge must, therefore, not be

understood as a mere generator of wealth as it can be manipulated as a resource that produces inequality, concentrates wealth and social asymmetries in both access and use.

- Understand knowledge as dialogue between science and knowledge, which allows people to produce knowledge based on endogenous epistemologies that generate systemic logics, going beyond the unidirectional logic in which one produces and another uses it.
- Going from *copyright* to the *right to copy*, because the fundamental value is to build a free flow of ideas, of dialogue of knowledge, promoting understanding and being able to explain. It is also fundamental to be able to appropriate the knowledge of others. The challenge for the university community is to move from official policies to shared practices.

Epilogue

Beyond the Method...

The question is how to go beyond technical rationality and replace it with creative rationality that recognizes everyone's planning capacity, and gear actions towards effective transformation. That is, to discover where the classic theory of the organization and deterministic or normative planning failed: the shared learning and planning collaborative action (Matus, 2006).

Recognize other forms of knowledge, cope with frontiers of uncertainty, dialogue with people who think differently, recognize people's life projects – everything implies not to fear that the university transgresses the *scientific method* that fails to explain certain things - such as history or social relations - simply because they cannot be reproduced in the laboratory. We do not need to negate science as such either, but we must be aware that scientific truth is always provisional and does not go beyond the validity of its methods.

The Ecosystem University advances in accordance with life and does not evade it because of the incompatibility of methods, as in the case of a university model guided by the overarching need for safety and reward. Compatibility with life and what is essential requires a break with phony discourses, the arrogance hidden in manipulated concepts of rigor and method, of quality and excellence.

This is how we venture, in the midst of uncertainty, to raise the flag of self-criticism and constant transformation that does not stop at methods, but at values of the human BEING that have to do with its capacity to feel and establish a socially responsible life project.

Planning in the Ecosystem University leaves behind traditional methods that paint the future as a mere extrapolation of the known and normalized present, leading to partiality, reductionism and simplification. Rather, it embraces the endless complexity that facilitates learning, knowing, creating and enjoying.

It is a question of putting knowledge into a cycle (Edgar Morin, 1977) (Edgar Morin, 1981) and embracing transdisciplinarity to understand science not only by making it specific but also complex, and understanding its greatness in a *systemically organized* way.

Creative rationality is directly related to *action*, and if action is involved, deterministic planning logics becomes meaningless as theoretical technical analysis is insufficient when it comes to making decisions; life problems are quasi-structured and there is no clear correlation between variables, and their solutions are situational. More than a deterministic method of calculation and result that leads nowhere, we are talking about a strategic planning of action in which the when and where are uncertain (Matus, 2006).

Planning based on action-communication-knowledge,[358] as addressed in this book, recognizes the planning capacity of everyone in the university community and, therefore, rests on multiple bodies of self-organization that act in accordance with the common good.

Going beyond the method implies to break with the Cartesian approach and interfere in the complexity to think in true planning that ignores considerations of predictability but seeks compatibility with uncertainty: planning that precedes and presides the action that creates but does not predict the future; planning that can deal with surprises and use opportunities and possible effects; planning that is able to correct ongoing calculations; planning that implies methods to learn from mistakes; and planning that goes beyond traditional deterministic or poor corporative strategic planning.

Thus, beyond the Euclidean and linear approach, *creative rationality* has to do with:

- *Existentiality,*[359] which permits us to see the life project that transcends the agitations and dispersions of the moment to interfere in the reflection and search of the true BEING.
- *Self-organization,*[360] a frequent phenomenon of biology, systems, information theory, epistemological problems of complexity, etc., everything connected to the autopoietic systems (Maturana & Varela, 1987) point

358 Cf. glossary.

359 The matter referring to *existentiality* was addressed in Part II of this book: Life forges its way: Liberate yourself to liberate others.

360 Cf. glossary.

to the emergent concept of order-disorder-organization-knowledge (E Morin, 1977) (Edgar Morin, 1981).

- The *knowledge of knowledge,*[361] the permanent concern for an observation that observes itself, a knowledge that knows itself (Edgar Morin, 1984), because of the central problem of a knowledge of knowledge.
- *Abduction,*[362] not losing the capacity for wonder, surprising observations that seem to be in conflict with the normal understanding of things can lead to making hypotheses loaded with novelty, as reasoning alone does not suffice to generate knowledge and must be integrated in a community of a certain type (S.C. Peirce & Buchler, 2012).
- *Serendipity*, the coincidence and the unexpected that provide an opportunity for developing a new theory; incongruity stimulates the researcher to "find meaning in what there is".
- *Analogy and metaphor,*[363] to rationalize the imagination; despite some ambiguity, it is the very lack of clarity that enhances the ability to expand the semantic field.

Setting up our model of the Ecosystem University implies assuming different and unexplored paths; it implies assuming the *creative rationality* that needs a different non-Cartesian method, reflexive and dialoguing, open and participative that recognizes the nodes and networks, their practices and relations. Implementing the Ecosystem University presupposes the fundamental capacity of *learning to learn* to make an epistemological shift from method and planning.

Learning is not about solving problems, making diagnoses and inventing corrections, as if it were an external aspect that resides outside the university community. It means self-examination to understand what we know is no longer useful and what needs to be updated and enriched. It is about innovating scenarios and situations that prepare the ground for new practices and rules that make the university a common, dynamic, collaborative and horizontal enterprise, characteristics that will no longer remain hollow words.

361 The explanatory capacity of reality and the criticism of itself and hat surrounds it in the face of the powers and dominant discourses, guarantee the production of knowledge at the university. The need for spaces, places and meetings of university reflection become increasingly essential to build a science with conscience inside an Academic Community. If we understand the need to understand and explain, and add that, from a point of view of subjectivity, we will have multiple points of view as critical reasoning, we will have multiple developments of knowledge.

362 Term coined by Peirce that will be addressed in greater detail further down.

363 Analogy and metaphor as a resource to enhance the imagination.

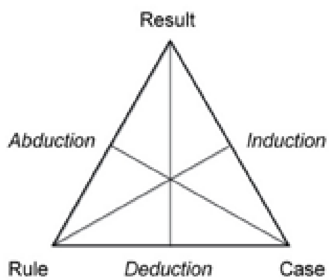
The *rational creation* of these scenarios and situations, which will constitute the living Ecosystem of the University, requires a constructive break with traditional positions on many subjects, the world, method and planning to build a kaleidoscopic vision required by the context and pave the way for a strategy and a new plan. As said before, this requires*: existentiality, self-organization, the knowledge of knowledge, abduction, serendipity and resorting to metaphor.*

Abduction and creation

For Charles Sanders Peirce, abduction coincides with the hypothetical experimental method that characterizes modern science from Galileo to this day. The conclusions reached by *abduction* are not definitive, but they open the way to new research and new conclusions in accordance with the model of progressive approximation to reality that characterizes the scientific method (Wittgenstein, 2014).

Three elements make up an inferential process (reasoning): (i) the case; (ii) the rule; (iii) the result.

Figure 104
Peirce Triangle



Elaboration: Salgado-Guerrero, J. P.

Table 18
Case - Rule - Result of the Peirce Triangle

If I have *the rule*	and *the case*	*I deduce the result*
If I have *the result*	and *the case*	*I induce the rule*
If I have *the rule*	and *the result*	*I abduce the case*

Elaboration: Salgado-Guerrero, J. P.

Abduction is a reverse process that is applied when you know the rules and results (conclusions), and you want to know the premises (case). It considers a specific fact, from which it obtains partial results, and which it connects with the hypothetical rule and establishes a case, i.e. a hypothetical fact.

Abduction starts from observable facts with no particular theory, only a probable rule that is provisionally adopted (C. Peirce, n. d.):

Figure 105
Example of abduction

Elaboration: Salgado-Guerrero, J. P. From Peirce (C. Peirce, s. f.)

The epistemological order of the three forms of inference is as follows:

1. Abduction
When faced with something strange, people tend to go for explanatory hypotheses.

Figure 106
Abduction

Elaboration: Salgado-Guerrero, J. P. From Peirce (C. Peirce, n.d.)

2. Deduction

Traces all the consequences (e.g. NN wears the watch on his right hand)

Figure 107
Deduction

Elaboration: Salgado-Guerrero, J. P. From Peirce (C. Peirce, n. d.)

3. Induction

Verification of the consequences as real

Figure 108
Induction

Elaboration: Salgado-Guerrero, J. P. From Peirce (C. Peirce, n. d.)

In scientific reasoning, the researchers use abductive investigative reasoning to verify a hypothesis. In abduction, the thought performs a lateral movement (ab-duction) or a backward movement (retro-duction).

Both induction and abduction are synthetic inferences, but by its nature, abduction is like a *bet*.

According to Peirce, scientific evolution is impossible without abduction. Induction produces a synthesis, deduction a thesis, while abduction leads to a hypothesis.

Serendipity constitutes an important aspect of abduction. The term was coined by the writer Horace Walpole based on the writings of Christoforo Armeno.[364] Some examples of serendipity are Christopher Columbus' discovery of America when he wanted to find a new route to India; Archimedes discovered the principle that bears his name while relaxing in his bathtub; Alexander Fleming discovered penicillin on his return from a vacation while working on staphylococcus, etc.

Serendipity and Abduction: Discovering the Opportunity

Serendipity (chance) as an abductive thought makes us think about the fact that we cannot simply accept that discoveries are made by chance, but require the ability to "take advantage of the unexpected".

Merton (Merton & Barber, 1992) defines *serendipity* as follows:

> The serendipity pattern refers to the fairly common experience of observing an unanticipated, anomalous and strategic datum which becomes the occasion for developing a new theory or for extending an existing theory (...) the seeming inconsistency stimulates the investigator to 'make sense of the datum.'

A book by Lucy Kimbell (Kimbell & others, 2015) can serve as an example for the field of research and innovation:

> Discussion of policy making is based on the rationality and validity of evidence produced by induction and deduction to justify decision making. In contrast, abductive approaches generate new initiatives and ideas that are plausible but provisional.[365]

364 Serendipo was the name of what is today Sri Lanka, the former Ceylon (Merton & Barber, 1992).
365 English to Spanish translated by Salgado, J.P. from: Lucy Kimbell (Kimbell & others, 2015, p. 34).

Peirce argues: *"I suspect that it may be difficult to demonstrate that, given two branches of science, one cannot somehow shed light on the other"*. The author continues: *"Abduction refers to how we develop a hypothesis based on surprising or anomalous observations"* (C. Peirce, n. d.). In the scientific context, deduction refers to deriving testable consequences from those hypotheses, while induction is the logic of testing those hypotheses and evaluating the results (C. Peirce, n. d.). The importance of Peirce's proposal lies in the fact that it shows how the principles of each of these three fundamental processes are implemented in a research community (Liszka, 1996).

Despite the fact that abduction has much to do with hypothesis and chance, many authors today refer to abduction as formulated by Peirce, and the term has been accepted in the scientific community (Aliseda, 2006) (Magnani, 2009) (Gabbay & Woods, 2005) (Psillos, 2009).

> How to give birth to those vital and procreative ideas which multiply into a thousand forms and diffuse themselves everywhere, advancing civilization and making the dignity of man, is an art not yet reduced to rules, but of the secret of which the history of science affords some hints. (Charles Sanders Peirce, 1998).

It would seem that the skeptics of abduction confuse risk and uncertainty. Uncertainty implies the impossibility of omniscience, while risk is a quantity that can be measured; it is a kind of measurable uncertainty. Knight (Knight, 2012) argues that "the problems of life" arise because too little is known and the most salient feature of probability is ignorance. It is not possible to measure with absolute precision all the circumstances that determine probability, which is why risk and uncertainty are not the same. Knight recognizes that mental processes differ from scientific ones, which are based on thorough analysis and exact measurement.

Probability estimates can be made using traditional (scientific) logic or everyday, non-scientific thinking, which relies on raw analysis and includes *judgment, intuition and common sense.* However, for most decisions in everyday life, rigorous scientific modes of reasoning are not accessible and can be replaced by tenuous and uncertain reflection. Moreover, scientific research, which is based on the structure of "positivist reasoning," has made everyday reasoning less accessible.

Abduction is therefore particularly useful for understanding the origin of innovation in Peirce's model, by bringing together the three elements: case, rule, result. Dewey (Dewey, 1997), the father of pragmatism, shows how innovation originates (Figure 109).

Figure 109
Induction, abduction and deduction phases

Source: (Dewey, 1997)

According to W. Jonas (Wolfgang, 2014), abduction is the central mechanism of knowledge generation in everyday life, design and science. This creates the need for models that explicitly recognize the creative phase, and thus provide a theoretical framework for Research Through Design (RTD). Internal or external disturbances (called ideas, creativity, intuition, accidents, environmental changes, etc.) create variations in the cycle, leading to stabilization (negative feedback) or amplifications and evolutionary developments (positive feedback).

A Cybernetic Model of Research Design

Regarding the link between RTD and abduction, and consequently between research and innovation through abduction, Jonas (Wolfgang, 2014) emphasizes that

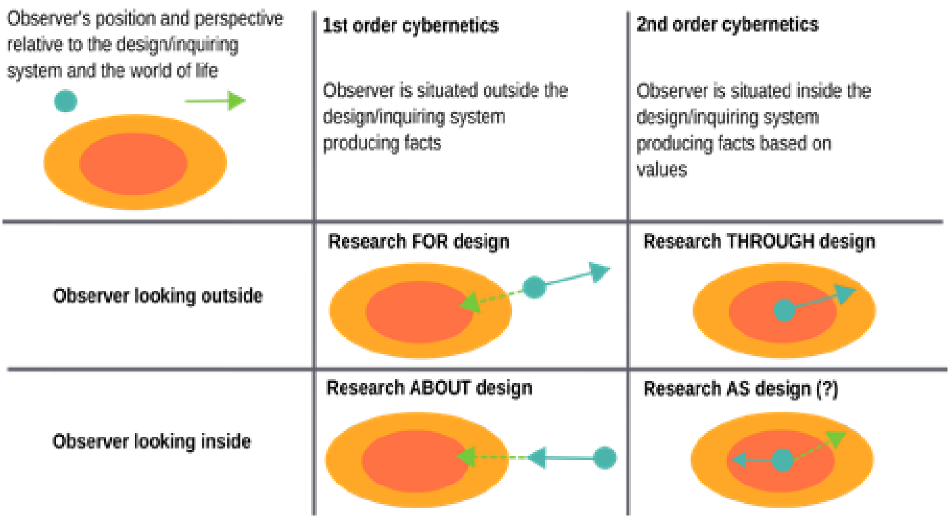
> Research about and for design is unambiguous. The epistemological state of RTD, however, remains fragile. Grounded theory such as Action-Research is likely to make a contribution. Both admit the participation of the researcher, as well as the abductive appearance of theories from empirical data, in contrast to the established concept of theory-building as the verification of previously formulated hypotheses.

Peirce understands *reason* as something that is evolving but is somehow not complete. Therefore, it is different from the human ability that has been called *reason* from a rationalist perspective but could perhaps be called *reasonability.* The conjunction between *rule* and *results* (consequences) produces a constant dynamic process of reasonable validation, which abductively creates the case in an emergent way and from which the confirmation of the hypothesis (rule) is fed back inductively.

The insinuation derived from abduction emerges as a spark and is an act of intuition (insight). Although the elements of the hypothesis have existed all along, it is the idea of putting together what nobody thought could ever been joined that generates the spark (C. Peirce, n. d.). Abduction is preceded by knowledge and experience and therefore depends on the continuity of the transformation of tacit-explicit knowledge (Ikujiro Nonaka & Takeuchi, 1995). The hypothesis must be examined to ascertain if it responds to what it initially promised. Novelty alone is not a sufficient guarantee for scientific creativity; the creative achievement must be beneficial and respond to the original search.

Glanville (Glanville, 1997) demonstrates the link between research design and the role of abduction (Figure 110).

Figure 110
Research concepts for, About, Through design, positions and perspectives



Source: (Glanville, 1997)

In the trans-disciplinary domain it is essential for researchers to develop and reflect on their own specific processes of knowledge production rather than idolizing scientific reasoning. Projective abduction integrates science and design and is therefore instrumental for establishing the new model. Abduction is, thus, inferential and logical, and includes a series of operations of the mind that we can become aware of.

Abduction is made possible because of our instinct-capability to guess, put together and interpret the right explanations for certain phenomena. Peirce thinks this is possible because of the affinity between the human mind and nature, a kinship that allows us to guess the truth. Although one can make correct conjectures, based on the confidence that the relationship between man and nature guarantees that intuitions are not in vain, the condition is that every attempt must be double-checked through comparison with what has been observed.

Approaching the organization from the perspective of complexity implies resorting to the concept of system.[366] Otherwise, one would risk submitting it to the utilitarian pretension and producing a stale relationship between critical sense and instrumental reason in the University.

As nature has had millions of years to evolve the logics of the organization-system, it is able to resort to its principles and rules of the Ecosystem to illuminate in an abductive way what happens with respect to the University system.

The continuous combination of analogous rules of nature in the University and their consequences, produce an Ecosystem University that relies on an Environment that Enhances Capacities (biocenosis)[367] and logics of organization on the basis of the Common Good (biotope);[368] this generates a University with the capacity to produce relevant knowledge and develops the people it requires.

This book is based on Participatory Research-Action that, from an abductive perspective, seeks to combine the rules and principles of ecosystems and monitor results from the beginning; and also on the confidence that the

366 Morín 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"*

367 Cf. glossary.

368 Cf. glossary.

secrets of nature will produce positive results and constant evaluation of innovations deepen the knowledge of the principles and rules of ecosystemic organization while validating them as organizational principles.

Through working by the same eco-systemic rules, the concept of entropy helped to identify an opportunity to evaluate the results and, once the case was built (in infinite permanent construction-evolution), it became possible to confirm the principles of nature within the Ecosystem University.

The Dewey cycle crosses the process of Investigation-Action-Participation, and the triangulation of the processes of abduction and induction are constant in the development of research.

Consequently, the results are used through an ontological analysis of knowledge production to identify improbable pairs and potential synergies that encourage actions to feed back into the system.

The metaphor as a resource for imagination

We have to be aware that in an organization, the future is unpredictable, that we must see order and disorder as something that needs to be encouraged and created at times, and that a new order will emerge from apparent confusion to learn to work with the disorder and not against it (McMillan, 2004). Therefore, wee need to look for patterns, analogies, similar trends and evidence of *attractors*[369] for complex and sometimes strange systems.

The complexity of the system is one of the most motivating factors for making an analogy with ecosystems and thermodynamics. One function of the thermodynamic state depends on a before and after the reaction, which is useful for explaining macro-states without having to establish the reactions and interactions of micro-states. Analogous reasoning helps to project the source domain by creating the target domain (Moser, 2004), which also brings out the semantic field[370] of information.

This book proposes analogies between the University and Ecosystem organizations, relating the concepts of the Environment that Enhances Ca-

369 The term *atractors* makes a reference to the Chaos Theory (Lorenz, 1963).

370 Although semantic fields are known as sets of words with related meanings - albeit each word has its own meaning - in the context of the present work we will use *Gunther Ipsen's* definition understanding the word as: sign/symbol (Ipsen, 1924).

pacities with those of Biocenosis and the conceps of Managing the Commons with those of the Biotope. By the same token, it uses analogies with the Ecosystems to understand the dynamics of the internal interactions of the University. In this case we talk about.

- Producers and research councils, ecosystem acceleration, research assessment, mentoring school and change management.
- Consumers and research groups, innovation groups, educational innovation groups.
- Decomposers and CreaMinka knowledge management.

On the other hand, if we take into account that, according to the basic aspects that summarize the characteristics of cognitive science raised by Lakoff and Johnson (Lakoff & Johnson, 2008), the way we conceptualize is fundamentally metaphorical:

- The mind is intrinsically embodied.
- Abstract concepts are largely metaphorical.
- Thinking is mostly unconscious. Thus, we build the tangible from the world of the intangible through metaphors (Fauconnier & Turner, 2008).

