ATMIRE

Title	Managing Complexity
Item Type	info:eu-repo/semantics/article
Authors	Mariotti, Humberto;Zauhy, Cristina
Citation	Mariotti, H., & Zauhy, C. (2013). Managing Complexity. Sinergia E InnovacióN, 1(08). Consultado de http://revistas.upc.edu.pe/index.php/sinergia/article/view/91
Publisher	Universidad Peruana de Ciencias Aplicadas (UPC)
Journal	Sinergia e Innovación
Rights	info:eu-repo/semantics/openAccess
Download date	2026-11-27 18:03:19

MANAGING COMPLEXITY

Conceptual and Practical Tools. Analysis of Examples

Humberto Mariotti* and Cristina Zauhy**

Abstract

This article is a brief introduction to complexity, complex thinking and complexity management. Its purpose is to present an update on the applications of the complexity sciences particularly to the universe of corporations and management. It includes an example taken from the globalized world and two more stories from the corporate environment. Some details on how to think about complexity and how to apply the conceptual and operative tools of complex thinking are provided. The article ends with some remarks on personal, interpersonal and corporate benefits of the complex thinking.

Key words

Complexity, complex thinking, complexity sciences and their applications, complexity management, globalization, corporate world.

INTRODUCTION

We use to define complexity as follows: “Complexity is not a theoretical concept. It manifests itself in the multiplicity, the weaving, and the never-ending interaction of the infinity of systems that constitute the natural world and the human societies. Complex systems are inside us and vice-versa. It is not possible to reduce it to simplistic explanations, rigid rules, simplified formulations, and closed systems.”[1]

Learning how to put into practice the concepts related to the sciences of complexity – that is, learning how to handle complex phenomena – requires a patient, pragmatic, and disciplined work. It is necessary to use cases and examples, as well as to develop management tools. Our experience, as well as other author’s, has shown that the difficulties for fulfilling this task are not few. Among them there is a common trend: very often people think that complexity and complication are the same thing. We have already explored this issue in several works, which includes two books.[2, 3]

The word “complex” comes from the Latin *complexus*, that means “what is woven together”. As a starting point in the study of complexity, we think that is important to remember two points: a) complication is about complicated systems; b) complexity is about complex systems.

Complicated systems are characterized by a high level of high precision and repetition, and a low level of adaptability, creativity and innovation. Machines (a watch, for example) are a good example.

Complex systems are all systems that include living beings. They are characterized by low precision, low repetition and high adaptability, creativity and innovation. That is why they are usually called complex adaptive systems. They also include a high level of error, uncertainty and illusion. Human groups, organizations and institutions are good example of complex systems. According to these concepts, we can already say that complexity management has among its main purposes to minimize as far as possible the level of error, uncertain and illusion inherent to complex adaptive systems.

This is an introductory, didactic, and expositive article. Its main purpose is to make readers familiar with some of the principles of complexity and complex thinking, as well as with some of their tools. Let us start with some examples.

EXAMPLE #1. The globalization challenge: everything is woven together

Let us talk about some manifestations of complexity as seen in the topics below.

Progress. Since the beginning of the 18th century, the so called Idea of Progress has claimed that practically all human problems would be solved by science and technology. This promise has not been kept as announced. If it is obvious that science and technology have produced and will still produce uncountable benefits, on the other hand they also have produced many unwanted side-effects: environmental pollution, climatic alterations, economic instability, the nuclear threat, unemployment, social exclusion and drug traffic and use, among others.[4]

Migrations. Since long ago, the insufficient development of many countries – the so-called Third World – keeps producing high levels of poverty. That is why people have been compelled to migrate to developed areas – the so-called First World – looking for better living conditions. As shown by many evidences, these migrations tend to increase as time goes on.

Conflicts. The traditional forms of war have been largely replaced by regional conflicts. Those usually happen in the Third World and very often affect entire populations. Besides death and destruction they also generate millions of refugees, and many of them tend to move to First World countries.

