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The Theory of the Organization and the New Paradigms

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ABSTRACT

This paper proposes to tackle a subject that many authors have warned should not be taken lightly: "the new paradigms of Science" and the theory of management. The paper begins with a brief explanation about the changing environment which began during the 1970s. This section contains background and relevant criticism made by several authors, and sets out the argument for the need to change to a new paradigm. This is followed by an exploration of new concepts and ideas that have emerged in New Science that have direct relevance to developing new organizational models. Finally, a way to envision and conceptualize the organization as a living entity and to undertake the construction of a new paradigm is suggested.

Keywords: New Paradigms; Chaos and Organization; Complex Systems; Self-Organization and Self-Reference

1. Introduction

For more than fifteen years this author has maintained the need to reinvent the Theory of the Organization and Management in numerous publications. At various academic seminars and congresses he has alluded to the harsh criticism that Drucker has made toward the current state of affairs in management theory and practices, even towards some of the very ones he himself had previously advocated and popularized. This is especially evident in Management Challenges for the 21st Century, written in 1999. With remarkable skill and clarity Drucker asserts that the book "deals exclusively with the 'hot' issues of today: issues that are central and crucial, that could even mean life or death, that will surely be the decisive challenges of tomorrow" [1].

What are these "hot" issues he is referring to? It is possible to suggest a few, by way of example:

- What type of structure should be used in a hyper-changing, globalised environment—the classic departmentalized, hierarchical structure?
- In a world where knowledge is the key to the competitive advantage and success, how can organizational knowledge be generated in a hierarchical structure?

How can planning be carried out in a highly complex environment, that is, a texturised environment characterized by high technology and connectivity, with highly dynamic but discontinuous change and feedback, and where linear methods no longer have long-term application [2-4]?

- In a world dominated by knowledge workers, a world ever more automated and technified [1] can control and regulation continue to be conceptualized as supervision and oversight?
- In a knowledge society, where people demand empowerment and creative leaders in charge of efficacious team work, is it still possible to conceive of McGregor's Theory X concept ever being accepted by management?

One could make an endless list of "hot issues" and "burning problems", but it is the intention of this introduction to show that these "hot issues" are not merely vague ideas or commonplace sayings, but rather concrete, identifiable problems that need to be addressed.

This work owes a considerable debt to Reinhard Friedmann [4] not only because the author tends to hold similar views on the issues and share an affinity for the same authors, but also because Friedmann's book served as a conduit of familiarization with many notable European authors whose work had been unknown to the author due to the fact that they were published in German.

The reminder of this paper is organized as follows: Section II, Changes and New Paradigms; Section III, "New Science" and Organizations; Section IV, Effects of Current Scientifics Concepts of the Generation of Models and New Concepts of an Enterprise and in the Area of Human Organizations; Section V, Self-Organization, So-

ciopoiesis and Enterprise and finally; VI, Conclusions.

2. Change and New Paradigms

2.1. Change

Perhaps the most frequently used word in Management texts in the past fifteen years has been change. Today no one denies the need for human organizations, such as businesses, to be capable of coping with change quickly, effectively, and creatively. In his book, Adaptive Enterprise, S. Haeckel writes, "In the Information Age, assimilating change is not everything, it is the only thing". "When facing unpredictable change, the only strategy that makes sense is to be endlessly adaptive" [5]. The legendary CEO of General Electric, Jack Welch, warns us: "Manage change or it will manage you".[1]

The need for permanent change of a business when faced with permanent change in the business environment is, unlike so many catchphrases in the field of business management, not a phrase that will be in vogue for a short while and then disappear.

On the contrary, it is a dramatic situation that all human organizations must deal with if they are to survive. It is and will continue to be a permanent characteristic of our time. For Adrian J. Slywotzky[2]: "Change, in the midst of unceasing discontinuity, demands a new business model. The big corporations that dominated in the 21st century will only be successful if they adopt new concepts, never if they use the old concepts". "Today everyone has accepted that change is inevitable" [1].

However, the type of change that is being talked about here goes beyond change that allows for permanent adaptation of the system to its environment, it deals with a change of paradigm. The task here is to explain, as far as it is possible, when and where the need for this change is produced and what it consists of. This will be done as concisely as possible, in order to visualize clearly and vividly exactly what must be reconsidered and/or reconceived.