We must, therefore, rationalize imagination (Lakoff & Johnson, 2008) through metaphor. Although we are talking of an ambiguous field, it is the very lack of clarity that enhances the capacity to expand into the semantic field.

The need for metaphor is due to the subjective nature of the subject of *knowledge.* Andriessen (Andriessen, 2006) conducted a study on knowledge-related research and identified 22 different metaphors. Analyzing them by their definitions, he concluded that most of the times the word knowledge is found next to a verb or noun. Such verbs tend to mean to construct, create or acquire something, whereas the nouns means something like storage, maps, resources or characteristics. In both cases, both verbs and nouns refer to knowledge as something abstract.

Inconclusion

This book is the result of successive spirals of dialogues, essays, actions, communications and knowledge, which prove that it is possible to work differently when people share the same objectives.

Since this book must end at some point, I have written this "closure" with the conviction that the work in your hand will continue to mutate, evolve and spot new horizons so that others through their acting, erring, getting things right and guided by their own responsibility, judgment and risk, can in the future rewrite the book, adding the value of collective intelligence.

At each turn of the action-knowledge spirals that make up this book, a level of greater complexity was reached that could finally be put on paper of this unfinished work, which awaits new cycles of communication-action.

The hope that this work will continue to transmute rests in the countless young people who have felt they benefited from a different approach and incorporated it as part of their life projects. My hope is also based on the numerous co-creators, brothers and sisters, who employed their creative indisciplines to build much of what has been addressed in this book.

In the many profound discussions about university that I had over the years - between the fervor to put the person in the center and the whim of valuing the least qualified – it have reached the conviction that university teaching must recognize its inefficiency als long as it does not change the rating system and indices of intellectual performance.

The certainty that this work is unfinished is rooted in the awareness that much remains to be researched and done with respect to the real *"popular wisdom"* and its mechanisms of collective memory to discover an intellectual system that does not start from deductions or inductions, but allows us to understand that it is radically and exclusively intuitive. Maybe it is not just that young people are poorly prepared for university, as many higher education experts argue, but that people and society are very differently organized in a cultural sense, based on a singular way of generating thought and a unique system of expressing and communicating it.

The university must deepen everything that intellectual logic can achieve in order to understand the collective memory and awareness, its own systems of communication or the power of transmission of intuition and perception, which stimulates the group that includes the university. Only that way can it truly be a product and producer of society.

A true approach to *wisdom,* which is as natural as the ecosystem in which we live and which existed before us, as well as to the pure experience of community, will take us by the hand and lead us - who presume to be professors - to the purest origin of human knowledge that tastes of life, to the refreshing purity of novelty and the authentic value of the ingenuous, that is, the simplicity and straightforwardness of learning and understanding.

Every person is substantially individual, unique, and exclusive. To inscribe *wisdom* in the university means to reach that exclusiveness and not try to go beyond it but to draw the *other* toward us and become *we*, the community, whose members self-organize and build projects of life, culture and destiny.

Don't forget, university!, the production of knowledge is easy, it occurs in the dialogue that initiates a natural creative relationship, essential for our existence and for being understood. Knowledge is created in one person through another, which makes us co-creators, with all the spontaneity and novelty it involves.

By building a communal university, there is no need to look into mysteries on this path, because the realities that life makes us aware of are all too clear. Based on their life reality, the dispossessed, the poor, the hungry, the indigenous people have an intellectual perception very different from that of those born into conditions of relative power. Intuition and wisdom must make their way into the university curriculum because they constitute values of humanity and are essential to feel, to experience, in short, to be university.

An Ecosystem, like the university that we have in mind, is *under permanent construction and destruction,* it means *to begin which is to create* permanently with the present and the past that is already assumed in the present; the unfinished is its identity. History in the ecosystem is not a memory of what it was, but a description of how we arrived at the present, and at the same time the exciting future.

Let us not despair by the inconclusive and unfinished nature of this work because, in the wisdom of our original communities, time is a *permanent now* that keeps us at the *source*, giving us the most crystalline community memory to drink, maintaining what is remembered with an unalterable sense of presence. Time amalgamates the place and the moment, stops what should not pass by because it is essential and substantial; time maintains the cultural background of wisdom.

Dear University, wisdom is humanity and freedom; define yourself by wisdom and direct your will towards the fruitfulness of co-creation: the person in community, with his or her collective consciousness and memory, with his or her wisdom that decodes and generates knowledge.

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Bibliography

Aagaard, K., Lockwood, J. L., & Green, E. J. (2016). A Bayesian approach for characterizing uncertainty in declaring a population collapse. *Ecological Modelling*, *328*, 78–84.

Abbate, F. (2017). *La imaginación al poder según Nussbaum: Terapia de las pasiones y autogobierno* (Abya Yala, pp. 251–274). Universidad Politécnica Salesiana.

Aceytuno Pérez, M. T., & Cáceres Carrasco, F. R. (2009). Elementos para elaboración de un marco de análisis para el fenómeno de las spin-offs universitarias. *Revista de economía mundial*, *23*.

Acosta, A. (2012). Sumak kawsay. Una oportunidad para imaginar otros mundos. *Quito: Ediciones Abya-Ayala*, *79*.

Adger, W. N. (2003). Social capital, collective action, and adaptation to climate change. *Economic geography*, *79*(4), 387–404.

AEIPRO. (2006). *NCB-Bases para la competencia en Dirección de Proyectos*.

Aguillo, I. F., Bar-Ilan, J., Levene, M., & Ortega, J. L. (2010). Comparing university rankings. *Scientometrics*, *85*(1), 243–256.

Alessandrini, G. (2017). *Generar Capacidades: Educación y justicia social.* (Abya Yala, pp. 19–46).

Alessandrini, G., & others. (2014). *La" pedagogia" di Martha Nussbaum. Approccio alle capacità e sfide educative*. FrancoAngeli.

Alexander, G., van Wyk, M. M., & Moreeng, B. B. (2014). Constructing student-teacher identities via a mentorship programme initiative: A case for school-based learning. *Mediterranean Journal of Social Sciences*, *5*(9), 405.

Aliseda, A. (2006). *Abductive reasoning* (Vol. 330). Springer.

Allen, T. D., & Eby, L. T. (2011). *The Blackwell handbook of mentoring: A multiple perspectives approach*. John Wiley & Sons.

Allen, T. F. (2004). Applying the principles of ecological emergence to building design and construction. *CJ Kibert, Jan Sendzimir, and GB Guy (London: Spon, 2002)*, 108–26.

Almeida, R. de C., & Chaves, M. (2015). Entrepreneurship as an aim of the European Union policy for higher education. *Educação e Pesquisa*, *41*(2), 513–526.

Altbach, P. G. (2012). The globalization of college and university rankings. *Change: The Magazine of Higher Learning*, *44*(1), 26–31.

Anders, V. (s. f.). *Etimologia de Resiliencia*. http://etimologias.dechile.net/?resiliencia

Andriessen, D. (2006). On the metaphorical nature of intellectual capital: A textual analysis. *Journal of Intellectual Capital*, *7*(1), 93–110.

Andriessen, D. (2011). Metaphors in knowledge management. *Systems Research and Behavioral Science*, *28*(2), 133–137.

Arévalo, L. E. B., & Espinosa, A. (2015). Theoretical approaches to managing complexity in organizations: A comparative analysis. *Estudios Gerenciales*, *31*(134), 20–29.

Argyris, C., Oliart, F. A., & Moreno, F. J. (1964). *Personalidad y Organización: El conflicto entre el sistema y el individuo*. Publ. del Centro de Formación y Perfeccionamiento de Funcionarios.

Aristóteles, A., María, M., & others. (1970). *Ética a Nicómaco*.

Armit, I., Swindles, G. T., Becker, K., Plunkett, G., & Blaauw, M. (2014). Rapid climate change did not cause population collapse at the end of the European Bronze Age. *Proceedings of the National Academy of Sciences*, *111*(48), 17045–17049.

Arthur, W. B. (1994). *Increasing returns and path dependence in the economy*. University of Michigan Press.

ARWU. (2017). Academic Ranking of World Universities. En *Academic Ranking of World Universities*. http://www.shanghairanking.com/aboutarwu.html

Aselle, M & Piccaluga, A. (2020). Sorella economia. Edizione Porziuncola. Italia

Ashby, W Ross. (1947). Principles of the self-organizing dynamic system. *The Journal of general psychology*, *37*(2), 125–128.

Ashby, W Ross. (1961). *An introduction to cybernetics*. Chapman & Hall Ltd.

Ashby, William Ross. (1947). The nervous system as physical machine: With special reference to the origin of adaptive behavior. *Mind*, *56*(221), 44–59.

ASME. (2009). *Innovative Technological Institute (ITI)*. American Society of Mechanical Engineers (ASME).

Auroux, J. (1981). *Les droits des travailleurs: Rapport au Président de la République et au premier Ministre*. Documentation française.

Bailey, K. D. (1990). Social Entropy Theory: An overview. *Systems practice*, *3*(4), 365–382. https://doi.org/10.1007/BF01063441

Bak, P. (2013). *How nature works: The science of self-organized criticality*. Springer Science & Business Media.

Bak, P., Tang, C., & Wiesenfeld, K. (1988). Self-organized criticality. *Physical review A*, *38*(1), 364.

Banister, P. (2011). *Qualitative methods in psychology: A research guide*. McGraw-Hill Education (UK).

Banks, J., Au, K., Ball, A. F., Bell, P., Gordon, E., Gutierrez, K., Brice-Heath, S., Lee, C. D., Mahiri, J., Nasir, N., Valdes, G., & Zhou, M. (2007). *Learning in and out of school in diverse environments: Life-Long, Life-Wide, Life-Deep*. The LIFE Center (University of Washington, Stanford University and SRI) & the Center for Multicultural Education, University of Washington.

Barabási, A.-L. (2009). Scale-free networks: A decade and beyond. *Science*, *325*(5939), 412–413.

Barry, A., & Osborne, T. (2013). *Foucault and Political Reason: Liberalism, neo-liberalism and the rationalities of government*. Routledge.

Bar-Yam, Y. (1997). *Dynamics of complex systems* (Vol. 213). Addison-Wesley Reading, MA.

Bascompte, J., Jordano, P., & Olesen, J. M. (2006). Asymmetric coevolutionary networks facilitate biodiversity maintenance. *Science*, *312*(5772), 431–433.

Bauman, Z. (1999). *Culture as praxis*. Sage.

Bauman, Z. (2015). *Modernidad líquida*. Fondo de cultura económica.

Baumeister, D. (2007). *Presentation at the University of Washington*.

Beer, M., Eisenstat, R. A., & Foote, N. (2009). *High commitment high performance: How to build a resilient organization for sustained advantage*. John Wiley & Sons.

Bejan, A. (2000). *Shape and structure, from engineering to nature*. Cambridge university press.

Bell, S., & Hindmoor, A. (2009). *Rethinking governance: The centrality of the state in modern society*. Cambridge University Press.

Bellini Fedozzi, L. (2009). *Memorias II Congreso Internacional. Universidad, desarrollo y cooperación*. Abya-Yala/UPS.

Bems, R., Johnson, R. C., & Yi, K.-M. (2013). The great trade collapse. *Annu. Rev. Econ.*, *5*(1), 375–400.

Béné, C., Newsham, A., Davies, M., Ulrichs, M., & Godfrey-Wood, R. (2014). Resilience, poverty and development. *Journal of International Development*, *26*(5), 598-623.

Bennis, W. G. (1967). The Coming Death of Bureaucracy. *Journal of Occupational and Environmental Medicine*, *9*(7), 380.

Benyus, J. M. (2002). *Biomimicry: Innovation inspired by nature*. Perennial New York.

Bergoglio, J. M. (2014). *Discurso del Santo Padre Francisco al Parlamento Europeo*. https://w2.vatican.va/content/francesco/es/speeches/2014/november/documents/papa-francesco_20141125_strasburgo-parlamento-europeo.html

Berkebile, B., & McLennan, J. (2004). The living building: Biomimicry in architecture, integrating technology with nature. *BioInspire Magazine*, *18*.

Berle, A. A., & Means, G. G. C. (1991). *The modern corporation and private property*. Transaction publishers.

Berman, M. (1983). *All that is solid melts into air: The experience of modernity*. Verso.

Bernstein, B. (1975). Language and social classes. *Socio-linguistic codes and social control, Paris, Editions de Minuit*.

Bianchi, P., & Labory, S. (2016). *Towards a New Industrial Policy*. McGraw-Hill Education. https://books.google.com.ec/books?id=rt4ADQEACAAJ

Biomimicry Guild. (2009). *Life´s principles.* https://www.fastcodesign.com/1648801/biomimicry-challenge-smart-designs-ecosystem-inpsired-water-saving-solution

Bodin, Ö., & Crona, B. I. (2009). The role of social networks in natural resource governance: What relational patterns make a difference? *Global environmental change*, *19*(3), 366–374.

Boff, L., & Valverde, J. (2002). *El cuidado esencial: Ética de lo humano, compasión por la tierra*.

Bohm, D. (2008). *La totalidad y el orden implicado*. Editorial Kairós.

Boltzmann, L. (1898). Vorlesungen über Gastheorie, IT, Leipzig 1896. II. *T. Leipzig*.

Bonabeau, E., Dorigo, M., & Theraulaz, G. (1999). *Swarm intelligence: From natural to artificial systems*. Oxford university press.

Boni, A., & Gasper, D. (2012). Rethinking the quality of universities: How can human development thinking contribute? *Journal of Human Development and Capabilities*, *13*(3), 451–470.

Bosco, J. (1884). Carta al Oratorio sobre el espíritu de familia. *en Ca-nals Pujol, J. y Martínez Azcona, A., oe*, 614.
Bourdieu, P. (2003). Ciencia de la ciencia y reflexividad. *El oficio de científico. Barcelona: Anagrama*.
Bourdieu, P., Wacquant, L. J., Dion, L., & others. (1995). *Respuestas por una antropología reflexiva*.
Braido, P. (1994). Buon cristiano e onesto cittadino. Una formula dell'umanesimo educativo di don Bosco. *Ricerche Storiche Salesiane*, *13*(1).
Bratianu, C. (2008). A dynamic structure of the organizational intellectual capital. *Knowledge management in organizations*, 233–243.
Bratianu, C. (2011). Changing paradigm for knowledge metaphors from dynamics to thermodynamics. *Systems Research and Behavioral Science*, *28*(2), 160–169.
Bratianu, C., & Andriessen, D. (2008). *Knowledge as energy: A metaphorical analysis*.
Brătianu, C., & Orzea, I. (2009). Emergence of the cognitive-emotional knowledge dyad. *Review of International Comparative Management*, *10*(5), 893–902.
Brodie, R. J., Hollebeek, L. D., Jurić, B., & Ilić, A. (2011). Customer engagement: Conceptual domain, fundamental propositions, and implications for research. *Journal of Service Research*, *14*(3), 252–271.
Broekstra, G. (1998). An organization is a conversation. *D. Grant, T. Keenoy en C. Oswick (eds) Discourse and Organization, SAGE Publications, London*.
Brondizio, E. S., Ostrom, E., & Young, O. R. (2009). Connectivity and the governance of multilevel social-ecological systems: The role of social capital. *Annual review of environment and resources*, *34*, 253–278.
Burawoy, M., & Serratacó, R. (1989). *El consentimiento en la producción: Los cambios del proceso productivo en el capitalismo monopolista*. Ministerio de Trabajo y Seguridad Social, Centro de Publicaciones.
Burnham, J., & Sánchez, A. (1967). *La revolución de los directores*. Editorial Sudamericana.
Burns, T. E., & Stalker, G. M. (1961). *The management of innovation*.
Burrell, G. (1988). Modernism, post modernism and organizational analysis 2: The contribution of Michel Foucault. *Organization studies*, *9*(2), 221–235.
Cabral, P., Augusto, G., Tewolde, M., & Araya, Y. (2013). Entropy in urban systems. *Entropy*, *15*(12), 5223–5236.
Caldwell, D. (1970). Non-linear effects in a Rayleigh–Bénard experiment. *Journal of Fluid Mechanics*, *42*(1), 161–175.
Calvo, L. M., Espinoza, C., Hosse, T., & Regalsky, P. (1994). Raqaypampa, los complejos caminos de una comunidad andina. Estrategias campesinas, mercado, revolución verde. *CENDA. Cochabamba*.
Camazine, S. (2003). *Self-organization in biological systems*. Princeton University Press.
Cameron, K. S., & Quinn, R. E. (2005). *Diagnosing and changing organizational culture: Based on the competing values framework*. John Wiley & Sons.
Cameron, K., & Sine, W. (1999). A framework for organizational quality culture. *Quality Management Journal*, *6*, 7–25.
Campbell, J. (1989). *El hombre gramatical: Información, entropía, lenguaje y vida*. Fondo de Cultura EconÃ$ˆ3$mica.

Candel Rosell, A., Satoca Valero, J., & Soler Llopis, J. B. (1984). Interpretación errónea del concepto de entropía. *Enseñanza de las Ciencias*, *2*(3), 198–201.

Cannon, W. B. (1932). *The wisdom of the body*.

Carayannis, E. G., Barth, T. D., & Campbell, D. F. (2012). The Quintuple Helix innovation model: Global warming as a challenge and driver for innovation. *Journal of Innovation and Entrepreneurship*, *1*(1), 2.

Carpenter, S. R., & Gunderson, L. H. (2001). Coping with Collapse: Ecological and Social Dynamics in Ecosystem Management: Like flight simulators that train would-be aviators, simple models can be used to evoke people's adaptive, forward-thinking behavior, aimed in this instance at sustainability of human–natural systems. *AIBS Bulletin*, *51*(6), 451–457.

Cazorla, A., De Los Ríos, I., & Salvo, M. (2013). Working With People (WWP) in rural development projects: A proposal from social learning. *Cuadernos de desarrollo rural*, *10*(SPE70), 131–157.

Cazorla, A., Fernández-Pello, C., Fontana, A., García, A. J., De Giusti, M. R., Gómez, F., Herrán, J., Mínguez, E., Muñoz, J. P., Nicolás, V. L. de, & others. (2017). *La universidad: Motor de transformación de la sociedad*.

Cazorla Montero, A., De los Rios Carmenado, I., & Salvo Mendivil, M. (2004). *Trabajando con la gente modelos de planificacion para un desarrollo rural y local.* Universidad Politécnica de Madrid, Madrid (España).

Chandler, A. D. (1988). *La mano visible: La revolución en la dirección de la empresa norteamericana*. Ministerio de Trabajo y Seguridad Social, Centro de Publicaciones.

Chapin, F. S., Walker, B. H., Hobbs, R. J., Hooper, D. U., Lawton, J. H., Sala, O. E., & Tilman, D. (1997). Biotic control over the functioning of ecosystems. *Science*, *277*(5325), 500–504.

Chelazzi, G., & Santi, G. (2012). *Ecologia* (Giunti Editore S.p.A).

Chinowsky, P. S., Brown, H., Szajnman, A., & Realph, A. (2006). Developing knowledge landscapes through project-based learning. *Journal of Professional Issues in Engineering Education and Practice*, *132*(2), 118–124.

Churuchumbi, G. (2006). Propuesta sobre gobiernos comunitarios de los pueblos Kichuas. *Nina Comunicaciones*.

Cian, L. (1978). *Il Sistema Preventivo di Don Bosco e i lineamenti caratteristici del suo stile.* Elle Di Ci, Torino.

Ciria, A., José, H., Ciria, A., & Sanguinetti, H. (1983). *La reforma universitaria: 1918-1983*. Centro Editor de América Latina,.

Clarysse, B., Wright, M., Bruneel, J., & Mahajan, A. (2014). Creating value in ecosystems: Crossing the chasm between knowledge and business ecosystems. *Research Policy*, *43*(7), 1164–1176.

Claude, M., & Pizarro, R. (1995). Indicadores de sustentabilidad y contabilidad macroeconómica. *Curso Interamericano sobre Cuentas Ambientales y de Recursos Naturales del*, *31*.