Work. In the First World, the increased income of the middle classes produced many people not any more interested in jobs that do not require technical qualifications. This has led to the need of receiving immigrants from the Third World, in order to these jobs could be ascribed to them. This relatively new market tends to saturation in the First World, but even so the migrations persist, with the consequent increase of the number of socially excluded people.

Tensions. Excluded people produce little in economic terms, but evidently this does not mean that they are not active users of the benefits provided by the State (health care and unemployment insurance, for example). Thus, they compete for these benefits with the other social classes, and this obviously generates social, ethnic, and economic tensions.

Transculturality. Immigrants who have jobs in the First World countries soon generate children who become citizens of these countries. Many of them go to school, graduate and get qualified jobs. This phenomenon, plus the continuity of immigration, leads to a great ethnic, cultural and religious diversity that countries and corporations have to manage. It is well known that at present such diversity poses important challenges to leaders and managers.

Terror. In some countries, the failure of the Idea of Progress has to a certain extent challenged the credibility of science and technology. People's faith in some scientific

and technological benefits appears to be decreasing. For this reason many of them are getting back to religious faith. In some of these countries the religions have somewhat recovered the importance lost since the 18th century. In several others, however, religious faith has never been challenged and keeps identified with the State. The identification of religion, the State, and politics encourage fundamentalisms and fanaticisms. Terrorism and not few of the regional wars are often related to these phenomena. Globalized corporations, many of them established in the Third World, are affected by these turbulent phenomena.

Instability. The globalization of economy has led to a great mobility of jobs and careers. Long-term jobs are now scarce and in many cases tend to disappear. The increased job turnover has produced great anxiety in all levels. Thus, we can conclude that social and economic instability were globalized altogether with political, environmental, ethnic, and religious instability.

Energy. Guarantee of energy availability for economic activities is increasingly problematic, as is the case of petroleum and electric energy. The development of alternative resources of energy is still in its beginning. Moreover, there is the problem of scarceness of resources necessary for biologic survival – the reserves of potable water, for instance.

Comments

It is easy to understand that all the above described situations are interconnected in direct (linear) and immediate (short-term) ways, as well as in indirect (non-linear) and remote (medium/long term) ways. If we put them in a circle and draw straight lines to illustrate these interconnections, what comes out is a complex drawing, that is, it shows how everything is woven together.

An analysis of the above described situations leads to the following conclusions:

- They are manifestations of the complexity inherent to the natural world and to the human societies. Any of them has to do with all others, because between them there is more than direct and immediate causal relationships. They are interwoven circumstances which interact in never ending ways.
- These influences and interactions may be illustrated through diagrams called mind mappings. Such diagrams can be drawn to illustrate contexts that surpass restricted spaces and, in terms of time, go well beyond the short term. They are valid for personal, interpersonal, socio-environmental and global ambits, and encompass personal relationships and the planetary context.

- As stated above, all these evidences reaffirm that complexity is not a theoretical concept – it is a huge set of real and interconnected phenomena. Thus we need to learn how to deal with it. That is what we call managing complexity.
- Complex phenomena cannot be understood through a mental model like the one nowadays prevalent in our culture. This model tends to fragment and simplify everything, and so leads us to think mostly in terms of short periods of time, direct causal relationships (simple causality), and restricted contexts of space.
- Since this model is insufficient for dealing with the real world's complexity, it should be complemented. For this purpose, it is necessary to develop conceptual and operational tools.

The challenge for developing these tools has been growing up for the past twenty years or so. This growth reflects the importance of the matter and its particular relevance in the corporate environment. The number of initiatives and schools interested in understanding and managing complexity is already expressive. Among them is the Nucleus for the Study of Complexity Management at Business School São Paulo (BSP), in Brazil. BSP's approach initially followed the ideas of French sociologist Edgar Morin[5, 6, 7, 8, 9 10, 11] and then developed, in terms of management, what has came to be our present version of complex thinking.