2.2. What Is a Paradigm?

Drucker describes it as "the prevailing general theory" composed of a set of assumptions with respect to "reality" [6]. It determines both what must be considered and what has to be omitted or ignored with regard to that "reality". The most worrying aspect of a paradigm is that it is generally assimilated "subconsciously" by academics, writers, professors, and professionals, and even by people at large. Although it permeates every section of society, it rarely comes under scrutiny. Drucker says that "in spite of their importance, these underlying assumptions are seldom analyzed, studied, called into question, or even stated explicitly" [1]. Hence, the paradigm, in spite of being based on generally accepted and unexamined assumptions, defines what one must think and believe in any discipline at any given time in the history of humanity.

What assumptions underlie traditional Theory of the Organization and traditional Management Theory?

After reflecting on what authors such as de Geus, Drucker, Haeckel, Senge, and Wheatley have had to say about management thinking through the first half of the 20th century, the following assumptions, to mention a few, may be drawn:

- There is only one suitable organization;
- Technology and its final uses are fixed or given;
- The effect of the environment on the organization is negligible in the long-term;
- The dynamics of organizations and their environment are linear;
- It is not necessary to worry about the domain of existence and operations of organizations; everything happens in the physical domain;
- Business decisions are by definition rational.

A list of the assumptions and beliefs that held sway during the first half of the 20th century could continue indefinitely, but perhaps it will be faster and more revealing to reflect for a moment on the conditions that were in force at that time—to examine what the infrastructure, the economy, technology, communications, and customs were like at that time in history—and then compare them with conditions today. Is it really sensible to think that the concepts, methods, and instruments that they generated in order to deal with the problems of their time can be relevant to today's organizational environment? Given all the dramatic change that has occurred, the answer is NO. And the first assumption that must be changed is the very concept of an enterprise itself.

2.3. When and Why Did the Environment Change So Drastically and Suddenly?

Although this subject has been addressed in previous publications [6], a brief summary is in order to establish a suitable backdrop to this crucially important point.

In contrast to what is generally supposed, the basic changes that occurred in the decade of the 1970s do not date back to the previous decades, the 1950s and 1960s, but rather go back to the beginning of the 20th century. They were born of the deep crisis in physics and biology that took place in the first thirty years of the century.

The vision of the world that emerged from those new concepts and methodologies was completely different from what had come before, not only in academic and scientific circles, but also in the way ordinary people thought of the universe. Within a few years the old paradigms had crumbled—paradigms that had laid out the

[1]Quoted in R. Friedmann 2004.
[2]Quoted in S. Haeckel 2000, prologue.

concepts and beliefs that had formed the basis of reality for over three hundred years.

The central ideas of the old paradigm from the 17th century that prevailed until the crisis in physics in the 1920s, were based on Newtonian—Cartesian Reductionism.

The new paradigm (20th century) effectively turned the old world view on its head [7]:

- Holism (Global perception of the interconnectedness of phenomena);
- Moving from the totality to the parts;
- Multicausality (an effect can have more than one cause);
- Circular Causality (an effect can modify its cause: Feedback);
- Epistemic Science (The observer is included in the explanation);
- Acceptance of uncertainty and approximate description;
- The emphasis is moved from the structure to the processes;
- The shift to viewing the construction of a network as a metaphor for knowledge.

One of the most important conclusions to be derived from the newly emerging reality—and that is still in effect today—is that reality does not imply separateness, which is the opposite of what was previously believed, the opposite of what science said prior to the 20th century. Today we have reversed this thinking. Contemporary science, what M. Wheatley calls New Science [8], holds that there is a single reality formed of interconnected particles. Whatever affects one particle, affects all the others (their behavior or their state).

Two other concepts currently accepted by the scientific community are the idea of indeterminacy or uncertainty (in social sciences and economics) and that of nonlinearity, or nonlinear systems.

Between 1930 and 1945 a new biological vision of life and the world spread and took hold coincidentally with the vision of the new physics, which L. Von Bertalanffy called the General Systems Theory [9]. All of this led to a new way of thinking that T. Kuhn called "the new paradigm".

3. "New Science" and Organizations

3.1. What Do Margaret Wheatley and Other Authors Mean by the Term "New Science"?

The term New Science refers to what in more technical language is called the study of complex nonlinear systems, studies that include areas such as chaos theory, dissipative structures, fractal geometry, complex systems, phase transition, strange attractors, self-organization, self-reference, among others. These fields have emerged in various sciences, such as biology, biomedicine, physical chemistry, contemporary mathematics, informatics, artificial intelligence, and cybernetics, among others.[3]

For R. Friedmann, "New Science is becoming an important framework of reference for twenty-first century management", an opinion fully shared by this author. "This emerging paradigm provides us with excellent mental hooks which allow us to rise above the now exhausted and spent business management practices of the past and reach a new management model for the future" [4].