Clausius, R. (1867). *The mechanical theory of heat: With its applications to the steam-engine and to the physical properties of bodies*. J. van Voorst.

Cohen, E., Cvitas, T., Fry, J., & others. (2007). IUPAC quantities, units and symbols in physical chemistry. *IUPAC and RSC Publishing, Cambridge*.

Coleman, J. (1990). Foundations of social theory. *Cambridge, MA: Belknap*.

Comeliau, C. (2002). *The impasse of modernity*. Zed Books.

Confederación de Nacionalidades Indígenas del Ecuador. (2007). *Propuesta de la CONAIE frente a la Asamblea Constituyente: Principios y lineamientos para la nueva constitución del Ecuador, por un estado plurinacional, unitario, soberano, incluyente, equitativo y laico*. Confederación de las Nacionalidades y Pueblos Indígenas del Ecuador.

Corbett, A. (2003). Ideas, Institutions and Policy Entrepreneurs: Towards a new history of higher education in the European Community. *European Journal of Education*, *38*(3), 315–330.

Corsi, G., Esposito, E., Baraldi, C., & Luhmann, N. (1996). *Glosario sobre la teoría social de Niklas Luhmann* (Vol. 9). Universidad Iberoamericana.

Cortina Orts, A. (2003). *Construir confianza: Ética de la empresa en la sociedad de la información y las comunicaciones*. Edicoes Loyola.

Costa, M. (2017). *Capacitar la innovación social* (Abya Yala, pp. 275–292). Universidad Politécnica Salesiana.

Costa, Massimiliano. (2014). Agency formativa per il nuovo learnfare. *FORMAZIONE & INSEGNAMENTO. Rivista internazionale di Scienze dell'educazione e della formazione*, *10*(2), 83–108.

Crespo Güemes, E. (2007). *El Banquete de Platón*. Madrid: Síntesis.

Crossan, M. M., & Apaydin, M. (2010). A multi-dimensional framework of organizational innovation: A systematic review of the literature. *Journal of management studies*, *47*(6), 1154–1191.

Crozier, M., Friedberg, E., & política, A. (1990). *El actor y el sistema: Las restricciones de la acción colectiva*. Alianza.

Cumming, G., Cumming, D. H., & Redman, C. (2006). Scale mismatches in social-ecological systems: Causes, consequences, and solutions. *Ecology and society*, *11*(1).

Cumming, G. S. (2016). Heterarchies: Reconciling networks and hierarchies. *Trends in ecology & evolution*, *31*(8), 622–632.

Cumming, G. S., Buerkert, A., Hoffmann, E. M., Schlecht, E., von Cramon-Taubadel, S., & Tscharntke, T. (2014). Implications of agricultural transitions and urbanization for ecosystem services. *Nature*, *515*(7525), 50–57.

Cumming, G. S., & Peterson, G. D. (2017). Unifying Research on Social–Ecological Resilience and Collapse. *Trends in Ecology & Evolution*, *32*(9), 695–713.

Cunningham, R. L. (1967). Ethics and game theory: The prisoner's dilemma. *Papers on Non-Market Decision Making*, *2*(1), 11–26.

Cutter, S. L., Burton, C. G., & Emrich, C. T. (2010). Disaster resilience indicators for benchmarking baseline conditions. *Journal of Homeland Security and Emergency Management*, *7*(1).

Daresh, J. (2004). Mentoring school leaders: Professional promise or predictable problems? *Educational administration quarterly*, *40*(4), 495–517.

Davenport, T. H., & Prusak, L. (1998). *Working knowledge: How organizations manage what they know*. Harvard Business Press.

Dawes, R. M. (1973). The commons dilemma game: An n-person mixed-motive game with a dominating strategy for defection. *ORI Research Bulletin*, *13*(2), 1–12.

de Córdoba, F. U. (1918). La Juventud Argentina de Córdoba a los Hombres Libres de Sudamérica. *Manifiesto Liminar") en: La Gaceta Universitaria. Órgano de la Federación Universitaria de Córdoba, Edición Extraordinaria*, *1*.

de los Ríos-Carmenado, I., Sastre-Merino, S., Fernández Jiménez, C., Núñez del Río, M., Reyes Pozo, E., & García Arjona, N. (2016). Proposals for improving assessment systems in higher education: An approach from the model «Working with people». *Journal of Technology and Science Education*, *6*(2).

De los Ríos-Carmenado, Ignacio, Rahoveanu, A. T., & Gallegos, A. A. (2014). Project management competencies for regional development in Romania: Analysis from "Working with People" model. *Procedia Economics and Finance*, *8*, 614–621.

De los Ríos-Carmenado, IGNACIO, Rodríguez, F., & Sánchez, C. (2015). Promoting professional project management skills in engineering higher education: Project-based learning (PBL) strategy. *International journal of engineering education*, *31*(1-B), 1–15.

de Nicolás, V. L. (2017). Los Rankings, un Reflejo de la Universidad en el Mundo: WEBOMETRICS. *La universidad: Motor de Transformación de la Sociedad*, 32.

De Souza Silva, J. (2008). La geopolítica del conocimiento y la gestión de procesos de innovación en la época histórica emergente. *Trabajo en progreso, sin revisión. Red Nuevo Paradigma para la innovación institucional en América Latina. Campina Grande, Brasil. Noviembre*.

Del Mar Alarcón, M., de los Rios-Carmenado, I., & de Nicolás, V. L. (2015). The Culture Of Risk Prevention In Madrid Based On Final Work At Universities: A New Educational Dimension From The Wwp Model In Engineering. *Procedia-Social and Behavioral Sciences*, *191*, 2307–2311.

Delahaye, J.-P., & Zenil, H. (2012). Numerical evaluation of algorithmic complexity for short strings: A glance into the innermost structure of randomness. *Applied Mathematics and Computation*, *219*(1), 63–77.

Deutschman, A. (2004). The fabric of creativity. *Fast Company*, *89*(December), 54–60.

Dewey, J. (1997). *How we think*. Courier Corporation.

Di Paolo, E. A. (2000). *Homeostatic adaptation to inversion of the visual field and other sensorimotor disruptions*.

Díaz-Montiel, Z. C., & Márquez-Fernández, Á. B. (2008). La Modernidad en Habermas: Del «sistema»(represor) al «mundo de Vida» (liberador). *Revista de artes y humanidades UNICA*, *9*(21), 71–97.

Dill, D. D., & Soo, M. (2005). Academic quality, league tables, and public policy: A cross-national analysis of university ranking systems. *Higher education*, *49*(4), 495–533.

Dominguez, N. (2012). Mentoring unfolded: The evolution of an emerging discipline. *unpublished dissertation, Degree of Doctor of Education, College of Education, University of New Mexico, Albuquerque, NM*.

Donaldson, L. (2001). *The contingency theory of organizations*. Sage.
Dostal, E., Cloete, A., & Járos, G. (2005). *Biomatrix: A systems approach to organisational and societal change*. BiomatrixWeb.
Dostoyevski, F. (1999). El Idiota. *Juan López-Morillas. Buenos Aires: Alianza*.
Dreyfus, H., Rabinow, P., & others. (1968). *Michel Foucault: Más allá del estructuralismo y la hermenéutica*. Nueva Visión,.
Drucker, P. F. (1969). The age of discontinuity: Guidelines to our changing economy. *New York: Harper&Row*.
Duit, A., & Galaz, V. (2008). Governance and complexity: Emerging issues for governance theory. *Governance*, *21*(3), 311–335.
Duncan, W. (2006). *Seis grados de separación. La ciencia de las redes en la era del acceso*. México: Paidós.
Durkheim, É., & Posada, C. G. (2012). *La división del trabajo social*. Biblioteca Nueva.
Duru-Bellat, M. (2009). *Le mérite contre la justice*.
Ebeling, W., & Feistel, R. (1994). *Chaos und Kosmos: Prinzipien der Evolution*. Spektrum Akad. Verlag.
Edelman, G. (1989). *Remembered present: A biological theory of consciousness*. Basic Books.
Ellerani, P. (2014). *Le opportunità di apprendimento nella formazione superiore.*
Ellerani, P. (2017). *Las oportunidades de aprendizaje en la formación superior. Perspectivas internacionales según el enfoque de Martha Nussbaum.* (Abya Yala, pp. 155–196). Universidad Politécnica Salesiana.
Elmqvist, T., Folke, C., Nyström, M., Peterson, G., Bengtsson, J., Walker, B., & Norberg, J. (2003). Response diversity, ecosystem change, and resilience. *Frontiers in Ecology and the Environment*, *1*(9), 488–494.
Elran, M. (2010). *The International Symposium on Societal Resilience*.
Enfantin, P., & others. (1831). *Doctrine de Saint-Simon: Exposition; première année, 1828-1829*. Au Bureau de l'organisateur.
Espinosa Rubio, L. (2007). *La vida global (en la eco-bio-tecno-noos-fera)*.
Estermann, J. (1998). *Filosofía Andina estudio intercultural de la sabiduría autóctona andina*.
Estrada, E. (2012). *The structure of complex networks: Theory and applications*. Oxford University Press.
Etimologia de la palabra crisis. (2017). https://patiodefilosofos.wordpress.com/2013/03/07/etimologia-de-la-palabra-crisis/
Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: From National Systems and "Mode 2" to a Triple Helix of university–industry–government relations. *Research policy*, *29*(2), 109–123.
Etzkowitz, H., Leydesdorff, L. A., & others. (1995). *Universities and the global knowledge economy: A triple helix of university-industry-government relations*.
European Commission. (2017). *Nature-Based Solutions*. https://ec.europa.eu/research/environment/index.cfm?pg=nbs
Evans, P. (2002). Collective capabilities, culture, and Amartya Sen's Development as Freedom. *Studies in comparative international development*, *37*(2), 54–60.
FAO. (2005). *Las abejas son los diligentes polinizadores de las frutas y cultivos*. http://www.fao.org/docrep/008/y5110s/y5110s03.htm

Fauconnier, G., & Turner, M. (2008). *The way we think: Conceptual blending and the mind's hidden complexities*. Basic Books.

Fayol, H. (2016). *General and industrial management*. Ravenio Books.

Feeny, D., Berkes, F., McCay, B. J., & Acheson, J. M. (1990). The tragedy of the commons: Twenty-two years later. *Human ecology*, *18*(1), 1–19.

Feigenbaum, M. J. (1978). Quantitative universality for a class of nonlinear transformations. *Journal of Statistical Physics*, *19*(1), 25–52.

Felber, C. (2017). *Arbeit zur Gemeinwohl-bilanz 5.0 Vollbilanz*.

Felber, Christian. (2012). La economía del bien común. *Deusto SA Ediciones. Barcelona, España*.

Fernández, N., Maldonado, C., & Gershenson, C. (2014). Information measures of complexity, emergence, self-organization, homeostasis, and autopoiesis. En *Guided self-organization: Inception* (pp. 19–51). Springer.

Feyerabend, P. (1975). *Against method: Outline of an anarchistic theory of knowledge* (Vol. 156). London: New Left Books.

Fistola, R. (2012). Urban entropy vs sustainability: A new town planning perspective. *The Sustainable City VII: Urban Regeneration and Sustainability*, *155*, 1195.

Folke, C. (2006). Resilience: The emergence of a perspective for social–ecological systems analyses. *Global environmental change*, *16*(3), 253–267.

Folke, C., Carpenter, S., Walker, B., Scheffer, M., Elmqvist, T., Gunderson, L., & Holling, C. S. (2004). Regime shifts, resilience, and biodiversity in ecosystem management. *Annual Review of Ecology, Evolution, and Systematics*, *35*.

Folke, C., Colding, J., & Berkes, F. (2003). Building resilience and adaptive capacity in social-ecological systems. *Navigating Social-Ecological Systems. Cambridge University Press, Cambridge, UK*, 352–387.

Folke, C., Hahn, T., Olsson, P., & Norberg, J. (2005). Adaptive governance of social-ecological systems. *Annual Review of Environment and Resources*, *30*, 441–473.

Folke, C., Holling, C. S., & Perrings, C. (1996). Biological diversity, ecosystems, and the human scale. *Ecological applications*, *6*(4), 1018–1024.

Foucault, M. (2009). *A Brief Reading of Kant: Introduction to Anthropology in a Pragmatic Sense*. Madrid: Semiotext.

Foucault, Michel. (1982). *La imposible prisión: Debate con Michel Foucault*. Anagrama.

Foucault, Michel. (1988). El sujeto y el poder. *Revista mexicana de sociología*, *50*(3), 3–20.

Foucault, Michel. (1991). La gubernamentalidad. *Espacios de poder*, 9–26.

Foucault, Michel. (1997). *La arqueología del saber*. Siglo xxi.

Foucault, Michel, Alvarez-Uría, F., Varela, J., & others. (1992). *Microfísica del poder*. La Piqueta,.

Francisco, P. (2015). Encíclica Laudato si. *Sobre el cuidado de las Casa Común (Enciclica)*.

Freire, P. (1997). *Pedagogía de la autonomía: Saberes necesarios para la práctica educativa*. siglo XXI.

Freire, P. (2018). *Teachers as cultural workers: Letters to those who dare teach*. Routledge.

Friedmann, J., & others. (2001). *Planificación en el ámbito público: Del conocimiento a la acción*.

Froese, T., & others. (2010). Life after Ashby: Ultrastability and the autopoietic foundations of biological autonomy. *Cybernetics & Human Knowing*, *17*(4), 7–49.
Fuller, T., & Moran, P. (2000). Moving beyond metaphor. *Emergence*, *2*(1), 50–71.
Gabbay, D. M., & Woods, J. (2005). *A Practical Logic of Cognitive Systems: The Reach of Abduction: Insight and Trial* (Vol. 2). Elsevier.
García Velarde, M., & Fairén Le Lay, V. (1980). *Estructuras disipativas: Algunas nociones básicas (I)*.
Gardner, R., Ostrom, E., & Walker, J. M. (1990). The nature of common-pool resource problems. *Rationality and society*, *2*(3), 335–358.
Gershenson, C. (2013). The implications of interactions for science and philosophy. *Foundations of Science*, *18*(4), 781–790.
Gibbs, J. W. (1877). *On the equilibrium of heterogeneous substances*. Connecticut Academy of Arts and Sciences.
Gijselaers, W. H. (1996). Connecting problem-based practices with educational theory. *New directions for teaching and learning*, *1996*(68), 13–21.
Girardot, D. (2011). La Société du mérite. Idéologie méritocratique et violence néolibérale. *Lectures, Publications reçues*.
Gladyshev, G. P. (1999). On thermodynamics, entropy and evolution of biological systems: What is life from a physical chemist's viewpoint. *Entropy*, *1*(2), 9–20.
Glanville, R. (1997). A Ship without a Rudder. En *Problems of excavating cybernetics and systems*. BKS+.
Gleick, J., & Berry, M. (1987). Chaos-Making a New Science. *Nature*, *330*, 293.
Godbout, J., & Caillé, A. (1992). *L'esprit du don*. La découverte Paris.
Godschalk, D. R. (2003). Urban hazard mitigation: Creating resilient cities. *Natural hazards review*, *4*(3), 136–143.
Gong, M., & Wall, G. (1997). On exergetics, economics and optimization of technical processes to meet environmental conditions. *Work*, *1*(5).
Gourlay, S. (2004). A Critical Analysis of Nonaka's Model of Knowledge Dynamics. *Electronic Journal of Knowledge Management*, *8*.
Gribbin, J. R. (1999). *The little book of science*. Barnes & Noble Books.
Guglielmi, G. J., & Koubi, G. (2000). *L'égalité des chances–Analyses, évolutions, perspectives*. Paris: Éditions La Découverte, coll. Recherches.
Guild, B. (2007). Innovation inspired by nature work book. *Biomimicry Guild, April*.
Gunderson, L. H. (2001). South Florida: The reality of change and the prospects for sustainability: Managing surprising ecosystems in Southern Florida. *Ecological economics*, *37*(3), 371–378.
Guy, M. E., & Rubin, M. M. (2015). *Public Administration Evolving: From Foundations to the Future*. Routledge.
Habermas, J. (1981). *Teoría de la acción comunicativa II: Crítica de la razón funcional*.
Habermas, J. (1987). Teoría de la acción comunicativa. Tomo I: Racionalidad de la acción y racionalización social. *Madri: Taurus*.
Hahn, H., Neurath, O., & Carnap, R. (2002). La concepción científica del mundo: El Círculo de Viena. *Redes*, *18*, 103–149.
Haken, Herman. (1979). *Synergetics-non-equilibrium Phase-transitions and self-organization in Physics, Chemistry and Biology*. New Swiss Chemical soc Verlag

Helvetica Chimica Acta, Malzgasse 21, Postfach 313, Ch-4010 Basel, Switzerland.

Haken, Hermann. (1984). Can synergetics be of use to management theory? En *Self-Organization and Management of Social Systems* (pp. 33–41). Springer.

Handy, C. (1995). *The age of unreason*. Random House.

Hardin, G. (1968). The Tragedy of the Commons. *Science*, *162*. https://doi.org/10.1126

Hardt, M., & Negri, A. (2000). *Empire*. Harvard University Press.

Hausman, C. R. (1993). *Charles S. Peirce's evolutionary philosophy*. Cambridge University Press.

Hawking, S. W., & Jackson, M. (2008). *A brief history of time*. Bantam New York, NY.

Hegel, G. W. (1986). *Jenaer Systementwürfe III: Naturphilosophie und Philosophie des Geistes (Jenaer Realphilosophie)* (Vol. 333). Felix Meiner Verlag.

Hegel, G. W. F. (2012). *The phenomenology of mind*. Courier Corporation.

Heidegger, M. (1949). *Vom Wesen der Wahrheit*. Klostermann.

Helfrich, S. (2008). Bienes comunes y ciudadanía: Una invitación a Compartir. *HELFRICH, Silke. Genes, bytes y emisiones: bienes comunes y ciudadanía, Introducción. Fundación Heirich Böll*.

Henderson, L. J. (1937). *Pareto's general sociology: A physiologist's interpretation*.

Henrich, J., Boyd, R., Bowles, S., Camerer, C., Fehr, E., Gintis, H., & McElreath, R. (2001). In search of homo economicus: Behavioral experiments in 15 small-scale societies. *American Economic Review*, *91*(2), 73–78.

Herrán Gómez, J. (2015). *Modelo de integración del conocimiento-acción a través del Proyecto de Comunicación para el Desarrollo: 25 años de experiencia en comunidades indígenas andinas en Ecuador*.

Herrán Gómez, J., Cazorla, A., De Los Ríos, I., Jordana, J., Yagüe, J. L., & Salgado, J. P. (2014). *Cuaderno de reflexión universitaria 14. Hacia una comunidad académica que investiga.* (AbyaYala).

Herrán Gómez, J., & Salgado Guerrero, J. (2018). Del oratorio a la universidad, según la joven generación de investigadores seglares del ámbito salesiano. En *El Modelo Pedagógico Salesiano*.

Herrán Gómez, J., Salgado, J. P., Álvarez, L., Carpio, M. I., & Barrezueta, T. (2019). *Resultados de Investigación, Innovación y Publicaciones* (AbyaYala).

Herrán, J., Salgado, J. P., Juncosa, J., Carrera, P., Torres, Á., Romero, L. M., & Solórzano, F. (2018). *La Universidad: Un Bien de Uso Común*.

Hess, C., & Ostrom, E. (2007). *Understanding knowledge as a commons*. The MIT Press.

Hess, C., Ostrom, E., & Pérez, P. C. (2016). *Los bienes comunes del conocimiento*. Traficantes de Sueños.

Hesselbarth, C., & Schaltegger, S. (2014). Educating change agents for sustainability–learnings from the first sustainability management master of business administration. *Journal of cleaner production*, *62*, 24–36.

Hey, J. (2004). The data, information, knowledge, wisdom chain: The metaphorical link. *Intergovernmental Oceanographic Commission*, *26*.

Heylighen, F., & others. (2001). The science of self-organization and adaptivity. *The encyclopedia of life support systems*, *5*(3), 253–280.