EXAMPLE # 2. Complex thinking and leadership. The vision of an executive: from "either/or" to "both/and" thinking

Our second example of complex thinking is a passage in an interview given by American executive Jack Welch. When asked about how executives should cope with market pressures for short-term results, allied to today's increasingly intense need to think also in terms of medium/long term, this was his answer:

"There is only one solution: management. In other words, it is necessary to balance the demands for quarterly results with the pressure for future profits. (...) To deal with a paradox – that is what you were hired for. (…) Anyone can do short-term management. For that it is enough to 'squeeze' costs till the marc. It is also simple to concentrate only in long-term management. (..) The most difficult is to do both things at the same time – this requires leadership. Leaders are tough, visionary, and courageous guys. They have the capacity do deal with short-term and long-term expectations at the same time." [12]

This answer demonstrates how Welch knows well that the need to deal with paradoxes is an essential feature of present-day managers challenges and, even more, it

reveals that he is keenly aware that this capacity is indispensable to leaders. This natural, intuitive ability to deal with paradoxes has been called integrative capacity by some authors. Integrative capacity is a well known mental feature of great leaders from several areas and times. Among many of them we could mention Mohandas Gandhi and two others who were deeply influenced by his ideas and actions: Martin Luther King and Nelson Mandela.

EXAMPLE # 3. Change at Whirlpool: from "either/or" to "both/and" thinking (once again)

This example was taken from Robert Quinn's book *Change the world* [13]. It is the story of two different periods of David Whitwam's activities at Whirlpool. During his first five years as Whirlpool's CEO, he globalized the company and drove it to huge levels of profit. As he started his sixth year, however, things were not so brilliant. He had pushed the company as far as it could bear. So, as he started dealing with the challenges of globalized markets, he also started talking about the need to designing values and promote the commitment to them. In other words, Whitwam wanted to build up a new culture – a high-performance one.

Some people did not react well to this initiative. How could such a task-focused person like Whitwam talk about values and human relationships? Here is the answer: as a man who was clearly interested in high performance, Whitwam had come to the conclusion that he only could have a high-performance company if he approached both task and people at the same time. Where did he take this conclusion from?

From his own internal adaptive, creative and innovative resources. That is what he said: "Sooner or later, every leader comes to understand how little power he or she really has. I will take you back to when this was just a North American business. A person could get things done continuously, consistently. As we became more complex and the environment more intense, it became impossible to get things done through the force of leadership. Everything in my mind has always been so clear and logical. I felt, if we just do what we know how to do every day, this thing will work. I had this grand scheme and grand design and I thought I could articulate it and get people lined up. It did not happen. It absolutely not happened. I think I had come to grips with the fact that it is not enough for me to be committed, to have a plan and understand were we are going. I realized I had to get everyone engaged and committed."

Comments

In the beginning, Whitwam was much more task-oriented than people-oriented. If asked to choose between people and tasks, his binary way of reasoning would make he say that he would better take either one or the other option. But we should remember that all that happened in a time when the world and the markets were much more clear and predictable. As time passed, the increasingly complexity of the world and the markets drove him to a significant change in his mental model. He put aside the binary way of thinking (the "either/or" format) and went into one (among many) of the characteristics of the complex way of thinking (one thing *and* the other one). This shift has led him to the creation of a task *and* relationships culture, that is, in Quinn's language, a productive community.[14]

THE LADDER OF KNOWLEDGE

Before getting on the practical applications of complex thinking, we think that it is important to understand what is the philosophy (that is, the general set of ideas) that constitutes the basis for it, and what are the methods (the conceptual tools) that originate from this philosophy. As it is well known, the methods generate the techniques (that is, the operational tools), and from these come the results.