The remainder of this section will attempt to show and explain, as succinctly as possible, some of the areas mentioned above as being included in New Science. Authors who are intimately involved in this field of research, such as F. Capra, M. Wheatley, V. Kauffman, among others, serve to illustrate these changes. Reinhard Friedmann's book [4], which contains a vast bibliography with clear, insightful summaries of each author and the application of their ideas to business, is an excellent guide to the latest thinking in the various areas and about the various ideas.

Chaos Theory. To briefly explain this complex subject it is helpful to begin by clearing up the most common misconception of its focus: the area of study of this theory is not disorder; to the contrary, in the words of César Monroy, "chaos is the same essence of order. Even though it does establish that small changes can cause enormous fluctuations and that it is impossible to predict the future state of a system with accuracy, one of the most important concepts of this science is that these matters are still trivial when it comes to modeling the overall behavior of the system" [10]. In other words, although it is chaotic, there is a clearly defined structure.

Chaos Theory has a profound impact on many scientific disciplines. It first began to generate interest and become the object of scientific research in the 1970s. In 1972 E. N. Lorenz gave his paper describing the conditions commonly known as the "butterfly effect". As a meteorologist, he had realized that it is virtually impossible to forecast the weather with a great degree of accuracy because meteorologists are dealing with complex and dynamic systems with nonperiodic behavior, and, as he himself states, "any physical system with nonperiodic behavior is unpredictable".[4]

The most celebrated author of Dissipative Structures is the physicist and academic, Ilya Prigogine, in Belgium. His theory about uncertainty suggests the existence of an "order" whose fundamental aspect is that there is no

[3]Zaugg, R.: Organisation-quo Vadis? quoted by Reinhard Friedmann in "Gestión y Organización de Empresas", RIL Editors, p. 80. See also F. Capra.: "La Trama de la Vida". op. cit.

[4]Quoted in Friedmann, who took it from a quote of J. Gleick, 1987.

equilibrium nor a tendency towards equilibrium, but rather a tendency towards disequilibrium and instability.[5] Thus, most physical, chemical, social, and organizational structures are open systems called Dissipative Structures. This term refers to the contradictory nature of many systems, and alludes to the paradox that disorder can be the source of a new order [10].

The term dissipation refers to a process in which energy gradually disappears from a system without causing its death or destruction. Then, after leaving the system, this energy reorganizes and assumes a new shape and adapts itself to its new environment [11].

The discovery of systemic, chaotic, and unpredictable behavior on which modern Chaos research is based, gave birth to a new concept: nonlinear dynamic systems [10]. Two of the most relevant concepts in this area are deterministic chaos and the phenomenon of fractals.

The three rules that describe chaotic systems are:

- Even though a chaotic system begins in perfect order, it ends in complete disorganization.
- Chaotic systems have extreme sensibility to initial conditions. This means that infinitesimal variation in the initial situation leads to large scale variation in the system.
- The evolution of a chaotic system can be predicted with a high degree of probability in the short term, but beyond that, its behavior becomes erratic.

This is an opportune moment to suggest that such behavior also has implications in the business world; for example, that there are considerable limitations to business planning due to the limitations of prediction in this type of system, a point to be taken up in greater detail later. This occurs because disturbances within the system are amplified by positive feedback, a phenomenon that can be observed in financial markets; for example, in 1997 the economies of western countries, which had been stable the last two weeks of October, were suddenly jolted by the ripple effect emanating from a disturbance in the Hong Kong stock market, which spread and amplified throughout the financial capitals of the globalised market.

Phase Space and Strange Attractors. Researchers have discovered patterns of order within structures that appeared to be disordered by examining graphic diagrams on computers. "The chaotic movements of a nonlinear system self-transform into a pattern called 'strange attractor'." This can be seen within a three-dimensional phase space,[6] a geometric construction that permits the visualization of measurements in time.[7] Each point on a graphic projection is the equivalent of a possible state of the system, and its evolution over time is reflected in the trajectory left in a three-dimensional space. The "strange attractor" is a gravitational point that is a territory in the phase space that attracts all nearby events, like a magnet within a system that draws a significant amount of energy towards itself [12]. The most well-known is the Lorenz Attractor. The concept of attractor plays an important role in explaining the "primary process", or operational feedback cycle, in the new description of a business [13].