Hickson, D. J. (1995). *Managerial Decision Making*. Dartmouth. https://books.google.com.ec/books?id=WvEJAQAAMAAJ

Hill, D. (2010). *Emotionomics: Leveraging Emotions for Business Success*. Kogan Page. https://books.google.com.ec/books?id=52HKy4RXqpAC

Hirschman, A. O. (1983). *Felicità privata e felicità pubblica*. Il Mulino. https://books.google.com.ec/books?id=a92UAAAACAAJ

Hirtt, N. (2003). L'offensive des marchés sur l'université. *Alternatives Sud*, *10*, 3.

Hodgson, D., & Cicmil, S. (2006). *Making projects critical*. Palgrave Macmillan.

Hoiling, C., Schindler, D., Walker, B. W., & Roughgarden, J. (1997). Biodiversity in the functioning of ecosystems: An ecological synthesis. *Biodiversity loss: economic and ecological issues*, 44.

Holland, John H. (2000). *Emergence: From chaos to order*. OUP Oxford.

Holland, John Henry. (1995). *Hidden order: How adaptation builds complexity*.

Holling, Crawford S. (1973). Resilience and stability of ecological systems. *Annual review of ecology and systematics*, *4*(1), 1–23.

Holling, Crawford S. (1992). Cross-scale morphology, geometry, and dynamics of ecosystems. *Ecological monographs*, *62*(4), 447–502.

Holling, Crawford S. (2001). Understanding the complexity of economic, ecological, and social systems. *Ecosystems*, *4*(5), 390–405.

Holling, Crawford S, & Meffe, G. K. (1996). Command and control and the pathology of natural resource management. *Conservation biology*, *10*(2), 328–337.

Holling, Crawford Stanley. (1996). Engineering resilience versus ecological resilience. *Engineering within ecological constraints*, *31*(1996), 32.

Holling, Crawford Stanley, & Gunderson, L. H. (2002). *Panarchy: Understanding transformations in human and natural systems*. Island Press.

Hollnagel, E., Nemeth, C. P., & Dekker, S. (2008). *Resilience engineering perspectives: Remaining sensitive to the possibility of failure* (Vol. 1). Ashgate Publishing, Ltd.

Horkheimer, M. (1992). *Zur Kritik der instrumentellen Vernunft: Aus den Vorträgen und Aufzeichnungen seit Kriegsende*. Fischer-Taschenbuch-Verlag.

Howells, J. (2006). Intermediation and the role of intermediaries in innovation. *Research policy*, *35*(5), 715–728.

Hubbell, S. P. (2004). The unified neutral theory of biodiversity and biogeography. *Ecology*, *85*(11), 3175–3178.

Huber, L. R., Sloof, R., & Van Praag, M. (2014). The effect of early entrepreneurship education: Evidence from a field experiment. *European Economic Review*, *72*, 76–97.

Humboldt, W. von. (1943). Sobre la organización interna y externa de los establecimientos científicos superiores en Berlín. *México: Fondo de Cultura Económica*, 165–175.

Humboldt, W. von. (2002). Los límites de la acción del Estado. *Estudo preliminar Joaquín Abellán. Madrid: Tecnos*.

Hwang, V. W., & Horowitt, G. (2012). *The rainforest: The secret to building the next Silicon Valley*. Regenwald Los Altos Hills, CA.

Ibarra Colado, E. (1993). Foucalt, entre el poder y la organización. La teoría de la organización como caja de herramientas. *Martínez Atilano, Guillermo (coord.)*.

Ibarra Colado, E. I. (1999). Los saberes sobre la organización: Etapas, enfoques y dilemas. *Economía, organización y trabajo: un enfoque sociológico*, 95–154.

Ibarra Colado, E., & others. (1993). *La universidad ante el espejo de la excelenciaenjuegos organizacionales*.

Ibarra, E. (1994). Organización del trabajo y dirección estratégica. Caracterización de la evolución de los paradigmas gerenciales. *Serie Investigación*, 15–47.

Ichijo, K., & Nonaka, I. (2006). *Knowledge creation and management: New challenges for managers*. Oxford university press.

Institución Libre de Enseñanza. (2009). https://www.upct.es/seeu/_as/divulgacion_cyt_09/Libro_Historia_Ciencia/web/mapa-centros/Institucion%20Libre%20de%20Ensenanza.htm

International Engineering Alliance. (s. f.). *Graduate Attributes and Professional Competencies*. http://www.ieagreements.org/assets/Uploads/Documents/Policy/Graduate-Attributes-and-Professional-Competencies.pdf

International Monetary Fund. (2000). *Globalization: Threat or Opportunity? An IMF Issues Brief*. http://www.imf.org/external/np/exr/ib/2000/041200to.htm

International Project Management Association, Caupin, G., & others. (2006). *IPMA competence baseline: ICB, Version 3.0*. International Project Management Association.

Ipsen, G. (1924). Der alte Orient und die Indogermanen. *Stand und Aufgaben der Sprachwissenschaft. Festschrift für Wilhelm Streitberg*, 200–237.

ISO 18458. (2015). *Biomimetics: Terminology, Concepts and Methodology ISO 18458:2015-05 2015*. https://www.iso.org/standard/62500.html

Jackson, D. J. (2011). What is an innovation ecosystem. *National Science Foundation*, *1*.

Jaffe, A. B. (2000). The US patent system in transition: Policy innovation and the innovation process. *Research policy*, *29*(4-5), 531–557.

Janssen, M. A., Kohler, T. A., & Scheffer, M. (2003). Sunk-cost effects and vulnerability to collapse in ancient societies. *Current anthropology*, *44*(5), 722–728.

Jaspers, K. (1961). Die Idee der Universität. En *Die Idee der Universität* (pp. 41–165). Springer.

Jaynes, E. T. (1957). Information theory and statistical mechanics. *Physical review*, *106*(4), 620.

Jekielek, S. M., Moore, K. A., Hair, E. C., & Scarupa, H. J. (2002). Mentoring: A promising strategy for youth development. *Child Trends Research Brief*, *2*, 1–8.

Jonassen, D. H. (1999). Designing constructivist learning environments. *Instructional design theories and models: A new paradigm of instructional theory*, *2*, 215–239.

Juan Pablo II. (1990). *Constitución Apostólica sobre las Universidades católicas "Ex Corde Ecclesiae"*. Roma.

Juan Pablo II, P. (1986). *Carta encíclica Laborem exercens*.

Juan Pablo II, P., & Caffarra, C. (1981). *Laborem exercens*. Libreria editrice vaticana.

Jucevičius, G., & Grumadaitė, K. (2014). Smart development of innovation ecosystem. *Procedia-social and behavioral sciences*, *156*, 125–129.

Juncosa Blasco, J. E., Salgado, J. P., Salgado Guerrero, B., Carrera Hidalgo, P., Morandi, A., Torres-Toukoumidis, Á., Moreno, D., Altamirano Chingay, K., Salazar Costa, P., Szadkowski, K., & others. (2019). *The University-Commune*.

Karimi, S., Chizari, M., Biemans, H. J., & Mulder, M. (2010). Entrepreneurship education in Iranian higher education: The current state and challenges. *European Journal of Scientific Research*, *48*(1), 35–50.

Kauffman, S. (1995). *At Home in the Universe: The Search for Laws of Self Organization and Complexity Viking*. London.

Kauffman, S. A. (1992). The origins of order: Self-organization and selection in evolution. En *Spin Glasses and Biology* (pp. 61–100). World Scientific.

Kauffman, S. A. (2000). *Investigations*. Oxford University Press.

Kauffman, S., & Levin, S. (1987). Towards a general theory of adaptive walks on rugged landscapes. *Journal of theoretical Biology*, *128*(1), 11–45.

Keck, M., & Sakdapolrak, P. (2013). What is social resilience? Lessons learned and ways forward. *Erdkunde*, 5–19.

Kelly, K. (1994). *Out of control: The new biology of machines, social systems, and the economic world*. Hachette UK.

Keohane, R. O., & Ostrom, E. (1994). *Local commons and global interdependence*. Sage.

Kibert, C. J., Sendzimir, J., & Guy, G. B. (2003). *Construction ecology: Nature as a basis for green buildings*. Routledge.

Kimbell, L., & others. (2015). *Applying design approaches to policy making: Discovering policy lab*.

Knight, F. H. (2012). *Risk, uncertainty and profit*. Courier Corporation.

Korhonen, J. (2001). Four ecosystem principles for an industrial ecosystem. *Journal of Cleaner Production*, *9*(3), 253–259.

Koster, S. (2004). *Spin-off firms and individual start-ups. Are they really different?*

Kotter, J. P. (1996). *Leading change*. Harvard Business Press.

Kreps, D. M., Milgrom, P., Roberts, J., & Wilson, R. (1982). Rational cooperation in the finitely repeated prisoners' dilemma. *Journal of Economic theory*, *27*(2), 245–252.

Kriwet, C. K. (1997). *Inter and Intraorganizational Knowledge Transfer*.

Kuhn, T. S. (1970). *The Structure of Scientific Revolutions*. University of Chicago Press.

Kwan, P., & Walker, A. (2004). Validating the competing values model as a representation of organizational culture through inter-institutional comparisons. *Organizational Analysis*, *12*(1), 21–37.

Ladrière, J. (1986). Scientific and Ethical Rationality. *Studies in Logic and the Foundations of Mathematics*, *114*, 699–710.

Lakoff, G., & Johnson, M. (2008). *Metaphors we live by*. University of Chicago press.

Langton, C. G. (1990). Computation at the edge of chaos: Phase transitions and emergent computation. *Physica D: Nonlinear Phenomena*, *42*(1-3), 12–37.

Laplantine, F. (2001). Antropologia dos sistemas de representações da doença: Sobre algumas pesquisas desenvolvidas na França contemporânea reexaminadas à luz de uma experiência brasileira. *As representações sociais. Rio de Janeiro: EDUERJ*, 241–259.

Latouche, S. (2001). *La déraison de la raison économique*. Albin Michel.

Latour, B. (1987). *Science in action: How to follow scientists and engineers through society*. Harvard university press.

Laval, C., & Dardot, P. (2015). *Común: Ensayo sobre la revolución en el siglo XXI* (Vol. 891029). Editorial Gedisa.

Lederman, D., Messina, J., Pienknagura, S., & Rigolini, J. (2014). *El emprendimiento en América Latina: Muchas empresas y poca innovación*. World Bank Publications.

Legendre, P. (1999). *Sur la Question Dogmatique En Occident Aspects Théoriques*.

Leonard, D. A. (2011). Core capabilities and core rigidities: A paradox in managing new product development. En *Managing Knowledge Assets, Creativity And Innovation* (pp. 11–27). World Scientific.

Leplat, J. (2009). Remaining sensitive to the possibility of failure de Hollnagel, Nemeth et Dekker. *Perspectives interdisciplinaires sur le travail et la santé*, *11-1*.

Levin, S. A. (1998). Ecosystems and the biosphere as complex adaptive systems. *Ecosystems*, *1*(5), 431–436.

Levin, S. A., & Segel, L. A. (1985). Pattern generation in space and aspect. *SIAM Review*, *27*(1), 45–67.

L'Heuillet, H. (2002). « Ni père, ni maître ». Quelques mots d'histoire de la pédagogie et de la didactique, de 1880 à nos jours. *Journal français de psychiatrie*, *15*(1), 32-33. Cairn.info. https://doi.org/10.3917/jfp.015.0032

Libchaber, A., Fauve, S., & Laroche, C. (1983). Two-parameter study of the routes to chaos. *Physica D: Nonlinear Phenomena*, 7(1-3), 73–84.

Linhart, R. (2013). *L'établi*. Minuit.

Link, A. N., Siegel, D. S., Siegel, D., & others. (2007). *Innovation, entrepreneurship, and technological change*. Oxford University Press on Demand.

Liszka, J. J. (1996). *A general introduction to the semiotic of Charles Sanders Peirce*. Indiana University Press.

Litterer, J. A. (1986). *The emergence of systematic management as shown by the literature of management from 1870-1900*. Dissertations-G.

Lopez-Ruiz, R., Mancini, H. L., & Calbet, X. (1995). A statistical measure of complexity. *Physics Letters A*, *209*(5-6), 321–326.

Lorenz, E. N. (1963). Deterministic nonperiodic flow. *Journal of the atmospheric sciences*, *20*(2), 130–141.

Lorenz, E. N. (1990). Can chaos and intransitivity lead to interannual variability? *Tellus A*, *42*(3), 378–389.

Lorenz, E. N. (2005). Designing chaotic models. *Journal of the Atmospheric Sciences*, *62*(5), 1574–1587.

Lovelock, J. E. (1983). Gaia as Seen Through the Atmosphere. En P. Westbroek & E. W. de Jong (Eds.), *Biomineralization and Biological Metal Accumulation: Biological and Geological Perspectives Papers presented at the Fourth International Symposium on Biomineralization, Renesse, The Netherlands, June 2–5, 1982* (pp. 15–25). Springer Netherlands. https://doi.org/10.1007/978-94-009-7944-4_2

Low, B., Ostrom, E., Simon, C., & Wilson, J. (2003). Redundancy and diversity: Do they influence optimal management. *Navigating social-ecological systems: building resilience for complexity and change*, 83–114.

Löwith, K. (1968). *De Hegel a Nietzsche: La quiebra revolucionaria del pensamiento en el siglo XIX*. Editorial Sudamericana.
Luce, R. D., & Raiffa, H. (1957). *Games and decisions: Introduction and critical survey*. Courier Corporation.
Luhmann, N. (1997). Organización y decisión. Autopoiesis, acción y entendimiento comunicativo. *México: Universidad Ibeoramericana-Anthropos*.
Luhmann, N. (1998). *Sistemas sociales: Lineamientos para una teoría general* (Vol. 15). Anthropos editorial.
Luisi, P. L. (2003). Autopoiesis: A review and a reappraisal. *Naturwissenschaften*, *90*(2), 49–59.
M. Bricall, J. (2000). *Conferencia de Rectores de las Universidades españolas (CRUE)*. http://www.oei.es/historico/oeivirt/bricall.htm
Magnani, L. (2009). *Abductive cognition: The epistemological and eco-cognitive dimensions of hypothetical reasoning* (Vol. 3). Springer Science & Business Media.
Magnavacca, S. (2012). Sobre el lenguaje escolástico como reflejo de actitudes. *Revista Española de Filosofía Medieval*, *19*, 39–43.
Maldonado, L., & Horowitt, G. (2016). *Ecosistemas Abiertos: Seis estrategias para acelerar el florecimiento de la innovación y el emprendimiento* (Bywaters).
Man, G. M. (1994). *The Quark and the Jaguar: Adventures in the Simple and the Complex*.
Mandelbrot, B. B., & Pignoni, R. (1983). *The fractal geometry of nature* (Vol. 173). WH freeman New York.
Margulis, L., & Lovelock, J. E. (1974). Biological modulation of the Earth's atmosphere. *Icarus*, *21*(4), 471–489.
Margulis, Lynn, ed. (1991). *Symbiosis as a Source of Evolutionary Innovation: Speciation and Morphogenesis*, The MIT Press
Marsh, H. W., & Hattie, J. (2002). The relation between research productivity and teaching effectiveness: Complementary, antagonistic, or independent constructs? *The Journal of Higher Education*, *73*(5), 603–641.
Martin, R. (2011). Regional economic resilience, hysteresis and recessionary shocks. *Journal of economic geography*, *12*(1), 1–32.
Martínez Rizo, F. (2011). Los rankings de universidades: Una visión crítica. *Revista de la educación superior*, *40*(157), 77–97.
Marx, K. (2004). *Tesis sobre Feuerbach*. El Cid Editor.
Marx, K. (2007). *Elementos fundamentales para la crítica de la economía política: Borrador 1857-1858* (Vol. 1). Siglo XXI.
Maturana, H. R., & Varela, F. (1980). Autopoiesis and Cognition Boston. *Dordrecht, Reidel*.
Maturana, H. R., & Varela, F. J. (1987). *The tree of knowledge: The biological roots of human understanding*. New Science Library/Shambhala Publications.
Matus, C. (1987). Planificación y gobierno. *Revista de la CEPAL*.
Matus, C. (2006). Planificar para gobernar: El método PES. *Entrevista realizada por F. Huertas). San Justo: Universidad Nacional de La Matanza*.
Max-Neef, M. (2011). Carta Abierta a Sebastián Piñera. *Ecología Política*, *41*, 14–15.

Max-Neef, M., Elizalde, A., & Hopenhayn, M. (1992). Development and human needs. *Real-life economics: Understanding wealth creation*, *197*, 213.

May, R. (1999). Fragile Dominion Complexity and the Commons. *Science*, *286*(5447), 2091–2091.

Maya-Carrillo, A. M., Cevallos-Recalde, C. P., Raura-Ruiz, J. G., & Cejas-Martínez, M. F. (2016). Emprendimiento por oportunidad en el contexto del cambio de la matriz productiva: Una estrategia innovadora-Ecuador. *Visión Gerencial*, *2*, 305–328.

McCann, K. S. (2000). The diversity–stability debate. *Nature*, *405*(6783), 228–233.

McCarthy, I., & Rakotobe-Joel, T. (2000). *Complexity and Complex Systems in Industry*. Warwick Univ. Bookshop.

McCulloch, W. S. (1945). A heterarchy of values determined by the topology of nervous nets. *Bulletin of Mathematical Biology*, *7*(2), 89–93.

McDonough, W., & Braungart, M. (2010). *Cradle to cradle: Remaking the way we make things*. North point press.

McMillan, E. (2004). *Complexity, organizations and change*. Routledge.

McMillan, E. (2008). *Complexity, management and the dynamics of change: Challenges for practice*. Routledge.

Meadows, D. H., Meadows, D. L., Randers, J., & Behrens, W. W. (1972). The limits to growth. *New York*, *102*, 27.

Mercier-Laurent, E. (2013). *Innovation ecosystems*. John Wiley & Sons.

Merino, S. S. (2014). *Desarrollo de capacidades para el liderazgo en proyectos de desarrollo rural. Aplicación a comunidades Aymaras* [PhD Thesis]. Universidad Politécnica de Madrid.

Merriam, S. (1983). Mentors and protégés: A critical review of the literature. *Adult Education*, *33*(3), 161–173.

Merrill, C. L. (1982). *Biomimicry of the Dioxygen Active Site in the Copper Proteins Hemocyanin and Cytochrome Oxidase: Part I: Copper (I) Complexes Which React Reversibly with Dioxygen and Serve to Mimic the Active Site Function of Hemocyanin. Part II: Mu-Imidazolato Binuclear Metalloporphyrin Complexes of Iron and Copper as Models for the Active Site Structure in Cytochrome Oxidase* [PhD Thesis]. Rice University.

Merton, R., & Barber, E. (1992). The travels and adventures of serendipity. A study in historical semantics and the sociology of science. Tr. It. *Viaggi e avventure della Serendipity*.

Meynhardt, T. (2003). *Wertwissen: Was Organisationen wirklich bewegt*. Waxmann Verlag.

Mezzo-Garcia, N. (2013). Bio-inspired political systems: Opening a field. *Proceedings of the European Conference on Complex Systems 2012*, 785–812.

Mezzo-Garcia, N., & Maldonado, C. E. (2015). Crítica al control jerárquico de los regímenes políticos: Complejidad y topología. *Desafíos*, *27*(1).

Miguel-Velasco, A. E., Maldonado-Cruz, P., Torres-Valdéz, J. C., & Cruz-Atayde, M. (2008). La entropía como indicador de las desigualdades regionales en México. *Economía, sociedad y territorio*, *8*(27), 693–719.

Millington, M. J., & Schultz, J. C. (2009). The challenge of organizational culture in quality assurance implementation. *Journal of Rehabilitation Administration*, *33*(2), 121.