It is evident that everything we do in search of results begins in the general ideas realm. Thinking is inherent to human nature and condition, and that obviously include philosophical thinking. Even the insights emerge from a never ending process through which the mind interacts with the world. Now let us imagine a four-step ladder. The highest of them is where the wide ideas com from – the ladder of philosophy. The next one is the step of the methods, that is, the conceptual tools. The next one is the step of techniques, that is, the operational tools. The lowest one is the step of the results. This set constitutes what we call The Ladder of Knowledge. The diagram below is a synthesis of it:

Philosophy (general ideas)
↓ ↑
Methods (conceptual tools)
↓ ↑
Techniques (operational tools)
↓ ↑
Results

Each one of these steps represents a way or a set of ways to see the world. As a rule, people use to stay in a given step and rarely communicate with the others. So, philosophers prefer the highest step and only in exceptional circumstances go down to the step of methods/concepts. The so-called "practical" people use to stay in the step of techniques, but many of them choose to go further down to the step of results. Thus, "theoretical" and "practical" people adopt different ways of thinking that almost never communicate – and this has been a big obstacle to the production, diffusion and validation of knowledge.

If people were used to go up and down through the ladder of knowledge, that is, if they were used to exchange experiences more often, certainly the surmised differences between "theoretical" and "practical" would be very few – and everyone would benefit from this fact.

Going up and down (and vice-versa) through the steps of the ladder of knowledge, with the purpose of learning from what happens in its different steps, would be helpful to everyone. It is obvious that nobody expects that philosophers suddenly start messing around with techniques, nor that technicians suddenly begin to philosophize. This would not be realistic for both parties. The desirable change would be that we could start thinking out from our boxes, that we could loose our defenses and be more open to the world events and to our daily experiences.

Many books on change and its management use to start in the step of methods and then go right down to the step of techniques. The highest step – the philosophic one – is usually ignored. This stance may lead to errors and misconceptions, as methods and techniques, even when they produce good results, should always be questioned. This questioning should be done to prevent that concepts be mistaken for rigid rules or repetitive prescriptions, which may impair change and innovation.

In other words, if we always apply the same methods and techniques we will always get the same results. Worse that that, when questioned about why it is so difficult to escape from this trap, we will certainly have many "convenient" explanations – that is, we will rationalize. Summing up: everything starts with philosophy and, through a series of processes that frequently include trial and error, leads to concepts, from which arise the techniques and from which eventually come the results.

Let us remember: general ideas, concepts, techniques, and results are not separate entities as people often imagine. They are in continuous interaction and through this

dynamics they fertilize each other. There are no such things as “very philosophical”, “very theoretical” or “very practical”. The ladder of knowledge is a consolidated structure and its steps exist to be climbed and descended according to the needs and circumstances. Each step contains all the others in potential, and this phenomenon allows our adaptability to the real world – and that includes creativity, innovation, and the processes of change and evolution.

We are always thinking, building up concepts, applying techniques and getting results. If one technique, product or service in not satisfactory, we need to go up to the step of concepts in order to find out what should be done to improve them. In these cases it might be necessary to change or improve the methods, that is, the conceptual tools. Even when we get good results, we often may have to go further up and search for some improvements. In either case, if the step of concepts does not provide the expected results we may have to go still further up to the step of philosophy – and once there we should think everything over and over again.

A BETTER WAY OF THINKING

“To work up to think well” is a phrase by French philosopher Blaise Pascal (1623-1662) applied to complex thinking by Morin. He uses it with to mean that even if sometimes – or very often – antagonist ways of thinking are mutually exclusive, there are circumstances in which they can and should coexist peacefully and produce good results, as we have seen in examples 2 and 3 of this text.

The topics below were adapted, with some alterations and additions, from Morin’s texts. They may be useful to the understanding of complex thinking and some of its most important assumptions and characteristics.

- Complex thinking and the complexity sciences from which it comes are not isolated approaches. They need to interact with many other disciplines of knowledge to be validated, and thus be able to produce effective results.
- In it important to keep always an open mind in order to be able to perceive the phenomena that constantly emerge from daily experience. It is from the connections of what is woven together that reality emerges.
- Even when all the conceivable aspects of a given issue or phenomenon appear already thoroughly perceived and explored, there is always room for the question: what else should be searched and discovered?
- It is very important do not fear complexity. The first step for that is do not confound it with complication or, even worse, with disorder.