Fractals. In the second half of the 20th century, Benoit Mandelbrot, while pondering the question about the length of the coast of Great Britain, realized that most of the lines and shapes in the universe are not straight lines or curves, but rather crooked, irregular shapes. The real world of dynamic systems could not be satisfactorily described by Euclidean geometry. He coined the term fractal, whose etymological root is the Latin word "fractus", which means fractured, fragment, fraction, broken, or irregularity, and went on to become the "father of fractal geometry" [14].

In the process Mandelbrot discovered that there was order, up to that time unknown, in such dissimilar phenomena such as the distribution of incomes of nations, the fluctuation of stock prices, errors in telephone line transmissions, and even in the structure of the cosmos.

Fritjof Capra says that, "the most surprising property of these 'fractal' shapes is that their characteristic pattern displays recurrent descending scales in such a way that its parts, regardless of scale, are similar in their set shape" [7].

Mandelbrot allowed us to understand that complexity makes itself visible in its simplicity and vice versa; a fact called "the paradox of complexity".

Iteration (iterated function systems or self-similarity) is the key to fractal geometry: that is, through the repetition of certain geometric operations it is possible to generate very complex figures starting from a basic pattern that is generally quite simple. One of the characteristics of fractal structures is their self-similarity across scales (invariance to scale) [4]. This property of fractals lends itself to the description of the formation of the structure of an enterprise and the simplified way it adapts to its environment, which allows it to sustain itself.

"The capacity of adaptation and innovation of fractal structures is due to the enormous multiplicity of possible

[5]Spire, A.: The Thought of Ilya Prigogine, Ed. Andrés Bello, 2000; quoted by R. Friedmann, op.cit. Prigogine, I: Order out of Chaos: Man's new dialogue with nature. Ed. Tusquets. Barcelona 1988.

[6]An attractor is a point located with the space of a dimension that generates an attractional force towards itself, beginning from an infinite field whose degree of attraction depends on a determined function of distance.

[7]J. Gleick, quoted in R. Friedmann, explains that in this geometric diagram "the complete knowledge of a dynamic system in a unique temporary place transforms itself into a point. This point is the dynamic system at that precise instant. But at the next instant the system will have changed every so slightly. Therefore, the point ***moves***. The history of the temporary system can be registered as a moving point that describes its orbit through phase spaces over time."

combinations based on a few simple, basic patterns (e.g., DNA) and the recombination/combination of very small variations in these basic patterns that, through the process of permanent feedback, allow them to become engines for modifications" [4]. "In short, chaos is the basic mechanism of nature that underlies all structural and functional phenomena within the sphere of life and inanimate physical processes. Deterministic chaos is the order of nature per se."

3.2. Complexity and Self-Organization

The new paradigm suggested by New Science is also known as the Study of Complex Systems. This refers to a wide range of multi-disciplinary research on the common properties of complex systems and living things; e.g., beehives, stock market operators, ant colonies, corporations, ecological systems, and economies. Complexity assumes irreversibility, such as transcience, nonlinearity, randomness, fluctuation, bifurcation, probability, and from this information it yields a richness of possibilities that promotes the growth of science.[8]

One of the main characteristics of complex systems is self-organization, which permits systems to transform themselves, creating highly organized structures that can, in turn, transform their environments. This enables them, unlike machines, to adapt, or at least the possibility of adapting, to changes that occur in their environment [15].

Richard Pascale defines self-organization as "the tendency of certain systems to operate far from equilibrium, to change to a new state when its constituent elements generate unusual combinations that result in the emergence of a new state or condition" [16]. From a physical-mathematical point of view, self-organization applies to all processes that, in an autonomous and random manner, use a function to minimize its entropy". In the course of his research, the author of this paper has defined self-organization as a property that some dynamic and complex systems possess in order to generate and corporatize or materialize a set of relations that specify their conditions of construction through an autopoietic dynamic.

Self-organization and self-definition are essential characteristics of living beings. Living systems cannot be channeled down a predetermined route or a linear path. The challenge is how to disturb them in such a way as to approximate the desired result.[9] A living system is a complex, adaptive system, and the outstanding feature of its ability to adapt lies in the fact that it is capable of moving in a state of co-drift with its environment through its ability to learn.