Mickiewicz, J. (2008). Globalization: Entropy unification through the Thiel index. *Physica A: Statistical Mechanics and its Applications*, *387*(26), 6595 – 6604. https://doi.org/10.1016/j.physa.2008.08.007

Molitor, M. (2009). *La Universidad para un desarrollo distinto*.

Morin, E. (1977). El método I: la naturaleza de la naturaleza (1986). *Madrid: Cátedra*.

Morin, E, & Le Moigne, J. (2006). Coloquio de Cerisy: Inteligencia de la Complejidad Epistemología y Pragmática. *Ediciones de L'aube. Recuperado de http://ilusionismosocial. org/pluginfile. php/1221/mod_resource/content/1/Inteligencia-deLa-Complejidad. pdf*.

Morín, E., & Le Moigne, J. L. (2006). *Inteligencia de la Complejidad Epistemología y Pragmática*. Ediciones de l'aube. http://ilusionismosocial.org/pluginfile.php/1221/mod_resource/content/1/Inteligencia-de-La-Complejidad.pdf

Morin, Edgar. (1974). La nature de la société. *Communications*, *22*(1), 3–32.

Morin, Edgar. (1976). Pour one crisologie. *Communications*, *25*(1), 149–163.

Morin, Edgar. (1977). Le système: Paradigme ou/et théorie. *Modélisation et maîtrise des*.

Morin, Edgar. (1981). El método II: la vida de la vida. *Cátedra, Madrid, 1*.

Morin, Edgar. (1984). Ciencia con conciencia. *Anthropos, Barcelona*.

Morin, Edgar. (1995). *Mis demonios*. Editorial Kairós.

Morin, Edgar. (1999a). *El Método. El conocimiento del conocimiento. Cátedra*. Madrid, UNESCO.

Morin, Edgar. (1999b). *Los siete saberes necesarios para la educación del futuro*. Unesco.

Morin, Edgar. (2000). La mente bien ordenada (Repensar la forma; reformar el pensamiento). *Los tres mundos, Barcelona, Seix-Barral*.

Morin, Edgar. (2007). Restricted complexity, general complexity. *Science and us: Philosophy and Complexity. Singapore: World Scientific*, 1–25.

Morin, Edgar. (2017). *El método 6*. Ediciones Cátedra.

Morin, Edgar, & Lazzari, S. (2001). *I sette saperi necessari all'educazione del futuro*. Raffaello Cortina.

Morin, Edgar, Pakman, M., & others. (1994). *Introducción al pensamiento complejo*. Gedisa Barcelona.

Morin, Edgar, & Piattelli-Palmarini, M. (1983). La unidad del hombre como fundamento y aproximación interdisciplinaria. *Interdisciplinariedad y ciencias humanas*, 188–214.

Moschini, L. (2017). *Gender Mainstreaming y capabilities approach en la formación a la ciudadanía*. (Abya Yala, pp. 217–250). Universidad Politécnica Salesiana.

Moser, K. S. (2004). The role of metaphors in acquiring and transmitting knowledge. *European perspectives on learning at work: the acquisition of work process knowledge*, 148–163.

Mowery, D. C., & Ziedonis, A. A. (2002). Academic patent quality and quantity before and after the Bayh–Dole act in the United States. *Research Policy*, *31*(3), 399–418.

Müller, F. (2010). *Thermodynamic constraints of ecosystem and landscape dynamics*.

Muller, G. (2012). Fuzzy architecture assessment for critical infrastructure resilience. *Procedia Computer Science*, *12*, 367–372.

Nelson, R. R. (1991). Why do firms differ, and how does it matter? *Strategic management journal*, *12*(S2), 61–74.

Nicolis, G., & Prigogine, I. (1997). *La estructura de lo complejo: En el camino hacia una nueva comprensión de las ciencias* (Vol. 784). Anaya-Spain.

Niño, M., Maiztegi, G., Calvo, A., & Blanco, J. M. (2014). Transformando la Junior Empresa de una Facultad de Informática en una pre-incubadora de startups como núcleo de un modelo de experiencia docente para el desarrollo de competencias en emprendimiento digital. *Jornadas de Enseñanza Universitaria de la Informática (20es: 2014: Oviedo)*.

Nissen, M. E. (2005). *Harnessing Knowledge Dynamics: Principled Organizational Knowing & Learning: Principled Organizational Knowing & Learning*. IGI Global.

Nonaka, lkujiro, Takeuchi, H., & Umemoto, K. (1996). A theory of organizational knowledge creation. *International Journal of Technology Management*, *11*(7-8), 833–845.

Nonaka, I, & Takeuchi, H. (1995). *La organización creadora de conocimiento. Cómo las compañías japonesas crean la dinámica de la innovación (MH Kocka, trans*. México: Oxford University Press.

Nonaka, Ikujiro. (1988). Creating organizational order out of chaos: Self-renewal in Japanese firms. *California management review*, *30*(3), 57–73.

Nonaka, Ikujiro, & Takeuchi, H. (1995). *The knowledge-creating company: How Japanese companies create the dynamics of innovation*. Oxford university press.

Nonaka, Ikujiro, & Toyama, R. (2003). The knowledge-creating theory revisited: Knowledge creation as a synthesizing process. *Knowledge management research & practice*, *1*(1), 2–10.

Nonaka, Ikujiro, Toyama, R., & Konno, N. (2000). SECI, Ba and leadership: A unified model of dynamic knowledge creation. *Long range planning*, *33*(1), 5–34.

Nur, A., & Burgess, D. (2008). *Apocalypse: Earthquakes, archaeology, and the wrath of God*. Princeton University Press.

Nussbaum, M. (1997). *Cultivating Humanity: A Classical Defense of Reform in Liberal Education*. Cambridge: Harvard University Press.

Nussbaum, M. (2009). Capabilities as fundamental entitlements: Sen and social justice. *From employability towards capability*, *4*, 15.

Nussbaum, Martha C. (2001). *Women and human development: The capabilities approach* (Vol. 3). Cambridge University Press.

Nussbaum, Martha C. (2003). *Upheavals of thought: The intelligence of emotions*. Cambridge University Press.

Nussbaum, Martha Craven. (2002). *Giustizia sociale e dignità umana: Da individui a persone*.

Nussbaum, Martha Craven. (2010). *Sin fines de lucro. Por qué la democracia necesita de las humanidades*. Katz Editores.

Nussbaum, Martha Craven. (2012). *Creare capacità: Liberarsi dalla dittatura del Pil*.

Oh, D.-S., Phillips, F., Park, S., & Lee, E. (2016). Innovation ecosystems: A critical examination. *Technovation*, *54*, 1–6.

Oliver, P. (1980). Rewards and punishments as selective incentives for collective action: Theoretical investigations. *American journal of sociology*, *85*(6), 1356–1375.
Olson, M. (1965). *Logic of Collective Action: Public Goods and the Theory of Groups (Harvard economic studies. V. 124)*. Harvard University Press.
Olson, S., & Dahlberg, M. (2013). *Trends in the Ecosystem: Can Past Successes Help Inform Future Strategies?*
O'Neill, R. V. (1986). *A hierarchical concept of ecosystems*. Princeton University Press.
Ordorika, I., & Lloyd, M. (2015). International rankings and the contest for university hegemony. *Journal of Education Policy*, *30*(3), 385–405.
Orts, A. C. (1996). *Ética de la empresa: Claves para una nueva cultura empresarial*. Trotta.
Ostrom, E. (2008). El Gobierno de los Bienes Comunes Desde el Punto de Vista de la Ciudadanía. *Genes, Bytes y Emisiones: Bienes Comunes y Ciudadanía [Genes, Bytes and Emissions: Commons and Citizenship], Ed. Silke Helfrich*, 268–278.
Ostrom, Elinor. (1994). Constituting social capital and collective action. *Journal of Theoretical politics*, *6*(4), 527–562.
Ostrom, Elinor. (2010a). Beyond markets and states: Polycentric governance of complex economic systems. *Transnational Corporations Review*, *2*(2), 1–12.
Ostrom, Elinor. (2010b). Polycentric systems for coping with collective action and global environmental change. *Global Environmental Change*, *20*(4), 550–557.
Ostrom, Elinor. (2011). *El gobierno de los bienes comunes: La evolución de las instituciones de acción colectiva*. Fondo de Cultura Económica.
Ostrom, Elinor, & others. (2000). El gobierno de los bienes comunes. *La evolución de las instituciones de acción colectiva*, *2*, 361.
Ostrom, V., Tiebout, C. M., & Warren, R. (1961). The organization of government in metropolitan areas: A theoretical inquiry. *American political science review*, *55*(4), 831–842.
Owen, R. (1993). *Classics of modern management theory* (Vol. 1). Routledge/Thoemmes.
Padmanabhan, G., & Katti, D. (2002). Using community-based projects in civil engineering capstone courses. *Journal of Professional Issues in Engineering Education and Practice*, *128*(1), 12–18.
Pahl-Wostl, C. (2009). A conceptual framework for analysing adaptive capacity and multi-level learning processes in resource governance regimes. *Global Environmental Change*, *19*(3), 354–365.
Pareto, V. (1974). *I sistemi socialisti*. Unione tipografico-editrice torinese.
Parsons, T. (1968). *La estructura de la acción social* (Vol. 1). Guadarrama Madrid.
Parsons, T. (1991). *The social system*. Psychology Press.
Parsons, T., Jiménez Blanco, J., Pèrez, C., & others. (1976). *El sistema social.* Revista de Occidente.
Pascale, R. T., Millemann, M., & Gioje, L. (2000). *Surfing the Edge of Chaos: The New Laws of Nature and the New Laws of Business*. Texere.
Pastor Sánchez, J. A. (2018). *SKOS*. UNESCO nomenclature for fields of science and technology. https://skos.um.es/unesco6/?l=en
Patera, S., Guerrero, J. S., & Zavala, F. S. (2016). Participatory Action-Research in a systemic framework for improving Social Innovation. The case study of Cen-

tro Audiovisual Don Bosco (UPS-Ecuador). *Journal of e-Learning and Knowledge Society*, *12*(1).

Pauchant, T. C. (1995). *In search of meaning: Managing for the health of our organizations, our communities, and the natural world*. Jossey-Bass Inc Pub.

Paulo, V. (1967). *Populorum progressio: Carta encíclica sobre o desenvolvimento dos povos*. São Paulo: Paulinas.

Pazos, D. R., López, S. F., González, L. O., & Sandiás, A. R. (2010). Factores determinantes de la creación de spin-offs universitarias. *European Journal of Management and Business Economics*, *19*(1), 47.

Peirce, C. (s. f.). Collected Papers 1931-58. *Hartshorne, C. & P. Weiss, vols*, 7–8.

Peirce, Charles Sanders. (1998). *The essential Peirce: Selected philosophical writings* (Vol. 2). Indiana University Press.

Peirce, C.S., & Buchler, J. (2012). *Philosophical Writings of Peirce*. Dover Publications. https://books.google.com.ec/books?id=De7DAgAAQBAJ

Peraza, F. (2011). *Proceso cronológico y argumental de la vida de Don Bosco*. Editorial CSRFP.

Peraza, F. (2012) *Los estigmas de nuestro tiempo y la pedagogía de la bondad.* Quito: Abya-Yala.

Peraza, F. (2001). *Memorias del Oratorio de San Francisco de Sales por San Juan Bosco.* Edición crítica a cargo del P Fernando Peraza Leal sdb. Centro Salesiano Regional de Formación Permanente. Imprenta Don Bosco Quito – Ecuador.

Peraza, F., & Jiménez, R. (2011). *Acompañamiento y paternidad espiritual en San Juan Bosco*. Editorial CCS.

Perez, M. P., & Sánchez, A. M. (2003). The development of university spin-offs: Early dynamics of technology transfer and networking. *Technovation*, *23*(10), 823–831.

Petrella, R. (2007). *Pour one nouvelle narration du monde: Humanité, biens communs, vivre ensemble*. Éditions Écosociété.

Petruzzellis, L., D'Uggento, A. M., & Romanazzi, S. (2006). Student satisfaction and quality of service in Italian universities. *Managing Service Quality: An International Journal*, *16*(4), 349–364.

Pfefferbaum, B. J., Reissman, D. B., Pfefferbaum, R. L., Klomp, R. W., & Gurwitch, R. H. (2008). Building resilience to mass trauma events. En *Handbook of injury and violence prevention* (pp. 347–358). Springer.

Piaget, J. (1966). Biologie et connaissance. *Diogène*, *54*, 3.

Pilataxi Lechón, C., & Ortíz, P. (2014). *Sumak Kawsay organización comunitaria y emprendimiento productivo. El caso de San Pablo Urku, Cayambe*.

Pimm, S. L. (1991). *The balance of nature?: Ecological issues in the conservation of species and communities*. University of Chicago Press.

Pirnay, F., Surlemont, B., & others. (2003). Toward a typology of university spin-offs. *Small business economics*, *21*(4), 355–369.

Polani, D., Prokopenko, M., & Yaeger, L. S. (2013). *Information and self-organization of behavior*. World Scientific.

Polanyi, K. (2001). *The political and economic origins of our time*. Boston, Mass: Beacon Press.

Polanyi, K., & others. (1957). The economy as instituted process. *Trade and market in the early empires*, *243*.

Polanyi, K., Pearson, H. W., & others. (1977). *Livelihood of man*. Academic press.

Polanyi, K., & Sánchez, A. (1992). *La gran transformación*. Juan Pablos.

Polanyi, M. (2009). *The tacit dimension*. University of Chicago press.

Polanyi, M. (2015). *Personal knowledge: Towards a post-critical philosophy*. University of Chicago Press.

Poma, L., & Nicolli, F. (2011). *L'innovazione come motore della competitività territoriale: Il caso della provincia di Ferrara* (Vol. 902). FrancoAngeli.

Poma, L., & Ramaciotti, L. (2008). La valorizzazione della ricerca universitaria mediante l'interpolazione dei saperi. Infrastrutture materiali ed immateriali. *L'industria, rivista di economia e politica industriale*, 269.

Porter, L. W. (1995). *Human relations: Theory and developments*. Dartmouth Pub Co.

Porter, L. W. (1996). Forty years of organization studies: Reflections from a micro perspective. *Administrative Science Quarterly*, 262–269.

Porter, M. E. (1998). *Clusters and the new economics of competition* (Vol. 76). Harvard Business Review Boston.

Portugali, J. (2012). *Self-organization and the city*. Springer Science & Business Media.

Pozo Ruiz, A. (s. f.). *Significado del termino «Universitas»*. https://personal.us.es/alporu/historia/universitas_termino.htm

Prigogine, I. (1997). *The end of certainty: Time, chaos, and the new laws of nature*. Free Press.

Prigogine, I., & Stengers, I. (2017). *Order Out of Chaos*. Verso Books. https://books.google.com.ec/books?id=kqgZMQAACAAJ

Prigogine, Ilya. (1978). Time, structure, and fluctuations. *Science*, 777–785.

Prigogine, Ilya, & Hiebert, E. N. (1982). From being to becoming: Time and complexity in the physical sciences. *Physics Today*, *35*, 69.

Prigogine, Ilya, & others. (1996). *El fin de las certidumbres*. Andrés Bello.

Prigogine, Ilya, & Stengers, I. (1979). *La nouvelle alliance: Métamorphose de la science*. Gallimard.

Proudhon, P.-J. (1865). *De la capacité politique des classes ouvrières*. Batitout, Questroy et Ce.

Psillos, S. (2009). An explorer upon untrodden ground: Peirce on abduction. *Handbook of the History of Logic: Inductive Logic*, *10*(2009), 117–151.

Qespi, M., & Eusebio, A. (1994). Pacha: Un concepto andino de espacio y tiempo. *Revista española de antropología americana*, *24*, 155–189.

Quacquarelli Symonds. (2018). *QS World University Rankings 2018*. https://www.topuniversities.com/university-rankings/world-university-rankings/2018

Ramírez, S. F. P. (2016). La experiencia de la aplicación del modelo mit-nextlab sobre innovacion y emprendimiento en la universidad de sonora. *EPISTEMUS, CIENCIA TECNOLOGÍA Y SALUD*, *19*.

Ramírez Salazar, M. del P., & García Valderrama, M. (2010). La Alianza Universidad-Empresa-Estado: Una estrategia para promover innovación. *Revista Escuela de Administración de Negocios*, *68*.

Ratzinger, J. (2010). *Exhortación apostólica postsinodal verbum domini del Santo Padre Benedicto XVI al episcopado, al clero, a las personas consagradas y a los fieles laicos sobre la palabra de dios en la vida y en la misión de la iglesia*. http://w2.vatican.va/content/benedict-xvi/es/apost_exhortations/documents/hf_ben-xvi_exh_20100930_verbum-domini.html

Reap, J., Baumeister, D., & Bras, B. (2005). Holism, biomimicry and sustainable engineering. *ASME International Mechanical Engineering Conference and Exposition. Orlando, FL, USA*.

Redon Pantoja, S. (2009). Auto evaluación institucional y acreditación como aseguramiento de la calidad de la educación: Implicancias teóricas y prácticas. *Estudios pedagógicos (Valdivia)*, *35*(2), 269–284.

Rey, A. (2011). *Dictionnaire historique de la langue française*. Le robert.

Ribeiro, D. (1971). *La universidad latinoamericana*. Editorial Universitaria.

Richardson, H. (1973). Economia regional e urbana, teoría de la localización, estructuras urbanas y crecimiento regional, Barcelona: Ed. *Vicens Vives*.

Riechmann, J. (2014). *Un buen encaje en los ecosistemas*.

Ríos Carmenado, I. de los, Herrera Reyes, A. T., & Guillen Torres, J. (2015). Complejidad en la Dirección de Proyectos: Análisis Conceptual desde el Modelo Working with People. *DYNA*, *90*(1).

Rísquez, F. A. (2002). *La Teoría del Caos. Modelo de interpretación epistémica e instrumento de solución: Reconciliación entre ciencias y humanidades*. http://www.pensamientocomplejo.com.ar/docs/files/Fernando%20ALmarza-R%EDsquez%2C%20La%20Teor%EDa%20del%20Caos%20Modelo%20de%20Interpretaci%F3n.pdf

Ritzer, G., & Yagatich, W. (1992). Contemporary sociological theory. *New York*, 608.

Robles-Bykbaev, V., Juncosa, J., Pérez, P., & Mosquera, T. (2017). *Funciones de Coordinadores y Consejos de Investigación*.

Rodríguez, A. (2018). *Liderazgo preventivo en la universidad*. Ediciones Navarra.

Roethlisberger, F. J., & Dickson, W. J. (2003). *Management and the Worker* (Vol. 5). Psychology Press.

Rose, A. (2007). Economic resilience to natural and man-made disasters: Multidisciplinary origins and contextual dimensions. *Environmental Hazards*, *7*(4), 383–398.

Rose, A., & Liao, S.-Y. (2005). Modeling regional economic resilience to disasters: A computable general equilibrium analysis of water service disruptions. *Journal of Regional Science*, *45*(1), 75–112.

Rousseau, J.-J. (2017). *Discurso sobre a economia política*. Editora Vozes Limitada.

Ruelle, D., & Takens, F. (1995). On the nature of turbulence. En *Turbulence, Strange Attractors And Chaos* (pp. 57–84). World Scientific.

Ruiz-Mirazo, K., & Moreno, A. (2004). Basic autonomy as a fundamental step in the synthesis of life. *Artificial life*, *10*(3), 235–259.

Sáenz, F. (2017). *Desarrrollo del pensamiento pedagógico de Don Bosco: Vigencia y Legado* [Doctoral]. Universidad de la Habana.

Saisana, M., d'Hombres, B., & Saltelli, A. (2011). Rickety numbers: Volatility of university rankings and policy implications. *Research policy*, *40*(1), 165–177.

Salgado, F. (2019). Reciprocidad y estudios organizacionales. *y pensamiento social*, 123.

Salgado Guerrero, J. P., Juncosa Blasco, J. E., Solórzano, F., Carrera Hidalgo, P., Torres-Toukoumidis, Á., Romero-Rodríguez, L. M., Salgado, B., & others. (2019). *The University as a Common Pool Resource. A set of resources, moral and cultural values from the Academic Community of Universidad Politécnica Salesiana*.

