Organizational Development, Complexity and Dynamics of Systems

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Abstract

The social, political, economic and ecological environment in which the organizations are immerse, has forced them to look for mechanisms that allow them to give agile and economic answers, in addition to show and generate flexibility and adaptation, that is to say, homeostasis. In other words, if the environment shows complexity, then the organization will respond in the same way. The Organizational Development (O.D.) and the Dynamics of Systems are tools of great importance for organizations. They allow them to adapt to the environment, to survive and to develop in it. While in the O.D. an appropriate intervention plan is created (of learning) in function of the wanted objectives of operation for the organization, the Dynamics of Systems combines the analysis and the synthesis and provides a language that allows: to express the relationships that take place in a complex system and to explain their behavior through time.

Keywords: complexity, organizational development, dynamics of systems, organization, social nets, systems.

Introduction

To achieve its objectives an organization uses a diversity of strategies, one of those is the Organizational Development (O.D.), in which, the organizational, technological and information structure are interrelated to each other and are participant.

There are internal and external elements to the organization that should be taken in consideration in the O.D. The social, political, economic and ecological surroundings are some of the external elements, while in account for the internal part, we should consider the individuals, the groups and the organization (see figure 1). The dynamic of systems allows to analyze and to model the complex organizations, it makes possible to simulate scenarios to observe the behavior of the organization through time.

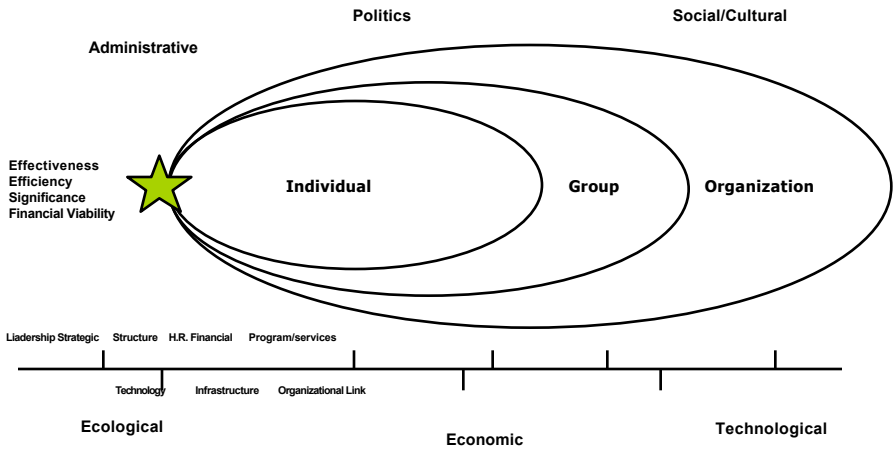

Figure 1. Organizational Development Approach

Organization and Theory of the Organization

The organization is a system immerse in a dynamic and unstable environment, to which it is related. The Theory of the organization considers the organizations, its environment and the relationships among these. The organizations are immerse in a social, cultural, political, technological, economic environment, to which they are relating, providing products, services, or information and at the same time they can also be getting back in the same way, products, services or information. The organizations are considered as complex social nets, in fact, it is through these and through the media that the relationships settle down inside and outside of the organization. In Figure 2, we observe the model of an organization and its environment.

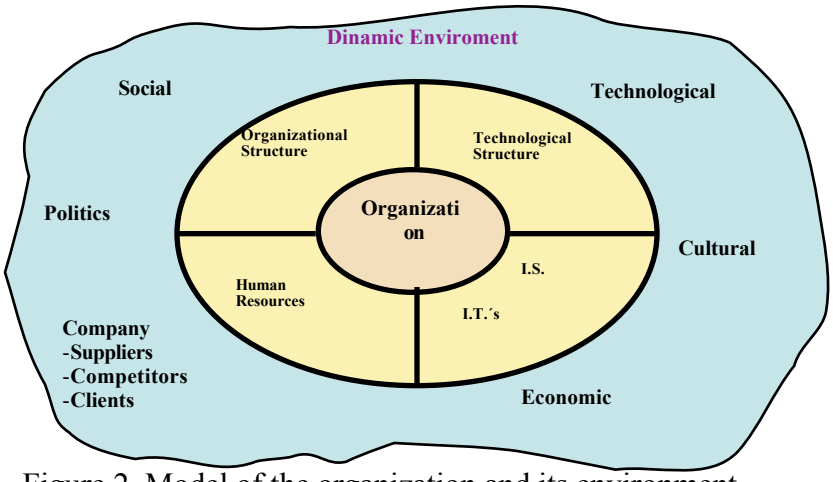

Figure 2. Model of the organization and its environment.