When confronted with a threat or pulled by competitive pressures, living things move toward chaos. This disequilibrium forces the system to move far from its usual behavioral patterns, producing high levels of mutation and activity that in turn increase the likelihood of reaching new organizational structures that will allow it to survive.[10]

4. Effects of Current Scientific Concept Son the Generation of Models and New Concepts of an Enterprise and in the Area of Human Organization

More recent contributions run from Peter Senge's concept that emphasizes the company as a learning organization [17] to the more current suggestion by R. T. Pascale, among others, who have developed a fascinating management model based on the following four guiding principles, which are applicable to the enterprise as a living system:

- Equilibrium is a precursor to death. When a living system finds itself in a state of equilibrium, it becomes less sensitive to the changes that are occurring around it.
- When faced with a threat, or when reacting to a pressing situation, living things move toward the edge of chaos. This condition provokes higher mutation rates and a surge in experimentation, resulting in greater probabilities of finding completely new solutions.
- As this takes place and energy is created, the components of living systems self-organize, and new forms, permutations, and arrangements emerge.
- Living systems cannot be directed down a linear path. Unforeseen consequences are inevitable. The challenge lies in finding the proper level of tension and disturbance in the system that will allow it to recognize patterns, adapt, and reinvent itself continually.

"These principles increase the possibilities of revitalization and progress of an organization, as demonstrated by, among others, British Petroleum, Tupperware, Visa, Hewlett-Packard, Royal Dutch/Shell, Sears and the US Army, all of which have experienced positive impact from its application" [4].

Other companies have deliberately provoked disequilibrium within the organization; for example, L'Oreal, which employs so-called "Confrontation Rooms" as places where personnel can freely and openly discuss issues that are relevant to the organization. Similarly, Jack Welch, known for his ability to effectively manage forces opposed to change, who launched the "Change Acceleration Process" in 1992, designating 100 senior executives as "Agents of Change" at General Electric. Referring to this, he said, "When change is taking place

[8]Riera, E. quoted in Andrade R. and others "El paradigma complejos" (U. de Chile, 2002), quoted by Friedmann R, op. cit.

[9]Chuster, P. How does complexity arise in evolution, in "Complexity" 1996, quoted by R. Friedmann.

[10]Chris Langton, in R. Lewin 1995, in Complexity: Life in the edge of chaos.

at a slower pace within the company than outside it, we have a huge problem. We cannot predict the future, but we can learn to react much faster than our adversaries."[11] In doing so, Welch very efficaciously applied Ashby's law of requisite variety.

Following this same line of thought, it is important here to make reference to a biologist who has had a powerful impact on the business world—Stuart Kauffman, who is considered one of the most outstanding thinkers in the field of the sciences of complexity.[12] He currently is director of the Institute of Bio-complexity and Informatics at the University of Calgary in Canada. He worked at the celebrated Santa Fe Institute for twenty years. In addition to being author of three books on complexity and bio-complexity, he has founded three biotechnology companies that commercialize his intellectual property—Darwin Molecular, Genpathway, and Genesis Molecular Discovery—and a fourth, Bios Group (now acquired by Nutech Solutions), that capitalized on his own knowledge of the theory of complexity and his belief that modern biology can help solve business problems. Through his studies of the phenomena of self-organization and emergency, he discovered the importance of the relationship between self-organization and networks [18].

Two other approaches which apply concepts from New Science to business are the fractal company of H. J. Warnecke[13] and chaordic organization developed by Dee Hock, based on the discoveries of M. Waldrop.

In the Fractal Company, H. J. Warnecke applies the approach of nonlinear dynamic systems to the field of organization. His approach is integrative, seeking to integrate different management concepts: agency model, outsourcing, and re-engineering. Warnecke makes it clear that the way to realize the most appropriate organizational forms is through parallel but synchronized process.

The fractal organization looks to increase, not reduce, complexity, as a means of maintaining optimal potential variety when the company faces pressures and disturbances. It has properties similar to those of living organisms and the characteristics of self-organization, the operational dynamic, and self-similarity. These characteristics guarantee the survival of the organization as an "organism". An organism is characterized by its capacity to adapt effectively to external disturbances while maintaining its competitive capacity. Fractal organization is based on the idea of cellular division, so instead of limiting the "entrepreneurial principle" to the senior levels of the organization, labour tasks and duties are assigned to all levels in the hierarchy.

[11]Pascale, R.T. quoted by Friedmann, op. cit.

[12]Interview with Stuart Kauffmann, in Trend Management 5/June-July 2006.

[13]Warnecke H.J.: Revolution der Unternehmenskultur. Das fraktale Unternehmen, Heidelberg, 1993. Quoted in Friedmann R.