Salgado, J. P. (2017). *Innovazione organizzativa per la valorizazzione della ricerca scientifica. Il Caso dell' Universidad Politécnica Salesiana.* [Doctoral]. Università degli Studi di Ferrara.

Salgado, J. P., de los Ríos Carmenado, I., & González, M. L. (2017). Management of Entrepreneurship Projects from Project-Based Learning: Coworking StartUPS Project at Universidad Politécnica Salesiana (Salesian Polytechnic University), Ecuador. En *Case Study of Innovative Projects-Successful Real Cases*. InTech.

Salgado, J. P., & Herrán Gómez, J. (2017). *Hacia una Comunidad Académica que Investiga e Innova: La Universidad Politécnica Salesiana*.

Salgado, J. P., & Patera, S. (2017). Nuevos indicadores de producción del conocimiento en la universidad, desde la impronta de una cultura de evaluación propendida a la innovación social. El caso de la Universidad Politécnica salesiana, de ecuador. *Revista Cubana de Educación Superior*, *3*, 116–136.

Salgado, J. P., Patera, S., Ellerani, S., & Sáenz, F. (2016). Crea minka: Allargare i contesti dell'apprendimento attraverso la tecnologia in UPS-ECUADOR. En *Design the Future! Extended Abstracts della Multiconferenza EMEMITALIA 2016* (pp. 957–969). Genova Univerdity Press.

Salgado-Guerrero, J. P., Galán-Mena, J., Pulla-Sánchez, D., Robles-Bykbaev, V., & Narváez-Pacheco, A. (2017). CREAMINKA: An Intelligent Ecosystem Based on Ontologies and Artificial Intelligence to Manage Research Processes, Knowledge Generation and Scientific Production in Higher Education. *Colombian Conference on Computing*, 115–129.

San Guido II. (s. f.). *Scala Claustralium*. https://es.scribd.com/document/254067942/Scala-Claustralium-San-Guigo-II-El-Cartujo

Sánchez Parga, J. (1997). *Globalización, gobernabilidad y cultura*. Instituto Latinoamericano de Investigación Social: Ediciones Abya-Yala: Centro de Estudios Latinoamericanos, Universidad Central del Ecuador.

Sánchez Parga, J. (2003). *La docencia universitaria: Para un manifiesto antipedagógico*. Editorial Abya Yala.

Sánchez Parga, J. (2012). Valores y contravalores en la sociedad de la plusvalía. *Universitas*, *1*(10).

Sánchez Parga, J. (2013a). *Qué significa ser indígena para el indígena. Más allá de la comunidad y la lengua*.

Sánchez Parga, J. (2013b). *Transformación antropológica del siglo XXI: El homos oeconómicus*. Abya-Yala/UPS.

Sandler, T. (1992). *Collective action: Theory and applications*. University of Michigan Press.

Sartre, J.-P. (1983). *Cahiers pour one morale*. Gallimard Paris.

Scheffer, M., & Westley, F. (2007). The evolutionary basis of rigidity: Locks in cells, minds, and society. *Ecology and Society*, *12*(2).
Schiuma, G. (2009). The managerial foundations of knowledge assets dynamics. *Knowledge Management Research & Practice*, 7(4), 290–299.
Schleiermacher, F. (1959). Pensamientos ocasionales sobre universidades en sentido alemán. *Fichte y otros, La idea de la Universidad en Alemania, Buenos Aires*, 117–208.
Schmehr, W., & Knoepfel, H. (2012). IPMA Certification Yearbook. En *International Project Management*. http://www.ipma.ch/certification
Schmitt, O. H. (1969). Some interesting and useful biomimetic transforms. *Third Int. Biophysics Congress*, *1069*, 197.
Schön, D. A. (1983). *The reflective practitioner: How professionals think in action*.
Schon, D. A. (1992). *La formación de profesionales reflexivos: Hacia un nuevo diseño de la enseñanza y el aprendizaje en las profesiones.* Ministerio de Educación y Ciencia, Madrid (España).
Schuldt, J. (1997). *Dineros alternativos para el desarrollo local*. Universidad del Pacífico.
Schumpeter, Joseph A. (1963). *Capitalismo, socialismo y democracia*.
Schumpeter, Joseph Alois, Schumpeter, E. B., Sacristán, M., García-Durán, J. A., & Serra, N. (1971). *Historia del análisis económico*. Ariel Barcelona.
Scriven, M. (1974). Standards for the evaluation of educational programs and products. En *Evaluating educational programs and products*. Englewood Cliffs: Educational Technology Publications.
Seidl, D. (2004). Luhmann's theory of autopoietic social systems. *Ludwig-Maximilians-Universität München-Munich School of Management*, 36–37.
Sen, Amartya. (2001). *Development as freedom*. Oxford Paperbacks.
Sen, Amartya. (2009). Capability: Reach and limits. *Debating Global Society. Reach and Limit of the Capability Approach*, 15–28.
Sen, Amartya. (2014). *Lo sviluppo è libertà*. Edizioni Mondadori.
Sen, Amartya, Nussbaum, M., & Sen, A. (1991). Capability and Well-being. *The Quality of Life*.
Sen, Amaryta, & others. (1999). On ethics and economics. *OUP Catalogue*.
Senescyt. (2013). *Código Orgánico de la Economía Social del Conocimiento (COESC+i)*. http://www.wipo.int/edocs/lexdocs/laws/es/ec/ec075es.pdf
Senge, P. (1990). *The fifth discipline: The art and practice of the learning organization*. Doubleday/Currency.
Sevilla, S. (2009). Hegel y los orígenes de la universidad contemporánea desde su crisis actual. *Filosofía para la universidad, filosofía contra la universidad:(de Kant a Nietzsche)*, 233–251.
Shane, S. A. (2004). *Academic entrepreneurship: University spinoffs and wealth creation*. Edward Elgar Publishing.
Shannon, C. E. (1948). A mathematical theory of communication, Part I, Part II. *Bell Syst. Tech. J.*, *27*, 379–423.
Sharifi, A., & Yamagata, Y. (2016). Principles and criteria for assessing urban energy resilience: A literature review. *Renewable and Sustainable Energy Reviews*, *60*, 1654–1677.

Sheffi, Y., & others. (2005). The resilient enterprise: Overcoming vulnerability for competitive advantage. *MIT Press Books*, *1*.

Shin, J. C., & Toutkoushian, R. K. (2011). The past, present, and future of university rankings. En *University Rankings* (pp. 1–16). Springer.

Sieniutycz, S. (1990). *Finite-time thermodynamics and thermoeconomics*. Taylor & Francis.

Silva, S. (2017). *La Crisis de 1929*. https://m.zonaeconomica.com/crisis-1929

Silverstein, D., Samuel, P., & DeCarlo, N. (2013). *The innovator's toolkit: 50+ techniques for predictable and sustainable organic growth*. John Wiley & Sons.

Simon, Herbert A. (1977). The organization of complex systems. En *Models of discovery* (pp. 245–261). Springer.

Simon, Herbert A. (1978). Rationality as process and as product of thought. *The American economic review*, 1–16.

Simon, Herbert A. (1962). *The architecture of complexity*. 467–482.

Simon, Herbert Alexander, & Ros, A. L. (1964). *El comportamiento administrativo: Estudio de los procesos decisorios en la organización administrativa*. Aguilar.

Simpson, D. M., & Katirai, M. (2006). Indicator issues and proposed framework for a disaster preparedness index (DPi). *University of Louisville*.

Smith, A., & McCulloch, J. R. (1838). *An Inquiry into the Nature and Causes of the Wealth of Nations*. A. and C. Black and W. Tait.

Soriano, E., & González, A. (2015). *Ciencias 3. Química*. Santillana.

Stack, M. (2016). Visualizing Excellence: The Times Higher Education Ranking. En *Global University Rankings and the Mediatization of Higher Education* (pp. 51–69). Springer.

Stake, R. E. (1995). *The art of case study research*. Sage.

Steele, J. (1960). *How Do We Get There? Bionics Symposium: Living Prototypes—The Key to New Technology*. WADD Technical Report 60-600, Wright Air Development Division, Wright-Patterson Air Force Base, OH.

Steele, J. E. (1983). *The Relevance of Biology to Engineering, presented at Society of Women Engineers Convention*.

Steffensen, M., Rogers, E. M., & Speakman, K. (2000). Spin-offs from research centers at a research university. *Journal of business venturing*, *15*(1), 93–111.

Stellingwerf, R., & Zandhuis, A. (2013). *ISO 21500 Guidance on project management: A Pocket Guide*. Van Haren.

Stewart, G., MacLean, D., & MacIntosh, R. (2000). Applying complexity theory in organisations (comparing experiences). *McCarthy, IP, Rakotobe-Joel, T., Complexity and Complex Systems in Industry, The University of Warwick*, 466–76.

Stiglitz, J. E., Sen, A., & Fitoussi, J.-P. (2010). *Mismeasuring our lives: Why GDP doesn't add up*. The New Press.

Stratta Fernández, R., Ríos Carmenado, I. de los, López González, M., & Appiah-Opoku, S. (2017). *Developing Competencies for Rural Development Project Management through Local Action Groups: The Punta Indio (Argentina) Experience*.

Strümpfer, D. (1993). Fie on 'survival of the fittest': A humane view of people in organizations. *IN: Manganyi, NC, Marais, HC, Mauer, KF, Prinsloo, RJ (eds.), A dissident among patriots. Pretoria: Centre for Science Development*.

Styhre, A. (2002). Non-linear change in organizations: Organization change management informed by complexity theory. *Leadership & Organization Development Journal*, *23*(6), 343–351.

Suarez Daza, A. M. del P., & others. (2014). *Emprendimiento innovador en Colombia* [B.S. thesis]. Universidad Militar Nueva Granada.

Sveiby, K. E. (1997). *The new organizational wealth: Managing & measuring knowledge-based assets*. Berrett-Koehler Publishers.

Svyantek, D. J., & DeShon, R. P. (1993). Organizational attractors: A chaos theory explanation of why cultural change efforts often fail. *Public Administration Quarterly*, 339–355.

Taylor, C. (1994). *La ética de la autenticidad*. Barcelona, ES: Paidós.

Taylor, F. W. (1911). *Shop management*. McGraw-Hill.

Taylor, F. W. (1981). *Principios de la administración científica*.

Taylor, M., & Ward, H. (1982). Chickens, Whales, and Lumpy Goods: Alternative models of public-goods provision. *Political Studies*, *30*(3), 350–370.

Teichler, U. (2011). Social contexts and systemic consequence of university rankings: A meta-analysis of the ranking literature. En *University rankings* (pp. 55–69). Springer.

Thom, R., & others. (1987). *Estabilidad estructural y morfogénesis: Ensayo de una teoría general de los modelos*.

Thompson, C. B. (1914). *Scientific management: A collection of the more significant articles describing the Taylor system of management* (Vol. 1). Harvard University Press.

Times Higher Education. (2017). *World University Rankings 2016-2017*. https://www.timeshighereducation.com/world-university-rankings/2017/world-ranking#!/page/0/length/25/sort_by/rank/sort_order/asc/cols/stats

Timmerman, P. (1981). Vulnerability, resilience and the collapse of society. *A Review of Models and Possible Climatic Applications. Toronto, Canada. Institute for Environmental Studies, University of Toronto*.

Touraine, A. (1965). *Sociologie de l'action*. Editions du Seuil Paris.

Touraine, A. (1993). Crítica de la modernidad. *Temas de hoy, Madrid*.

Touraine, A., & Gregorio, M. (1997). *Eguaglianza e diversità: I nuovi compiti della democrazia*. Laterza.

Touraine, A., Khosrokhavar, F., Ibaäez, G., & others. (2002). *A la búsqueda de sí mismo: Diálogo sobre el sujeto*.

Touraine, A., & Pons, H. (1997). *¿Podremos vivir juntos?: Iguales y diferentes*. PPC Madrid.

Tourraine, A. (1997). Pourrons-nous vivre ensemble. *Égaux et différents. Paris: Fayard*.

Townsend, R., & Wilson, J. A. (1987). An economic view of the tragedy of the commons. *The question of the commons. The culture and ecology of communal resources*, 311–326.

Trueba, I., Cazorla, A. G., & others. (1995). *Proyectos empresariales: Formulación, evaluación*.

Tünnermann, C. (1996). *Políticas y estrategias para la transformación de la Educación Superior en América Latina y el Caribe*. CRESALC UNESCO. http://unesdoc.unesco.org/images/0021/002194/219407so.pdf

Ulanowicz, R. E. (2000). Ascendancy: A Measure of Ecosystem Performance. *Handbook of ecosystem theories and management*, 303.
Ulrich, B. (2008). La convergencia de movimientos: Los bienes comunes en tanto que cosmovisión crítica emancipatoria y en tanto que perspectiva estratégica. *S. Helfrich (comp.). Genes, bytes y emisiones: bienes comunes y ciudadanía. México. Ediciones Böll*, 302–310.
Unesco. (1998). *Declaración mundial sobre la educación superior en el siglo XXI: Visión y acción*.
UNICEF, & others. (2016). *La naturaleza del aprendizaje: Usando la investigación para inspirar la práctica*.
United Nations. (s. f.). *Objetivos de desarrollo del milenio, desarrollo, la pobreza, la mortalidad infantil, salud materna, salud de la mujer, la alfabetización de VIH / SIDA, la tuberculosis, la educación, la igualdad de género, el agua potable, la malaria, el medio ambiente*. United Nations. http://www.un.org/es/millenniumgoals/
United Nations. (2005). *International Strategy for Disaster Reduction Hyogo Framework for Action 2005-2015: Building the Resilience of Nations*. http://www.unisdr.org/we/inform/publications/1037
Universidad Don Bosco, & Dicasterio de Pastoral Juvenil. (2014). *La pastoral juvenil salesiana. Cuadro de referencia*. http://hdl.handle.net/11715/695
Universidad Politécnica Salesiana. (2018, noviembre 14). *Congreso de Educación Salesiana: El modelo pedagógico salesiano*. https://cmodelosalesiano.blog.ups.edu.ec/
Universidad Politécnica Salesiana. (2019). *Carta de Navegación*. https://www.ups.edu.ec/documents/10184/14643/Carta+de+Navegaci%C3%B3n+2019+-+2023.pdf/6d05c75f-4f92-4c50-a33c-262ad33344aa
Varela, F. G., Maturana, H. R., & Uribe, R. (1974). Autopoiesis: The organization of living systems, its characterization and a model. *Biosystems*, *5*(4), 187–196.
Vázquez, E., & Alonso, M. (2007). Historia del mundo contemporáneo y la Argentina de hoy. *Aique, Buenos Aires*.
Vendrell-Herrero, F., & Ortín-Ángel, P. (2010). Evolución comparada de los spin-offs universitarios españoles. *Clm Econ*, *16*, 345–379.
Vernon, J. (2008). Erfahren and Erleben: Metaphysical Experience and its Overcoming in Heidegger's Beiträge. *Symposium*, *12*, 108–125.
Vignaux, G. (2013). *Les Jeux des ruses. Petit traité d'intelligence pratique*. Le Seuil.
Vogel, S. (2000). *Cats' paws and catapults: Mechanical worlds of nature and people*. WW Norton & Company.
Vogus, T. J., & Sutcliffe, K. M. (2007). Organizational resilience: Towards a theory and research agenda. *Systems, Man and Cybernetics, 2007. ISIC. IEEE International Conference on*, 3418–3422.
Von Foerster, H. (2003). Disorder/Order: Discovery or invention? *Understanding Understanding; Springer: Berlin Heidelberg, Germany*, 273–282.
Von Neumann, J., Burks, A. W., & others. (1966). Theory of self-reproducing automata. *IEEE Transactions on Neural Networks*, *5*(1), 3–14.

Walker, B. H. (1992). Biodiversity and ecological redundancy. *Conservation biology*, *6*(1), 18–23.

Walker, M. (2005). *Higher education pedagogies*. McGraw-Hill Education (UK).

Warner, W. L. (1963). *Yankee city*.

Weber, M. (1991). Histoire économique. *Esquisse d'une histoire universelle de l'économie et de la société*, *1*, 162.

Weber, M. (2002). *The Protestant ethic and the" spirit" of capitalism and other writings*. Penguin.

Weber, M. (2009). *The theory of social and economic organization*. Simon and Schuster.

Weber, M. (2014). *Economía y sociedad*. Fondo de cultura económica.

Weber, M., Gerth, H. H., & Mills, C. W. (1982). *Ensayos de sociologia*.

Weber-Gesamtausgabe, M. (2016). *Comunità Economia e società*. Edizione Italiana a cura di Massimo Palma.

Webometrics. (2017). *Ranking web de universidades*. http://www.webometrics.info/es/world

Wennekers, S., & Thurik, R. (1999). Linking entrepreneurship and economic growth. *Small business economics*, *13*(1), 27–56.

Wheatley, M. (1993). *Leadership and the new science*. CRM Films.

Whitesides, G. M. (2015). Bioinspiration: Something for everyone. *Interface focus*, *5*(4), 20150031.

Wiki. (2020, mayo 21). Wiki. https://es.wikipedia.org/wiki/Wiki

Williams, H. T. P. (2006). *Homeostatic adaptive networks* [PhD Thesis]. University of Leeds.

Wilson, E. O., & Hölldobler, B. (1988). Dense heterarchies and mass communication as the basis of organization in ant colonies. *Trends in Ecology & Evolution*, *3*(3), 65–68.

Winter, M., Smith, C., Morris, P., & Cicmil, S. (2006). Directions for future research in project management: The main findings of a UK government-funded research network. *International journal of project management*, *24*(8), 638–649.

Wittgenstein, L. (2014). *Della certezza*. Giulio Einaudi Editore.

Wolfgang, J. (2014). *A cybernetic model of design research*.

Wolpe, H. (1980). *The articulation of modes of production: Essays from economy and society*. Routledge.

World Economic Forum. (2015). *Leveraging Entrepreneurial Ambition and Innovation*. http://www3.weforum.org/docs/WEFUSA_EntrepreneurialInnovation_Report.pdf

World Resources Institute (WRI). (2008). *Roots of Resilience: Growing the Wealth of the Poor*. United Nations and World Bank.

Xiao, Y., & Drucker, J. (2013). Does Economic Diversity Enhance Regional Disaster Resilience? *Journal of the American Planning Association*, *79*(2), 148–160.

Xiong, J., & Bauer, C. E. (2002). Complex evolution of photosynthesis. *Annual review of plant biology*, *53*(1), 503–521.

Zack, M. H. (1999). Developing a knowledge strategy. *California management review*, *41*(3), 125–145.

Zahra, S. A., Van de Velde, E., & Larraneta, B. (2007). Knowledge conversion capability and the performance of corporate and university spin-offs. *Industrial and Corporate Change*, *16*(4), 569–608.
Zari, M. P., & Storey, J. (2007). An ecosystem based biomimetic theory for a regenerative built environment. *Sustainable Building Conference*, *7*.
Zopf Jr, G., & others. (1962). *Principles of self-organization: The Illinois symposium on theory and technology of self-organizing systems*.

Glossary of Terms

Agency. In pedagogical or social-development literature the term *agency* can be understood as the *capacity to do or act.* It is directly related to *autopoiesis*, which for Aristotle is *productive action* (poiesis) that is result-oriented (Aristotle et al., 1970). 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 – to do or to 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).

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: the effective relations of a person's expectations and the freedom to meet them.

pp. 80, 146, 185, 187, 188, 189, 190, 193, 320, 326, 454, 457, 475.

Environment that Enhances Capacities (Biocenosis). An intentional environment, with its own culture, values and valorizations, which offers opportunities for individuals, living beings of the ecosystem, to fully develop their capacities and capabilities. Just as a plant grows on its own, so does a person. It is up to the educator, the family or society to provide the necessary environment for this to happen.

Contrary to what it may seem, this environment is not necessarily a paradise on earth. It is full of uncertainty, complexity and diversity, but it offers tools and opportunities for the actor to respond with hope, trust and love.