The change from the authoritarian and rigid type metaphors to the one of flexible and open systems, has allowed that the organizations to evolve. The changing factors of the surroundings and their demand, have achieved that the organizations change in structure, that they modify their processes and improve their products and services. The innovation and adaptation are factors that contribute to an organization's flexibility to its environment and to its preparation for the contingencies of this.

The decisions in an organization have grown in complexity, not because of the information that is required to make them, but because of its great quantity and diversity.

As it was previously mentioned, the organizations are considered as complex social nets. It is a fact that the complexity increases along with the rise in the number of internal and external communication channels, that is to say, among companies, groups, areas and individuals. Figure 3 shows an example of a net, in which we observe the interrelation between groups and people of an organization. It is relevant to mention that among elements we can have more than one communication channel, but we should also mention that in this type of social complex nets we have those of the type known as "free scale" where, few nodes have a great quantity of communication channels and many nodes have few communication channels. In Figure 4, a more complex net is shown with a lager number of people and interrelations. The nets in organizations can be called of the managerial type and are classified according to the degree and relationship form that exists among the companies.

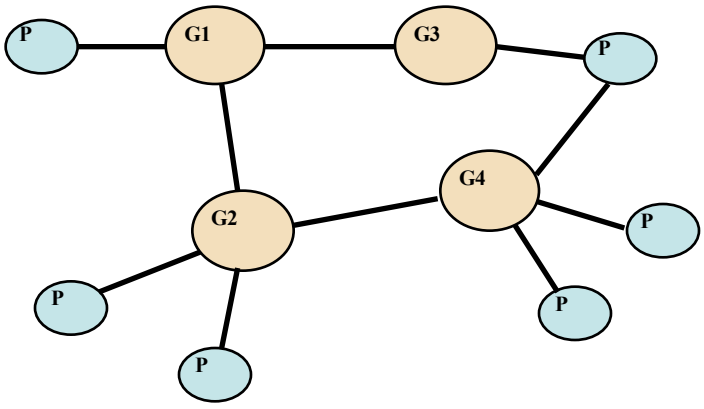

Figure 3. Example of communication net in the organization.