At the end of the decade of the 1970s, Dee Hock, the founder of Visa (credit card) applied the principles of self-organization to his company and transformed it into a "chaordic organization". Hock's idea was based on the discoveries of M. Waldrop, who, in his book Complexity, defined complexity as the emerging science that deals with the frontier between chaos and order, thus its name —Chaorder, from chaos and order [19].

Autocatalytic, self-organizing, nonlinear, adaptive complex systems surge and move towards the edge of chaos. In this way they can count on sufficient order to generate reliable patterns and boundaries, but not so much as to diminish adaptation and learning. According to M. Gell Mann, adaptive systems function better in an intermediate regime between order and disorder. Additionally, they have the capacity to exploit the regularities that determinism provides, while at the same time to take advantage useful indeterminations in pursuit of better arrangements.[14]

Today the chaordic concept is being put into practice in commercial business organizations, as well as in social, community, and governmental organizations [4].

5. Self-Organization, Sociopoiesis and Enterprise

An idea, whose usefulness has been increasingly gaining support in the field of organizations, is that of the corporation know as a "living entity".

The idea is an old one, but is currently at the height of its acceptance. In the 1960s, S. Beer was one of the first to use the term as it applied to his studies of the human nervous system. Among his many publications, "The Brain of the Firm" is probably the best known [20].

Several other international authors suggest this approach. Among the clearest and most outstanding voices are Gareth Morgan (1990), Frijof Capra (1996), Peter Senge (1998), Margaret Wheatley (1994), Ykujiro Nonaka, and Arie de Geus (1998).

Parallelly, there are other authors who, although they do not clearly and openly promote this approach, suggest it and insinuate it in a less explicit way. Among these number Stephan Haeckel (2000), Moshe Rubinstein and Iris Firstenberg (2001).

In Chile there are published works incorporating a systems approach, such as the book by Pablo Illanes, and the publications of Dario Rodríguez and Marcelo Arnold, and José M. Araya, who follow the line of thinking of Luhmann about organizations as autopoetic systems.

However, nobody has carried this concept as far as Professor Milan Marinovich and the author of this paper, who, despite starting from distinct points of view, move beyond the simple metaphor to assert that indeed the en-

[14]M. Gell Mann, quoted by R. Lewin (1995) pg. 21-30.

terprise is a living entity.

When M. Marinovich proposes that human organizations are self-organizing, self-disturbing systems, he is doing so from the perspective of a sociologist, placing emphasis on people and their behavior.

The author of this paper, on the other hand, tries to make science of the organization, viewing it from the perspective of cybernetics and using the contributions of contemporary biology.

When one stresses the idea that a business enterprise is a living entity, one does so in order to leave no doubt that this theory never uses the concept of living as a metaphor, but rather as a means of literally explaining what the living essence of a company consists of.

Below the fundamental ideas of this theory will be laid out and elaborated upon. Space limitations do not permit an in-depth analysis. Anyone interested in pursuing the matter further should access the books and articles of the authors cited in the bibliography to this paper.

5.1. Central Processes

First of all, one must emphasize that an enterprise, like all systems, automatically exists simultaneously in two domains: that in which it behaves as a simple unit and that in which it acts as a composite unit. Thus the enterprise manifests itself in the physical domain, as living beings, and in the social domain or social space, where these beings share a space generated by their interactions with other human beings.

The social domain emerged thousands of years ago at the same time that language emerged, at the time when human beings were learning how to coordinate their actions and behaviors. This distinction between the two domains or spaces of existence of an enterprise shares much with the ideas of the physicist [8].

To illustrate the concept let us consider paper money. If one strikes a match and lights a $10 dollar bill, it will ignite and burn, just as any other piece of paper in the physical world. So, why are people willing to exchange a shirt, for example, for this piece of paper? Because its value exists not in the physical realm, but rather in a different domain of meaning and coordination that is generated through their interactions as human beings—the social domain or social space. The same dynamic that is at play here is the dynamic that enables an enterprise to sustain itself through time.

In an attempt to clarify this concept, it can be said that when an enterprise is referred to as a living being, this does not mean that it has internal organs or vital systems as human bodies do, nor does this mean that it functions like a cell. Other components, structures, and processes are involved. Life in social space is quite different to life in physical space. What exactly is it, then, that justifies saying that the enterprise is a living entity? What relates living beings in physical space to living entities of the social domain is that they use a similar dynamic process to sustain themselves and their viability, and autopoiesis is the starting point.