This book makes an analogy between the Environment that Enhances Capacities and the biocenosis of ecosystems, then intertwines this concept with that of the Common Good to justify several assumptions and explain how a communal organization that produces knowledge emerges from the product between the two dimensions.

pp. 68, 69, 81ff., 126ff. 176, 182ff., 186, 189, 190, 191, 200, 201, 202, 203, 204, 285, 295, 332, 328, 330,365, 376, 380, 384, 411, 426, 451ff., 455, 457, 459, 465ff., 470, 471, 472, 473, 476, 523.

Self-Organization. Self-organization highlights the adaptive capacity of the system, it is the evolution or co-evolution of the ecosystem. Combined with the capacity of self-organization, the synergies based on reciprocity are the foundation of university autonomy and at the same time of the communal university. The capacity for self-organization combines personal and collective interests and facilitates ethics (Aristotelian ethical praxis that can be translated as politics) as economic know-how that aims to guide human action in a rational sense.

This knowledge that empowers 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 knowl-how.

The communal university builds its autonomy from the self-organization and autopoiesis of the base groups of the community and the personal development of those who compose them. Therefore, it is itself a fabric that accomodates projects that build the common good. If the primary concern is the living organization and its management for the creation of knowledge, self-organization finds its place in the desired definition from within and the affirmation of the university's identity.

Autopoiesis. *Auto-poiesis* is a Greek word made up of *auto* (self) and *poiesis* (creation, production) and was proposed as a concept to define life. According to Maturana (2011), the concept of autopoiesis has emerged to suggest and represent the molecular processes that take place when living beings become autonomous entities.

We could define autopoiesis as the relationship between complexity of a system and the complexity of its environment. It is important to emphasize that this is *not a question of life as entelechy but of life or living as a process*. In other words, we are not talking of a system of communication or transmission of information, but of a *complex system of coexistence, where the living beings organize themselves in autopoietic molecular systems that have the capacity to produce themselves.* This realization of self-production is what constitutes life.

The concept of autopoiesis has spread to other areas beyond biology (Froese & others, 2010), (Luisi, 2003), (Varela et al., 1974) but a standard measurement has not yet been suggested. Of interest may be the conception that Plato gives to the term poiesis as "the cause that converts anything that we considers from non-being into being" (Crespo Güemes, 2007).

Common Good (Biotope). *The commons* referred to in this book is a concept developed by Elionor Ostrom (2008) who found that there are common-pool resources in nature that are sustainably managed by the communities, which appropriate them to reverse the fate of Hardin's Tragedy of the Commons. The university as a resource that a community appropriates and sustains can also be considered a common-pool resource. Transcending the conditions of belonging or ownership, what is relevant is not to whom an asset belongs to, but how it is managed for the subsistence of a community of individuals who have personal interests that are combined – frequently following negotiations and not without sacrifices - with the point of a shared common good. This book draws an analogy of the Common Good with the biotopes of ecosystems to help us understand their role in sustaining a living community. Subsequently, it addresses topics that are directly related to the logic of the commune as a community that is constantly negotiating for the preservation of the common good.

pp. 20, 21, 22, 23, 25, 35, 52, 66, 74, 75, 76, 84, 162, 167ff., 169, 170, 172, 173, 174, 175, 178, 179, 181, 182, 184, 185, 186, 187, 189, 200, 205, 206, 230, 240, 241, 250, 261, 331ff., 332, 333, 334, 335, 338, 339, 340ff., 343, 344, 345, 346, 347, 349, 350, 351, 352, 353, 360, 361, 365, 374, 376, 381, 383, 385, 412, 426, 445, 486, 491ff., 492, 493, 494, 497, 499, 500, 501, 505, 510, 514, 523.

Centrality of the Person. The centrality of the person in the ecosystemic organizational model implies the development of a socially responsible life project for the common good. It is not the subordination to the demands of others but the freedom that is won through the concurrence of purposes and desires with regard to a common good.

The centrality of persons implies that knowledge is a tool that empowers the individual in community to make his way in life and endows him with moral judgment as a result of dialogical reflection among diverse points of view. The centrality of the person urges the university to create environments where individuals are able to live their freedom, not to do as they please, but be autonomous in the conquest of being. As part of such freedom the values reaffirm the individual as a member of a community, with virtues in terms of respect for others, reciprocity and co-responsibility. The development of intelligence and wisdom endow the person with content and meaning, the progressive understanding of meanings opens his spirit and his life.

The centrality of the person in the ecosystem university implies enabling the person to self-organize not only the environment in which he learns, but his own learning objectives according to the forms and methods of development of his internal capacities. Such active learning is active not because of didactic dynamics but because it facilitates continuously elaborating and recovering connections of knowledge from experience. Thus, the sense (direction and raison d'être) of the Ecosystem University lies in the interaction with the context that develops agency and enhances the combined capacities.

The centrality of the person in the University becomes apparent from two clearly marked dynamics with society: [1] *Dynamics in the production of knowledge.* [2] *Dynamics in the formation of citizens.*

University education is understood around the life project of the student and, why not, of the teacher. This project bears responsibility for society and leads the individual to BE a main actor capable of raising questions and problems as well as providing critical solutions based on ideas and knowledge. Teaching-Research rests on three pillars: (i) the plurality of values, (ii) the search for human development and the common good, and, (iii) the recognition of the centrality of the person, his or her life project and communal reciprocity.

pp. 27, 183, 124, 257ff., 259, 275, 312, 336, 376, 400, 441, 443, 496.

Action Cycles. The metaphor of action cycles is related to the biogeochemical cycles of ecosystems. The sustainability of many of these resources obeys cyclical processes.

Similarly, in the Ecosystem University these cycles and processes cut across the university community (biotic component) and the common pool resource (abiotic component). The action cycles connect and form integrating links related to the facets of life, back and forth relationships in complex cycles that recognize the multidimensional unity of the human being in its diversity and indissolubility.

Consequently, we need to open our thinking from linear to complex approaches to design learning and understanding of knowledge that is based on experiences and relationships rather than in disciplinary elements and components.

pp. 14, 27, 33, 47, 50ff., 51, 52, 53, 56, 59, 60, 63, 64, 65, 66, 67, 68, 72, 73, 74, 76, 77, 85, 114, 117, 121, 134, 139, 148, 149, 150, 191, 192, 193, 199, 201, 204, 2020, 226, 232, 237, 245, 254, 255, 262, 263, 315, 320, 325, 327, 328, 334, 355, 359, 365ff., 366, 367, 369, 371ff., 372, 373, 374, 375, 411, 412, 415, 425, 427, 428, 429, 473, 483, 484, 485, 492, 499, 508, 509, 514, 527.

Communal Complex. The communal complex is not an objective or verifiable value. It does not have a material existence and, therefore, cannot be scientifically proved. Nevertheless, we can feel it when we share communal life. What the communal complex adds to the logic of pure reason is the reason of emotions and ideas to form part of the communal sense, which develops through what we do and what we are.

The complex, the integrated, the holistic, belong to a whole that is more than the sum of its parts. That is why the communal complex cannot be divided since it would be destroyed and lose all its meaning.

The communal complex recovers the intrinsic value of things beyond the utilitarian value; it is, therefore, possible that reciprocity and redistribution emerge in the middle of contractual relations that imply long-time coexistence and allow for otherness, dignifying the work over the commercial and promote the development of every university actor-commoner.

The communal complex gives meaning and direction to the movement of the organization, as every individual imprints direction and substance to their daily work, which outweighs bureaucratic intrusions, political party influences or academic structuralism.

pp. 81ss, 82, 84, 86, 352, 365, 375, 378, 379,

Communality and Communalization. Communality is a complex process that combines three elements: commons, commoners and collective action (knowledge and actions of provision, provision and sustenance). Juncosa (2021). Communalization is the concrete and specific process of the development of communality. Juncosa (2021).

pp. 16, 81, 134, 205, 278, 284, 332, 343, 350, 365, 378, 445, 493, 494.

Knowledge-Communication-Action. Communication-action-knowledge forms a spiral where communication stimulates action and reflected action produces new knowledge. The dynamics of human action implies a continuous reflection process on the action so that the knowledge generated by the community can be mapped out and avoid a gap between theory and practice. Ideas and experience can then be combined in models and formal concepts that are based on reality.

pp. 57, 76, 77, 101, 139, 148, 150, 188, 192, 201, 203, 204, 220, 221, 250, 251, 328, 366, 514, 527.

Relevant, Pertinent, and Transforming Knowledge. The university has often been understood as a "provider of goods and services" or even worse as an "innovative machine that consumes and processes information." Yet, if in principle the university is a product and producer of society, there is no other way than to understand it as a "facilitator of change" that is inspired by the challenges of society. The knowledge that the university produces should not only transform society but allow it to transform itself, innovating and changing along with the transformations of the environment. The university organization that facilitates change emerges from the interaction of internal subsystems and their interaction with the environment, which implies internal coherence and external connections.

Knowledge that is relevant to the environment is not "produced for" or "provided" by the university, but is knowledge that emerges from the complex processes of social interaction. An expert who knows how to do things cannot define alone what should be done.

Therefore, the environment or society in which the university is immersed is not a simple consumer or processor of what the university can contribute. Between the subsystems of the university and society there is a network of relationships, meanings, ways of life created by human action where the solution to shared problems comes from sustainability that is perceived as a quality that emerges from human interaction.

University action must focus on producing relevant, pertinent knowledge that is capable of transforming society, as well as on forming citizens who act on these changes. Otherwise the society in which the university is immersed might be unaware of the value of the university and turn its back on it, which would imply its gradual decline.

It is essential for the ecosystem university to provide for its actors an environment where autonomy, interdependence, reciprocity and social pedagogy, all of which are fundamental for building a society that is based on freedom. Freedom is the *sine qua non* for a self-organization that values ethical knowledge and produces relevant, pertinent and transformative knowledge.

pp. 19, 66, 83, 84, 85, 99, 123, 126, 130, 131, 134, 149, 150, 164, 165, 192ff., 200, 203, 254, 255, 264, 266, 280, 286, 296, 297, 386, 418, 426, 445, 472, 477, 509, 523.

CREAMINKA. Is an ecosystem of intelligent tools that analyzes and diagnoses at a micro and macro level the *movement* of the ecosystem of the university and is supported by various techniques of artificial intelligence, data mining and knowledge modeling that provide services understood as a flow of energy as knowledge that is useful to other actors in the system.

Based on the analysis of the actors within the different groups of the ecosystem, we can *analyze the development of individuals* through the competencies they obtain by interacting with the ecosystem, developing relevant and transforming knowledge.

CREAMINKA monitors the dynamics of the research and other groups with the help of *entropic analysis,* which produces a *resilience footprint* that demonstrates the strength and diversity of the groups.

This books draws an analogy between the CREAMINKA platform and the digesters of ecosystems as it provides other actors with data that give feedback to the dynamics of the university ecosystem.

Development and Growth Integrated by Self-Organization. (*Bottom-up action, network, cooperation, heterarchies, self-organization, use of interdependence, emergency).* According to Ashby, any dynamic system can be seen as self-organizing (W. Ross Ashby, 1947) if there are *attractors* (Lorenz, 1963) that lead to interactions to generate global patterns of behavior (Camazine, 2003). While the process of self-organization implies greater organization, the same systemic process also implies interactions that produce disorder (Edgar Morin, 1984).

Still, self-organization requires feedback, both positive and negative, as well as interaction through direct communication and randomness with respect to the search for solutions and alternatives that facilitate the growth and strengthening of the structure.

Ecosystems build from the bottom up, put together components one at a time, then assemble units from the simple to the complex, combining modular and nodal components (Guild, 2007). The *bottom-up* perspective does not aim to ascend to the *top* but to change the *top*. It is a process of construction that incorporates territory and context in a spiral of constant growth in amplitude and depth of transformations, and is the result of the failures and achievements of the previous action, which implies not only a change of direction but also a change of actors.

Resulting from the respective valorization of interactions, values are built from below and then ascend and descend in the form of agreements and constitutions of the organization, always respecting the emergence of values. In this life cycle of the Ecosystem University, groups choose their own organizational structures and are transformed in time as the number of interactions and synergies increases; when the maturity of the group is high it mutates and transforms, evolves into a group of groups and the rhizome cycle begins, where each of the new groups assumes its own structures to mutate them again.

Energy: Source of Flow and Ecosystem Cycle. (Energy (knowledge), open ecosystem (University). The logic of dissipative systems, as mentioned above, demands that they be open to the context and exchange knowledge-energy and resources-matter. These flows modify both biotic and abiotic conditions, which means that the university community is responsive to changes in both material and environmental conditions and because of the dynamics of the relationships of exchange of interests, knowledge and dialogue between people and groups inside and outside the university. Likewise, it is necessary to emphasize that the community and its processes and exchanges are also responsible for the transformation of common resources (this constitutes a cycle).

The knowledge flows (energy) and cycles of action-resources (matter) exist in an interactive context between the biotic or biocenosis part that we have identified as an Environment that Enhances Capacities and the abiotic or biotope part that in our case is the *common pool resource.*

The action cycles of the Ecosystem University are what would correspond to the biogeochemical cycles of a natural ecosystem. Ecosystems are not only determined by energy flows but also by fundamental resources for the life of the community; the maintenance of many of these resources is the result of cyclical processes that cut across the university community (biotic component) and the common pool resource (abiotic component) in the Ecosystem University.

The analogy between energy-knowledge can be explained through a metaphoric analysis of a dissipative system. Cf. thermodynamic metaphor in this glossary of terms.

Entropy. The analysis of entropy made in this book seeks to understand the highly complex phenomena within a dissipative ecosystem in a relatively simple way and encode them in a global vision of this system. The reasons why the criterion of entropy is highly useful for the analysis of an Ecosystem Model for the University lie in understanding the functioning of matter systems and living systems. The analysis deals with the relationship between entropy and the organizational heterarchies of groups, internal interactions and the production of ecosystem outcomes, as well as the relationship between entropy and the production of knowledge and novelty in an ecosystem.

Evolution and Adaptation *(Homeostasis (culture of innovation and research) Entropy (entropy of the Ecosystem University organization).* The life cycle does not originate in opposition to entropic dissipative processes but right within them (Rísquez, 2002). This is possible thanks to adaptation and evolution (Reap et al., 2005), when the organism (actor or group: while diversity in an ecosystem is important, the synergy between the diverse spheres is even more important) adjusts behaviorally and physically, adaptation occurs; and when genetic changes are triggered and consequently, evolution occurs, producing a leap to a higher state of organization (This evolutionary leap generates transformation in the hierarchy-heterarchy relationship of human groups; evolution is directly related to entropy).

Ecosystems have the capacity to maintain a state of equilibrium-non-equilibrium (Cannon, 1932), and even if certain conditions were to change, the macro properties are maintained. This feature is generally known as *homeostasis* and involves an adaptive reaction to keep the essential *variables* within an admissible range (William Ross Ashby, 1947). Homeostasis is related to the capacity to generate behavior (University culture) and learning from living beings (Di Paolo, 2000) (Actors and groups of the Ecosystem University).

The Ecosystem University perfectly uses everything that can contain energy as a resource and knowledge, but we must bear in mind that who defines whether or not the optimization of a resource is efficient depends on who uses it. From an organizational perspective, it is necessary to create an environment that favors the capacities and development potential of individuals and their groups. From a linear point of view, it would seem that granting autonomy and freedom to individuals and groups could make everything spin out of control (Kelly, 1994); however, mediated by the need to sustain the common ground, it is this very freedom and autonomy that negotiates interests according to superior interests.

Contrary to the efficiency paradigm where every university unit fulfills a specific and unique function to prevent degradation, in the Ecosystem University the necessary condition to produce homeostasis depends on the redundancy (Low et al., 2003) of the life of some individuals, which is based on the diversity and multiplicity of functions, and which can decide on life or death for the ecosystem (McDonough & Braungart, 2010) (Ilya Prigogine & Stengers, 1979). Like some ecosystems in nature, the university must also use resources for more than one function (Benyus, 2002). The prevailing logic is one of optimization rather than maximization.

Knowledge Flows. This book explains the concept of knowledge flow from a thermodynamic perspective. Its importance lies in the need to maintain a permanent flow of knowledge from the university to society and vice versa, making the university a product and producer of society. If this flow ceases, the university metaphorically ceases to exist. Although it could continue to do so, the knowledge produced in it is not relevant, much less a transformer of society.

Hurricane of Knowledge. This text offers a knowledge management model called hurricane of knowledge, because it refers to a dissipative system similar to a hurricane, where its movement absorbs the hot air that, in turn, causes its own movement. The exchange of energy and resources with the environment is similar to the university dynamics, which at the same time creates the society that feeds the university itself.

The process of knowledge creation is at the center of the hurricane, its movement (inspired by Nonaka Takeuchi's SECI model) generates all possible developments, the synergies and exchanges, the necessary communications, the exchanges with the environment, the systematization of knowledge, as well as the continuous creation of community. Around the central spiral there is another type of spiral that represents society, where knowledge is produced through the cycle of action-knowledge-communication. This movement interacts with the movement of the central spiral contributing to it and taking from it knowledge and resources.

Whenever interaction occurs between the central and external spirals, it stimulates the building of knowledge and at the same time of community in an organization that learns and understands not only with the mind but also with the body. In addition, the interactions of the spirals of the model make the knowledge produced in the university relevant, pertinent and transforming of society at the same time that it encourages the production of knowledge within the university.

pp. 114, 132ff., 133, 135, 138, 139, 147, 148, 149, 150, 151, 193, 201, 202, 265, 283, 296, 365, 379, 380, 410, 418, 509.

Locally Focused and Receptive. *(Simple, Gregarious (groups organized by affinities and interests))* In an ecosystem, the interactions between the components and the context favor evolution, depending on the properties of the biosphere. The approach of this book is that an organizational culture prone to innovation and based on free interactions produces organizational evolution in the university. Lovelock (Margulis & Lovelock, 1974) (Gaia hypothesis) suggests that living communities (academic community) not only depend on, but can influence their environment (society). These interactions with respect to locality or context are also internal and maintain the condition of dynamic equilibrium (Benyus, 2002).

The simplicity with which biological and natural processes take place in the ecosystem is also related to the spontaneity of relationships with the environment or context since they are motivated by satisfying specific and therefore desired needs, which makes complex processes apparently so simple that they hardly warrant attention. Hidden behind the growth of a plant or the simple fact of it feeding us, we find a complex maze and a network of simple and reliable systems and subsystems that function interdependently.

pp. 28, 34, 36, 38ff., 42, 44, 53, 54ff., 55, 56, 62, 63, 67, 72, 73, 74, 76, 79, 80, 81, 84, 86, 91ff., 92, 96, 98, 100, 101, 102, 106, 107, 115, 116, 117, 121, 122, 123, 124, 125, 126, 127, 128, 136, 141, 150, 173, 175, 177, 179, 194, 196, 204ff., 205, 206, 207, 208, 209, 210, 212, 214, 215, 219, 220, 221, 222, 223, 224, 225, 228, 231, 232, 234, 235, 236, 237, 238, 239, 240, 241, 242, 244, 245, 246, 248, 250, 251, 252, 253, 254, 255, 266, 269,

Meeting Place and Teaching-Research Fabric. meeting place is a space without dimensions or ubiquity but the convergence of interests and hopes of a group of people or groups that converge and organize themselves as complex systems adapting to diversity and developing capacities in an intentional environment, interacting and recreating dynamic learning spaces.

The sum of interests and search for meanings makes these people converge in a meeting place within the academic community that researches forming motor cells.

The exercise of perceiving a new organic architecture motivates people to discover the new ways in which the university community produces knowledge, generates answers and solutions to problems, and even raises new problems that arise from the teaching-research nucleus. These situations occur from the complexity and correspond to a spatial fabric-organization that enhances what we define in general terms as “meeting places”.