- Another way to get rid of fearing complexity is not trying to flee away from non-linear and multiple causality. Life and its many phenomena cannot be simplified in terms of "if-then" or "one cause, one effect".
- It is important do not adopt the practice of fragmenting things and then try to deal with the separate parts as the only way of knowledge. It is obvious that fragmentation (reduction) can be used as an initial step for knowing in many cases. However, if we see it as the only approach the knowledge obtained through this method will be very limited.
- Welcoming complexity is a signal of adaptability and openness to novelty and to the emergent reality and its paradoxes. Let us remember here a phrase by Greek philosopher Heraclitus, according to whom opposites are necessary for life, and they are unified in a system of equilibrant exchanges.
- In practical terms, all that means that the conceptual and operational tools of complex thinking provide ways to establish a mutual fertilization between analysis (fragmentation) and synthesis (reconnection). Complex thinking does not adopt linear Cartesian thinking as the only useful mental process, and does the same with systems thinking. In other words, it looks for a complementarity between these two ways of thinking.
- As a consequence, it is also important to understand that complex thinking looks for ways to put together different disciplines and specialties through the use of a language and transversal themes that could promote their interaction. In corporate terms, this concept is particularly useful for help solving the problems caused by the so-called "organizational silos".
- Complex thinking acknowledges that calculus, mensuration, and quantification are indispensable as ways of knowledge – but also states that they are not the only useful ones. It welcomes uncertainty, unpredictability and contradictions and advises methods and techniques to deal with them, as well as with paradoxes and ambiguity.
- Complex thinking provides methods and techniques for thinking beyond the short and the medium terms, that is, it stresses the importance of strategic thinking.
- Complex thinking does not lose sight of the fact that it is very important to learn how to deal with error, uncertainty, and illusion. As already mentioned in the beginning of this text, this is one of the fundamental aspects of complexity management.

THE TOOLS OF COMPLEX THINKING

1. The conceptual tools: the cognitive operators of complex thinking

The conceptual (methodological) tools of complex thinking are the cognitive operators. From the operators come the operational tools, that is, the techniques. A detailed description of them – with accompanying examples – is available in some works by one of us[15, 16], so in this text we will talk about them in a somewhat brief way.

The cognitive operators have been presented under several ways. The format in which they will be presented now is the result of a research done by one of us on Morin's ideas. The operators are not isolated. None is more or less useful than the others. All of them are interconnected, thus they work in a synergic way.

The operators enable us to explore the multiple aspects of a given reality. They facilitate the identification of the connections between objects, facts, data or situations which at first sight appear to be unconnected. They enable us to understand how new ideas or properties can emerge from these connections. Thus they are articulation tools, which help us to get out of our usual mental linearity and to be able to detect nuances and to design scenarios.

As conceptual tools, the cognitive operators create the necessary conditions for understanding and using the operational tools of complex thinking. Let us first mention the most important ones and then add a brief description of each one: linear/Cartesian thinking; systems thinking; multiple working hypotheses; self-organization; dialogics (management of paradoxes); hologramatics (whole-parts integration); observer-observed integration; ecology of action.

- ***Linear/Cartesian thinking***

Concept: Divide everything in parts then work separately with them. Causality is seen as a linear phenomenon: one cause, one effect ("if-then").

When to apply: when it is necessary to use the sequential, step-by-step approach (supply chains, assembly lines, linear logistics).

Some techniques: critical thinking. Rational decisions. Processes. Some aspects of project management.

- ***Systems thinking***

Concept: when assembled, the parts constitute a system. Causality is seen as a non-linear phenomenon. The effects go back to the causes and reinforce them (feedback).