What is autopoiesis? Autopoiesis is not a thing or a mechanism; it is an operational dynamic. How does this dynamic manifest itself? Through a closed network of relations of the production of components; that is, components interacting with each other produce the configuration of the processes that regenerate the components themselves. Something similar occurs with regard to social organizations, but the process is longer and more involved. The production of components in the autopoietic dynamic is immediate (as seen in **Figure 1** below), whereas the sociopoietic process involves a greater number of steps (as seen in **Figure 2** below). The difference between autopoiesis and sociopoiesis cannot be reduced to merely the number of steps involved, but a full description of the differences goes beyond the scope of this paper.

Based on what has been said up to this point, an enterprise can be defined as "a set of labour, technological, and economic acts in operational closure that constitute

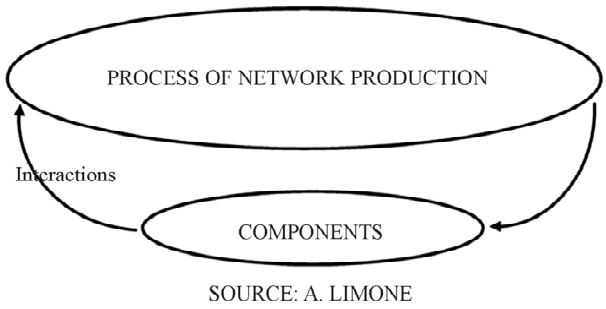

Figure 1. Diagram of the autopoiesis process.

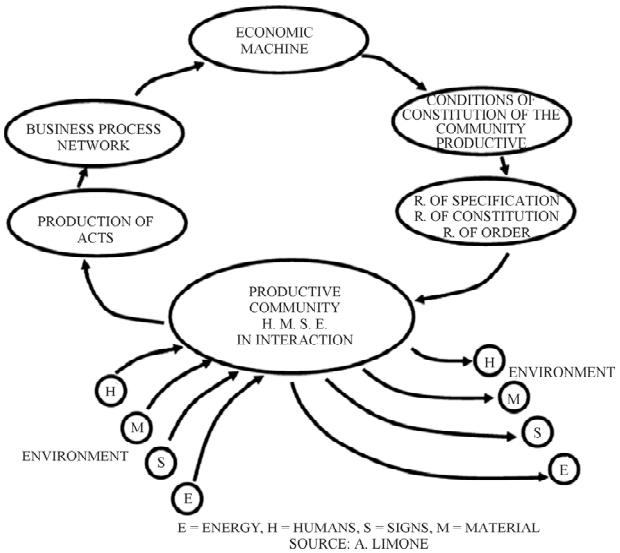

Figure 2. Diagram of the sociopoiesis process.

the enterprise as a unit in social space". People or personnel do not constitute the enterprise, but rather produce the enterprise. Moreover, they produce it uninterruptedly, for if they ceased to produce it for a period of time the system could not bear, the enterprise would disintegrate.

The physicist Fritjof Capra suggests that anyone who wants to explain a phenomenon in a rigorous manner must be able to do the following:

- Identify and explain the organizational pattern which constitutes the phenomenon;
- Specify the type of structure that is embodied in its domain of existence;
- Identify the process or processes that give rise to the structure as materialization or corporealization of the pattern [8].

The organizational pattern is in effect identified through the definition of an enterprise as a dynamic system of acts in operational closure. So, now it remains to specify the structure and identify the process.

The structure of an enterprise is fractal, which means the basic module repeats itself across scales generating the business structure that the economic community is willing to adopt (See **Figure 3** below).

Finally three great processes in the system of an enterprise can be distinguished: The primary process defined as the set of transformations that allow for the recovery of the resources used in the maintenance of the structure and in carrying out the transformations. This process consists of four families of transformations: financial, productive, commercial, and personal. These families of transformations are all interconnected and form a network of production processes comprised of labour, technological, and economic acts. The other two processes are the decisional process and the process of structuring.

The decisional process is made up of a closed network of conversations whose relative activity is, throughout the entire system, continuously specifying the operational coherencies necessary for the production of the labour, technological, and economic relations that constitute the system in the total network of processes (primary, decisional, and structural). Conversation here is defined as the set of language operations intermingled with the emotional effects the constituent members have upon one another. With respect to the primary process and structural process, the decisional process, through its coupling with the other two processes, plays the role of activation/disactivation, regulation, and coordination, which is called "steering".