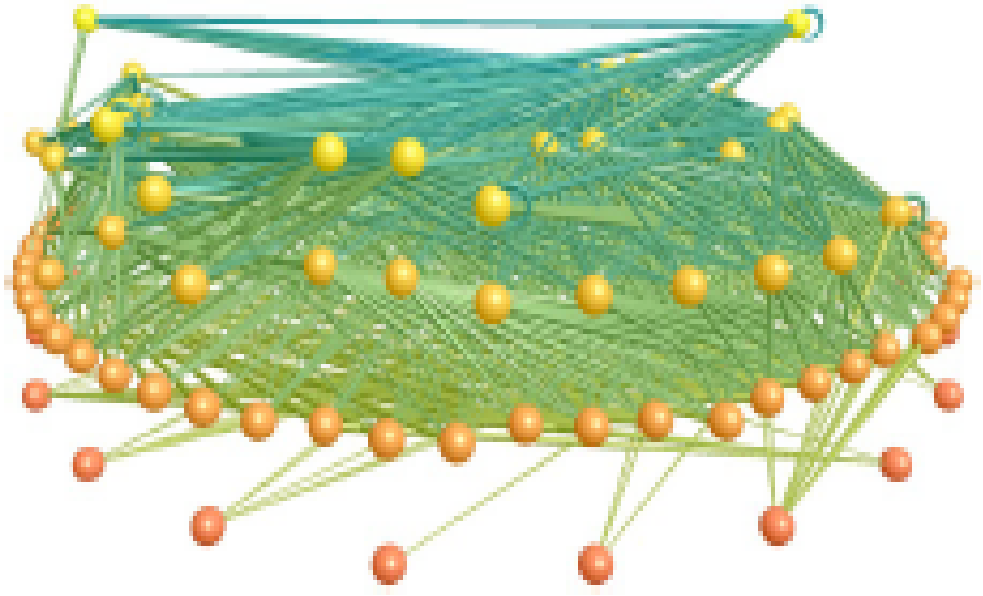

Figure 4. Example of more complex communication net in the organization.

Complex Organizations

The complexity in organizations is not only determined by the size of these, rather, as it has been mentioned, it is the result of the growth in the number of variables, the elements it counts with (groups, areas, personal) and the given relationships among these. The quantity and size in the relationships between the system and its surroundings will give us a parameter about how permeable or not the system is, that is to say, how open it is.

For the complex systems, the hardest thing to predict is their behavior and future evolution, since in many of the cases, the behavior of the groups and individuals is of emergent nature.

There is a great diversity of complex systems, among which we can mention: the computation systems, the physiques, the biological ones, the social ones and the economic ones.

We can say that one of the basic characteristics that identify the complex organizations, which can be seen as complex systems, is: the numerous group of elements that participate as well as their internal and external relationships.

In Figure 5, the relationship is shown between the complexity and the degree of disorder in the systems. In this figure we can observe that as a consequence of the complexity increase in a system or stable organization, we get a more complex system, however, if the degree of disorder is increased in the stable systems, then these will tend to be complex and later on chaotic.

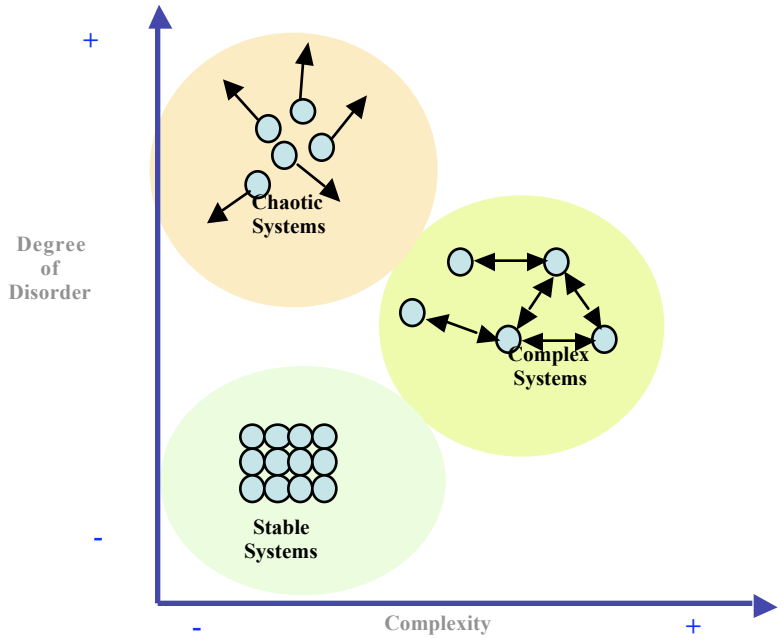

Figure 5. Relationship of the complexity and the degree of disorder in the systems.

Other aspects that have been considered regarding the increment of the complexity in organizations are the diversity of the environment, the diversity of the products and/or services that it generates, and again the relationships and interrelations among them. Under the previous perspective and according to the model that Mary Jo Hatch presents, regarding the uncertainty, the complexity and the speed of change of the environment, it can be mentioned that: the uncertainty is the answer to the speed of change in the environment and the complexity (Jo,H.,1997) (See Figure 6).