When to apply: when it is necessary to deal with the parts without losing sight of the whole and vice-versa (for example, to deal with the corporation without losing sight of its departments). When it necessary to do strategic logistics.

Some techniques: mind mapping, systemic modeling, other computer simulations.

- ***Self-organization***

Concept: complex adaptive systems produce their constituent elements and self-organize through this process.

When to apply: when it is necessary to produce new ideas for decision making, problem-solving, strategic design and action.

Some techniques: open space technology, positive deviance, appreciative inquiry.

- ***Dialogics (paradoxes management)***

Concept: there are contradictions that cannot be resolved (paradoxes). That is, there are opposites that are simultaneously antagonistic and complementary.

When to apply: when it is necessary to deal with conflicts and with unclear and ambiguous situations.

Some techniques: coaching. Decision making. Conflict resolution. Persuasion. Conflict resolution.

- ***Hologramatics (whole-parts integration)***

Concept: the parts are within the whole and the whole is within the parts. (That is, in the terms of complexity science this is a fractal process).

When to apply: when it is necessary to interconnect issues and/or areas that do not communicate well (the different areas of an organization, that is, the so-called "organizational silos").

Some techniques: the connections map. The "zoom" techniques.

- ***Subject-object interaction***

Concept: the observer always influences what he or she observes and vice versa. There is no observer-observed separation in the real world.

When to apply: when it is necessary to include new people or new methods in an organization or other kinds of environment (expatriated people, some specific consulting works, handicapped people).

Some techniques: social inclusion techniques, cross-cultural management, integrative group dynamics.

- ***Ecology of action (action-context interaction)***

Concept: actions often escape from their author's control and can produce unexpected and sometimes paradoxical effects.

When to apply: when it is necessary to make decisions in turbulent times and contexts, volatile markets, and long term scenarios.

Some techniques: scenarios design. Peripheral vision. Error, uncertainty and illusion management. Risk management.

The operational tools

The first operational tools of what we call complex thinking were proposed to be used as systems thinking tools by American authors from Massachusetts Institute of Technology and Harvard University, namely Chris Argyris and his associates. To these we should add many others who helped to develop the concepts of organizational culture (Edgar Schein, for example[17]), organizational change, organizational learning, and change management. We will not describe these tools in this paper because they are already well known and there is an extensive bibliography on them. Among many others, we should mention two useful sources for their learning and applications: the books by Senge and associates[18, 19] who, as Argyris, propose their use as system thinking operational tools. There are also many useful books on this matter. We will mention particularly one written by Zimmerman et al[20] to which we attribute great value. Several more tools had been created and some still are being developed at the Nucleus for the Study for the Management of Complexity at Business School São Paulo, in São Paulo, Brazil. They will be presented, described, and commented in another paper.

SOME PERSONAL AND ORGANIZATIONAL BENEFITS

Now we will present some of the benefits provided by the use of complex thinking:

- It is an effective tool for decision making and problem solving.
- It facilitates the processes of negotiation, mediation, and conflict management.
- It facilitates the communications between people and consequently improves organizational climate, teamwork, creativity, and innovation.
- It improves communications between corporate areas and thus is useful for dealing with the problem of "organizational silos".
- By improving the communications between specialized disciplines, it facilitates knowledge diffusion.
- It enables people to think not only about short-term and local contexts of space and time, but also about medium/long-term and global contexts of space and time. In this sense, it can be seen as a set of powerful instruments for the preparation of strategic leaders.

- It encourages risk detection, acceptance and management. In this sense it is an important tool for the design of scenarios.
- It provides ways and tools for dealing with error, illusion and uncertainty.
- Through their tools, it encourages people to be always aware of the emergent phenomena. This obviously enhances the creation of favorable environments for shared learning.

CONCLUSION

Complex thinking has been introduced as a way of reassemble separate pools of knowledge and ways of thinking, which includes Cartesian thinking and systems thinking. Its purpose is reassembling them in a dynamic and productive way. Our experience in the business and educational environments allows us to conclude that it is useful in the following areas, among many others: a) executive/corporate education; b) organizational development and management; c) leadership development; d) personal and corporate coaching; e) strategic planning; f) strategic thinking.