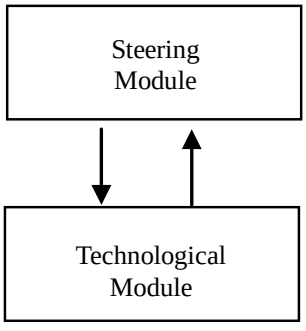

Figure 3. Basic link of the structure: fractal pair.

The process of structuring is that which permits the generation of the structure of the enterprise by collecting, differentiating, and integrating its constituent elements on the basis of what is called the basic link of the structure or the minimal fractal structure. It is comprised of two modules—the technological module and the steering module. The technological module carries out the transformations (operations) needed to sustain the continuous activity of both the structure and the steering module, which is the part of the structural link that activates, regulates and coordinates the actions of the technological module.

There are three types of flows that characterize the interactions among the modules: Information Flows, Financial Flows (collecting and allocating resources and expenditures), and Material Flows.

5.2. Economic Community and Economic Machine

All systems exist in two domains or distinct spaces: that of the simple unit and that of the composite unit. Thus, a system can be disturbed both as a simple unit that responds to behaviors and properties of the totality without distinction as to its parts, and it may be disturbed as a composite unit, whereby the system is disturbed through its constituent elements.

An enterprise exists as a simple unit in social space and as a composite unit in what is called the economic community, which exists in physical space. The economic community is composed of four basic elements: human beings, materials, symbols, and energy. These four elements interact and, while carrying out their tasks, produce three types of acts: labour, technological, and economic. These acts create added value and form the structure of the economic machine in the domain of social space (See **Figure 4**).

6. Conclusions

The essential points of this paper can be summarized by way of the following list:

- That there is a need to renew the Theory of the Organization and Management at this time seems to be beyond doubt. But, beyond the mere recognition of this need, the time has come to recognize the increasingly critical nature of the situation. As Drucker has said, today it is a matter "of life and death" for many organizations.

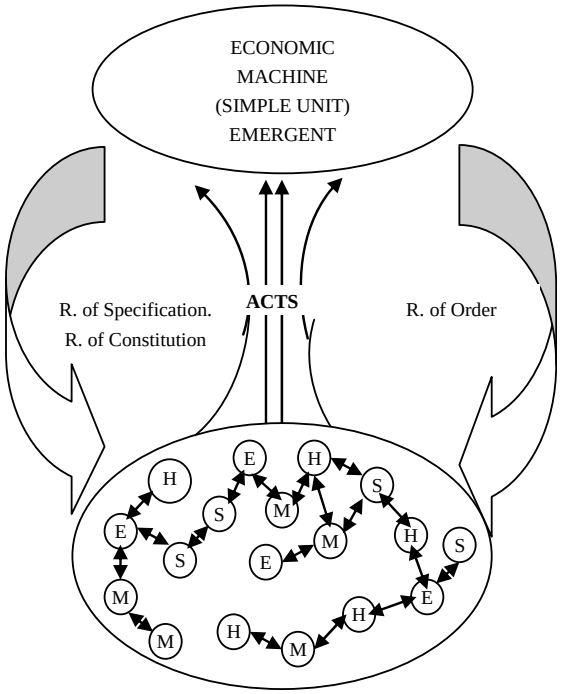

Figure 4. Economic community (composite unit).

- Until now the main obstacle to generating a new paradigm to form a framework for new assumptions or hypotheses has been the conceptualization of the nature of an enterprise as "a set of people deliberately structured to reach a common aim"; but today this definition makes no sense, as it does not take into account technology, information, and energy. Thus, the first thing that must be changed is the concept of an enterprise by way of a definition that clearly and explicitly describes the organizational pattern that constitutes an enterprise.
- The contribution of the fields of study of New Science that investigate dynamic complex nonlinear systems is of paramount importance to the task of generating a new paradigm.
- The systemic and cybernetic model of an enterprise has been built up by using those contributions of the New Science that confer greater insight into understanding and solving the problems that an enterprise faces in a growingly complex world with a high dynamic of change.
- The theory of self generation by the sociopoietic process of the enterprise seeks to provide a full accounting of the main phenomena observed in the life of a contemporary enterprise.

The only thing that remains to be done is to reiterate and stress the urgency of developing a new conceptualization. It simply is not enough to say that the old paradigms have become obsolete and no longer apply. It is imperative and urgent that the task of producing a new model, a new paradigm, become a priority for the field of business management.

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