The fabric of the organization must have the following characteristics: [1) The contributive nature of knowledge and experience. [2] the “realistic” nature of the individual task, which is determined by the overall situation of the organization. [3] The continuous adjustment and redefinition of individual tasks through interaction with others. [4] The understanding of “responsibility” as a field not solely limited to rights, obligations and methods (problems are not seen as other people’s responsibility). [5] A commitment to the organization beyond any technical relationship. [6] A network structure of authority and communication. The sanctions that apply to the conduct of individuals in their work function derive from the interests of the community and the survival and growth of the organization, rather than from a contractual relationship, represented by an immediate superior. [7] Knowledge can be located in any part of the network; that part becomes the *ad-hoc* center of controlling authority and communication and is not only in the hands of the organization’s head. [8] Communication is also lateral and not just vertical. In addition, it is more akin to consultation than giving orders. [9] Communication content consisting of information and advice, rather than instructions and decisions. [10] Commitment to the organization and the “*technological ethos*” of progress and growth is more valuable than loyalty and obedience.

Thermodynamic Metaphor. When referring to knowledge, the metaphor is on the one hand fundamental, and on the other, it will be the tool we use to understand the relationship of knowledge with the ecosystem organization. The present analysis aims first of all to understand the metaphor of knowledge as a flow, as suggested by Nissen (Nissen, 2005) and its relationship with the Newtonian linear model. This metaphor is relevant for the approach of the knowledge-energy analogy. Bratianu (Bratianu, 2011) later questions this metaphor by assuming Newtonian linearity and introduces a thermodynamic metaphor for knowledge. Finally, he proposes to extend the thermodynamic metaphor using a thermodynamic state function of a system to understand the function of knowledge within a university ecosystem.

pp. 43, 45, 101, 103, 107, 112, 132, 133, 134, 139ff., 140, 143, 144, 145, 147, 148, 151, 152, 153, 154, 155, 156, 157, 159, 191, 524, 573.

Heterarchy. McCulloch studied the variation of individual preferences and identified this inconsistency in the hierarchy, which he explains as follows: if someone prefers *A* to *B, B* to *C* and *C* to *A,* such *"inconsistency"* 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. While McCulloch did not define the term *"heterarchy,"* he did use it in a paper on psychology (McCulloch, 1945).

Cumming manages to interlace the elements of networks and hierarchies in an organizational/structural continuum. Relating these concepts in a linear way and accepting the network as a flat hierarchy, 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 tune with the context from the perspective of heterarchies (G. S. Cumming, 2016).

pp. 53,61ff., 62, 114, 115, 127, 130, 151, 161, 209, 210, 221, 225, 235,238, 240, 242, 243, 244, 246, 247, 248, 385, 503, 504.

Non-Linearity. (Keywords: Constant flow, Creative boundaries, Cross-pollination, Feedback cycles). In a dissipative, open and complex system such as the Ecosystem University, paths depend on multiple emergencies and fortuitous events, and change depending on the states of each moment. Therefore, any future is unpredictable and uncertainty the only certainty. The rules change as the system evolves and develops in a diachronic/synchronous way, like someone going through a cycle again. This characteristic breaks with the linearity of the known to approach the understanding of the complexity of action that comes from self-organization.

pp. 43, 45, 56ff., 57, 58, 59, 77, 96, 112, 122, 143, 236, 255, 323, 375.

Optimization Rather Than Maximization. (*Recycling, efficiency-equity-resilience, order-disorder, multifunction, adaptation to functionality.)* Due to the complexity of Ecosystems and their constant dynamics, we must rethink the concept of efficiency, since these tend towards interdependence and self-organization that are based on redundancy and diversity. Sustainability of ecosystems depends directly on whether they are capable of combining *flexibility, efficiency, diversity, adaptability and redundancy*. (Sharifi & Yamagata, 2016)

The *flexibility, adaptability* of its organization and *redundancy* depend on the ecosystem´s capability to substitute functions among its members, i.e. to transform to minimize external impacts. This has a double relationship with efficiency; on the one hand, if there is a high capacity to minimize impacts through *redundancy,* the organization is sustainable and efficient; on the other hand, however, overlapping functions and possible replacements can also negatively affect efficiency by depleting resources. The challenge is to maintain a balance through building resilience, a quality considered the greatest asset for any organization in today's constantly changing world.

Ecosystems optimize the use of energy and resources from the perspective of the system rather than from that of its individual components (Kelly, 1994). For an ecosystem, non-linear optimization logics seem to be much more commendable than linear maximization logics. The apparent inefficiencies of individuals lead to redundancy and basic diversity to produce resilience needed in the face of crises and/or need for evolution. Therefore, this principle questions a rationality that is concerned with efficiency and achieving objectives at the lowest cost, since instead of enriching the organization of the Ecosystem University, it flattens and narrows its vital possibilities.

Oratory. This term of Italian origin is closely related to the educational-pastoral experience of Don Bosco, who wrote "Memoirs of the Oratory of St. Francis de Sales" (St. John Bosco in Peraza, 2001). This work offers a glimpse of what the Salesian oratory is for Don Bosco. He refers to a charismatic environment that encompasses all his actions as a priest, teacher and friend of young people. In the present book, the environment that enhances capacities is permeated by the charisma of the oratory.

For Bosco every educational center, project, school or Salesian house should be all of the following: [1] *a welcoming home* where children and young people feel at ease, where everyone considers others as friends and takes care of the goods as their own, [2] *a parish that evangelizes*, that offers a way of seeing life from a dimension of transcendence, [3] *a school that leads to life,* where the capacities that each one possesses are enhanced, and [4] a place of coexistence, where one can meet friends and have a good time.

"The Oratory is a global project of human and Christian growth, with its itineraries for the different ages and situations of young people" (Peraza, 2011). Thus, in the Salesian world, oratory can be *any cultural environment where the educational process takes place; it is the system of encounter and academic and pedagogical reciprocity*. Rather than structures and institutions, it is a way of being, of relating, of responding to life; it is about every person's profound attitudes person, fundamental options of life projects.

Today, the implicit dimension of the oratory have moved from an identity for the addressees to an identity for a model of doing things in the educational process. According to Peraza, "o*ratory is the optic that puts into play all the criteria, the style, the resources and the formative contents*". All post-conciliar Salesian works are identified with the oratorian environment, be they youth centers or formal educational centers.

From the Salesian university context, this book redefines the oratory of Valdocco (a district of Turin where Don Bosco founded his first oratory) in the following way: [1] Developing people's capabilities. [2] Exercising citizenship, participation in democracy and social cohesion. [3] Managing common goods under a logic of appropriation-provision. [4] Generating relevant knowledge that is pertinent to the context and transformative. [5] Forming new generations of young people in a multicultural context. [6] Teacher and student together in the process of understanding and explaining science, in an environment where students learn science by undertaking scientific ventures. [7] The capabilities of individuals to create and generate new knowledge. [8] The cooperative learning ecosystem.

This oratory is above all a place where we experience and learn the experience of values through coexistence with fellow students. In the Salesian environment, associativism is understood as a way of being, relating, and responding to life. In the Oratory of Valdocco, Don Bosco referred to them as companies, in the UPS, they are known as Salesian University Associations (ASU); they are stable groups of young people who are motivated by personal interests that become shared ones and involve academic and pedagogical reciprocity.

pp. 22, 68, 125, 176, 182ff., 186, 189, 190, 191, 200, 285, 295, 322, 328, 330, 331, 365, 376, 380, 384, 411, 413, 426, 451ff., 452, 453, 454, 455, 456, 457, 465ff., 470, 471, 472, 473, 476, 523.

Not Orderly but Organized Order. From a complexity perspective we need to organize what is in disarray. Yet, as living beings - and not machines - we can only organize things through multiple systemic interactions that in turn produce new disorder; by doing so, we will have achieved the new order. Order and disorder are not only antagonistic but also complementary, which is why the resulting order may not be orderly but organized. System and organization are intrinsically linked connected.

pp. 18, 23, 33, 34, 42, 43, 48, 54, 55, 65, 67, 89, 111ff., 114, 122, 124, 125, 134, 135ff., 179, 205, 215, 241, 245, 323, 353ff., 355, 373, 374, 375, 383, 494, 514.

Living Organization Addressing the Theory of Organization from a living perspective requires a wider concept: "A global unit based on interrelated elements whose interpretation constitutes an organization... it is a combination of different, interdependent elements... it is not identified with the phenomenal object but is projected on it" (Edgar Morin, 1974).

The perspective of a *living organization* as presented in this book - opposed to that of a *machine* organization - shows the following characteristics: [1] It potentiates the growth of people as the center of the organization, [2] it puts the production of knowledge, whether general or organizational, before the production of goods and services, [3] it combines knowledge (the real) and truth (scientific); [4] 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 top-down by consensus; [6] it exchanges knowledge and reduces the gap between the organization society, thus lending the organization's knowledge relevancy and a transforming potential.

More than the concept of administration, it is a social organization of work that links the concept of organization with the concept of work. Thus, it attaches greater value to a living organization composed of creativity, fraternal bonds, tacit rules of mutual aid and above all strategies for access to socio-productive resources, and, what is more, combines individual interest with the common good.

Therefore, the need to resort to nature in order to understand this living organization. The biomimetics (Benyus, 2002) of ecosystems combines not only the elements that make up the university from the perspective of complexity, but also allows us to understand the non-linear cyclical relationships, the sometimes even contradictory interdependencies, the synergies that constitute the foundation of university autonomy when combined with its self-organizing capacity; in short, the indivisible relationship between organization and system (Edgar Morin, 1984).

pp. 13, 17ff., 19, 20, 21, 23, 35, 83, 129, 192ff., 212ff., 278, 300, 348, 375.

Cross-Pollination: A popular folk tale provides the following parable as an explanation for cross-pollination: *"There was a farmer who had the best crop of corn that would win him the first prize in the village fair year after year. And yet, each time he would bring one quintal of the most select of his crop to share with all other participants; someone eventually asked: "How can you pass on your best seeds to your competitors? Don't you fear that they might outperform you?" Replied the farmer: "Don't you understand that the bees that pollinate their plants will also pollinate mine?"*

pp. 56ff., 58, 59, 126, 132, 348, 415, 416, 417.

Life Project. In the Salesian world, the life project means building a life path and developing oneself as a self-knowing subject. Hence, it goes beyond a plan that includes an order of priorities, values and expectations. It is a liberating experience because it imagines, designs, recreates, gives shape, color, expression, to a vital and formative itinerary. The vitality of this itinerary in the Salesian world is marked by: [1] a reason that thinks and feels, compares, evaluates and deduces, that expresses itself vitally and emotionally as the result of the experience of life, [2] a love that educates, that accompanies, that animates from the heart the formative path of liberation and human growth, and [3] the search for the transcendent as a vital process and not only as doctrinal contents. Peraza (2012).

pp. 19, 21, 23, 24, 27, 28, 35, 36, 167, 189, 218, 260, 261, 317, 318, 331, 336, 348, 352, 376, 380, 381, 385, 392, 401, 406, 413, 442, 447, 452, 453, 454, 455, 456, 458, 467, 472, 473, 482, 513, 514, 527.

Resilience. This book proposes a concept of resilience in connection with the university as: *"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."*

pp. 20, 59, 60, 88, 94, 98, 99, 115, 117ff., 118, 119, 121, 122, 123, 124, 125, 126ff., 127, 128, 129, 130ff., 131, 190, 199, 203, 204, 223, 226, 231, 233, 236, 240, 245, 246, 249, 281, 282, 283, 313, 425, 427, 428, 430, 437, 438, 454, 456, 458, 505, 506, 508, 509.

Rhizome. The rhizome is not an object of reproduction. It is an antigenealogy, the result of expansion, collection, connection, and can link any point with any other point. A rhizome cannot be reduced to the one or the multiple, because it is indivisible and is not a multiple of the one, it is not the result of units but of dimensions that involve changing directions.

The lines between points are not to be confused with simple unions, lineaments or filiations. These lines are lines of synergies, dimensions of deterritorialization, along which a metamorphosis takes places and changes its nature. A rhizome is defined simply by the evolution of states, it is a system without center, without hierarch. It must be produced, constructed, deconstructed, and be alterable, modifiable, and have multiple inputs and outputs.

SECI. The SECI process (Ikujiro Nonaka & Takeuchi, 1995), explains the conversion of tacit knowledge into explicit knowledge and vice versa. This process is also referred to as knowledge conversion spiral and distinguishes four different modes: socialization - from tacit to tacit; externalization - from tacit to explicit; combination - from explicit to explicit; and internalization - from explicit to tacit.

Dissipative System,Open System. From a thermodynamical vantage point, the total energy in a dissipative system is represented by interactions with the environment as mechanical work and heat transfer, which means that transformations occur from mechanical energy to heat and vice versa. The university is a dissipative system in itself because it is a product and producer of society, which implies a series of exchanges of knowledge, resources, with the environment. The university organization is, therefore, dynamic and transitions to new levels of order and organization.

From the ecosystemic perspective, a dissipative system, combined with the increase of entropy, opens the door to evolution to a higher state. A dissipative and complex system becomes practically uncontrollable, and the alternative is to modify the environment as much as possible in order to influence the self-organizing dynamics to keep the ecosystem alive. Thus, the dissipative ecosystem of the university constantly discovers a new order, and all the patterns of complex organization develop in this continuous spiral.

Preventive System. The Preventive System of Don Bosco is not a script or a pedagocical treatise, but a successful practice that can become a model and inspiration for those who can resort to the memory of an experience attuned to the differing circumstances of young people (Viganò in Cian, 1978). The main pillars of the preventive system are: [1] a *reason* that thinks and feels, compares, evaluates and deduces, that expresses itself vitally and emotionally as the result of the experience of life, [2] a love that educates, that accompanies, that animates from the heart the formative path of liberation and human growth, and [3] the search for the transcendent as a vital process and not only as doctrinal contents. (Peraza, 2012).

There can be no doubt that Don Bosco's most important legacy is that the educational experience of the relationship that creates fraternity, affiliation that inspires and generates family should be superimposed on any structure. The Salesian Preventive System does not punish but seeks to liberate the person by helping him to find out what God has given him, and enable him to discover and live his vocation in an environment that develops life skills and allows him to develop values in community.

This leads to building the Salesian patio of accompaniment for education with a Preventive System based on responsibility that aims to promote personal, professional, socioeconomic, local and regional development, carried out in a shared-leadership framework.

In addition to the very skills and competencies, it is necessary to promote the values of the individual in his or her daily life. In this respect, the university cannot merely be a place where people acquire knowledge, but must be a place that values experience, and focuses on the person to determine and develop his or her decisions.

Therefore, the Ecosystem University provides different environments that give new meaning to Don Bosco's oratory and allow students and other members of the university community to enhance their capabilities and develop their life projects. Education that focuses on the person based on the preventive system, allows the formation of honest citizens and good Christians who are free to reflect, act and be the architects of their own future.

A Liberating Option. The organization of the ecosystem university is communal and not based on defined deadlines and places, schedules and inflexible work duties. On the contrary, it relies on the exercise of freedom and multiple possible creations to obtain results through shared responsibilities. Instead of treating others as manipulable, the university identifies them as actors capable of building autonomy and freedom to exercise their own socially responsible life projects. The greater the freedom of thought and action, the greater the risks that people take, the more mature they will become and get into a virtuous cycle for the formation of the human being.

From an efficient and linear point of view, it would seem that granting autonomy and freedom to individuals and groups could lead to a total loss of control (Kelly, 1994). Yet, this very freedom and autonomy that, mediated by the need to sustain the common good, negotiates the interests in accordance with a superior one.

While entropic analysis does not seek to exactly calculate the complex problems of the organization-system, it aims 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 untrodden paths, and to allow the individual to twist the rules, manage and create particular spaces of freedom (Vignaux, 2013).

From the point of view of action, Morín (Edgar Morin, 1999b) defines the paradigm of complexity as a model of life that finds responsibility in freedom and community as the projection towards globality.

As a social organization, the University must seek to extend people´s freedom of self-promotion and self-realization since these constitute the basis for self-organization. Capacities are substantial liberties, a set of opportunities to choose from and use (Martha Craven Nussbaum, 2010), which any person can initiate through multiple combinations of actions that s/he is capable of performing (Amartya Sen et al., 1991).

If the University, the center of reason, must focus on the human being, it cannot ignore its transcendent dimension but must foster environments that facilitate to seek meaning beyond reason. Reason must not be negated, but the university must integrate it with the experience of transcendence to free the individual from everything that precludes the discovery of his true being.

pp. 14, 19, 20, 27, 29, 38, 54, 75, 80, 82, 125, 128, 129, 132, 152, 162, 163, 164, 165, 166, 167, 171, 184, 185, 191, 219, 234, 259, 261, 268, 271, 272, 273, 277, 294, 305ff., 310, 311ff., 315, 316, 317ff., 318, 321, 322, 325, 328, 329, 331, 334, 335, 338, 348, 351, 359, 378, 380, 426, 441, 452, 454, 456, 457, 466, 470, 474, 505, 522, 529.

University, a Product and Producer of Society. The society in which the university is embedded, recognized as an external medium as the real base of the ecosystem, directly relates to the basic science of university knowledge production. In other words, the university is a product and producer of society and no knowledge can be generated that does not depend on and is relevant for the society in which it is immersed. At the same time, this knowledge is not valid without permanent dialogue with society and without the capacity to transform society. The Ecosystem University as an actor is, therefore, defined as social, to the extent that it is a product of society and its action has an effect on society. Thus, the university is able to transform society from within and also be transformed by it. The Ecosystem University has the opportunity to be a product and producer of society, through the formation of citizens with transforming capacity and the production of pertinent and relevant knowledge for society.

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 university must deepen everything the intellectual logic reaches to understand the collective memory and conscience, its own systems of communication or the power of transmission of what is intuited and perceived, which animates the human group to which the university belongs. Only in this way can it truly be a product and producer of society.

pp. 42, 43, 85, 124, 132ff., 133ff., 134, 135ff., 176, 188, 265, 297, 367, 499, 508, 528.

An Ecosystem Called University

Juan Pablo
Salgado-Guerrero

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Reading the book, you will discover how an organizational model inspired by ecosystems has been implemented. It is the result of permanent reflection and a steady flow of practical feedback as the project expanded on the author's doctoral thesis: "Innovazione organizzativa per la valorizzazione della ricerca scientifica." It won the title of best doctoral thesis of 2017 at the University of Ferrara, Italy, for addressing relevant issues attributed to the socio-economic role of the university in building a knowledge society focused on the individual. It was based on a case study how this model was implemented at the Universidad Politécnica Salesiana, where the author has been the head of research since 2015.

The Department of Economics and the Department of Higher Education at the University of Ferrara recognized the publication of my research results as being a potential source of knowledge for the academic community as well as for those involved in policy-making and managing higher-educational institutions. There will always be scope to refine the model as it continues to grow. I invite you to join in and add your contributions to create more value cycles.

Vice-President for Research
University and Common Good Research Group
Learning to Learn Research Group
GameLab Research Group

This book is dedicated to the university as a protagonist of change. Its purpose is to see the university as a place where the lines between organization and system are fluid, where the whole is more than the sum of its parts, and the product is knowledge as an end, a means and a way of developing the individual (critical sense) and its interaction with the environment (instrumental reason).

The book seeks throughout to foster the image of the Ecosystem University as being a producer of novelty, where the only certainty is uncertainty. The university undergoes a process of permanent spiral growth – the spiral of knowledge without any control of causality – and creating, through its environment, responsible citizens, and free-thinking persons.

The Ecosystem University is undeTTast that is assumed in the present.

Our work to rediscover the natural feel of an ecosystem embedded in the university and the rich experience of community will take us by the hand and lead us, proud professors, to the purest origin of human knowledge with a flair of joie de vivre: the refreshing purity of the new and the authentic value of ingenuity that will allow us to be ourselves in that very moment: a community that self-organizes, builds projects of life and culture, and determines its own destiny.

ABYA YALA | UNIVERSIDAD POLITÉCNICA SALESIANA

ECUADOR
SALESIANOS DON BOSCO

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