***HUMBERTO MARIOTTI**. Doctor and Psychotherapist. Professor and Research & Publications Director of Business School São Paulo (São Paulo, Brazil). Founder and Coordinator of the Nucleus for the Study of Complexity Management at Business School São Paulo (Laureate International Universities), São Paulo, Brazil.

E-mail: humberto.mariotti@bsp.edu.br

****CRISTINA ZAUHY**. Social worker. Executive and life coach. Co-founder and Co-coordinator of the Nucleus for the Study of Complexity Management at Business School São Paulo (Laureate International Universities), São Paulo, Brazil.

E-mail: zauhy@uol.com.br

(© Humberto Mariotti and Cristina Zauhy, 2009)

NOTES

[1] MARIOTTI, Humberto. "Complexidade e pensamento complexo: breve introdução e desafios actuais". *Revista Portuguesa de Clínica Geral* 23:727-731, 2007.

[2] MARIOTTI, Humberto. *As paixões do ego: complexidade, política e solidariedade*. São Paulo: Palas Athena, 2000.

[3] MARIOTTI, Humberto. *Pensamento complexo: suas aplicações à liderança, à aprendizagem e ao desenvolvimento sustentável*. São Paulo: Atlas, 2007.

[4] It is obvious that we do not mean being against science and technology. Our purpose is to help to think about ways and means to increment their benefits and to minimize their human and environmental costs.

[5] MORIN, Edgar. *La méthode 1. la nature de la nature*. Paris: Seuil, 1977.

[6] MORIN, Edgar. *La méthode 2. La vie de la vie.* Paris: Seuil, 1980.

[7] MORIN, Edgar. *La méthode 3. La connaissance de la coinnassance*. Paris: Seuil, 1986.

[8] MORIN, Edgar. *Introduction à la pensée complexe*. Paris: ESF Editeur, 1990.

[9] MORIN, Edgar. *La méthode 4. Les idées; leur habitat, leur vie, leurs moeurs, leur organization.* Paris: Seuil, 1991.

[10] MORIN, Edgar. *La méthode 5. L'humanité de l'humanité. l'identité humaine*. Paris: Seuil, 2001.

[11] MORIN, Edgar. *La méthode 6. Éthique*. Paris: Seuil, 2004.

[12] WELCH, Jack. Interview. *Exame* (São Paulo, Brasil), 4/11/2007, p. 118.

[13] QUINN, Robert E. *Change the world: how ordinary people can achieve extraordinary results*. San Francisco: Jossey-Bass, 2000, p. 204-205..

[14] QUINN, *op. cit*., p. 205.

[15] MARIOTTI, Humberto. *As paixões do ego*. *Op. cit*., p. 89-99 . Also available in www.geocities.com/pluriversu

[16] MARIOTTI, Humberto. *Pensamento complexo: suas aplicações à liderança, à aprendizagem e ao desenvolvimento sustentável. Op. cit*., p.137-164.

[17] SCHEIN, Edgar H. *Organizational culture and leadership*. San Francisco: Jossey-Bass, 2004.

[18] SENGE, Peter; KLEINER, Art; ROBERTS, Charlotte; ROSS, Richard B.; SMITH, Bryan. *The fifth discipline fieldbook: strategies for building a learning organization*. New York: Doubleday Currency, 1994.

[19] SENGE, Peter; KLEINER, Art; ROBERTS, Charlotte; ROSS, Richard; ROTH, George; SMITH, Bryan. *The dance of change; the challenge of sustaining momentum in learning organizations*. New York: Doubleday Currency, 1999.

[20] ZIMMERMAN, Brenda; LINDBERG, Curt; PLSEK, Paul. *Edgeware: lessons from complexity science for health care leaders*. Plexus Institute, 2008.