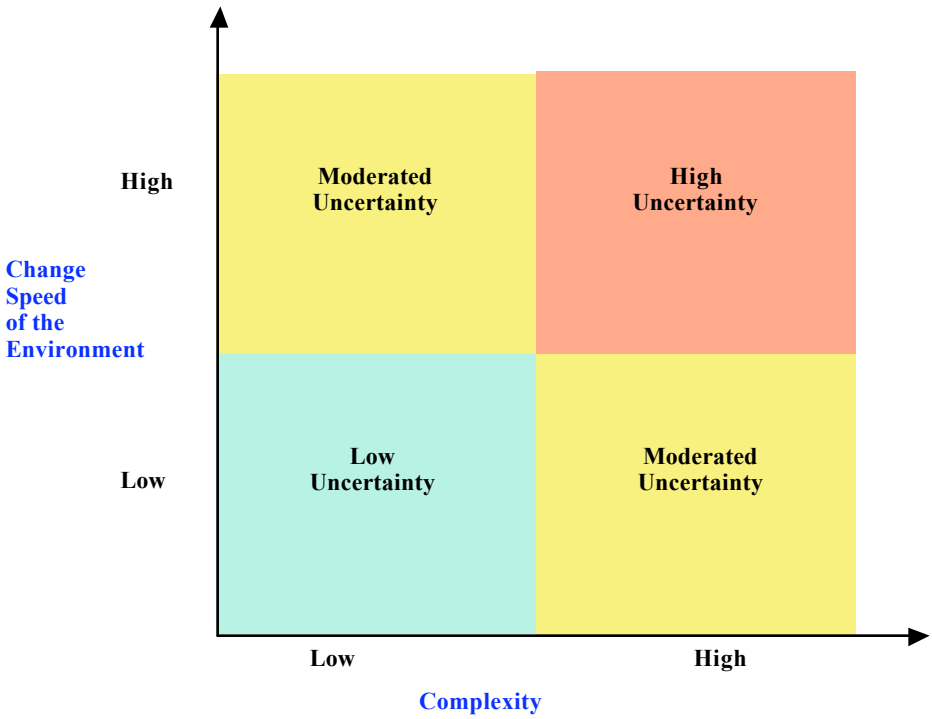

Figure 6. Uncertainty of the environment, speed of the environmental change and complexity of the system.

We can mention, according to the above-mentioned, and quoting Ilya Prigogine that the evolution of the state changes of the complex systems, takes place obeying small changes in the elements that constitute the system, and they are translated in to changes of the whole system.

Every change that is generated in an organization or outside of it, generates a rupture of the preset order, however, in long term, balance with the environment will be generated again.

Ashby's law of the required variety, is one of the intents to explain how the organizations respond to the uncertainty of the environment. The required Ashby's law has as objective the position that the existent variety in the environment can only be attenuated if the variety of the system is larger or equal to this. Of the above-mentioned we can say that: the structure of the organization will tend to respond to the complexity of the environment, and it will adopt similar conditions to those of the environment.

The Organizational Structure

According to Strategor (Robbins,S.,1994), "the organizational structure is the group of the functions and relationships that formally determine the functions that each unit ought to

complete and the communication way among each unit". As the number of functions and interrelations among these increases, the structure grows in complexity. The job's degree of specialization; the increment in the number of positions and the communication among these, have been other key motives of the complexity growth in the organizations and in their structures.

Robbins, outlines the influence of the environment in the complexity; establishes a series of variables that intervene in the complexity of the environment (Flood & Carson,1993). Chart 1, shows the variables of the environment's uncertainty that Robbins considers.

SIMPLE Few and homogeneous variables	**COMPLEX** Many and very heterogeneous variables
Stable Few unpredictable changes	**Dynamic** Many unpredictable changes
Few technological changes	Many technological changes
Handling of scarce information	Handling of plentiful information
Volatility little variability	A lot of variables

Table 1. Variables that intervene in the complexity of the environment.

The environment when influencing the uncertainty and the behavior dynamics of an organization, influences the organizational structure.

Of the above-mentioned it can be established that the type of recommended structure, in the case of the systems with little uncertainty of the environment, is adapted to the mechanical structure and in the second case, to systems of wider uncertainty, the organic structure is recommended.

The characteristics of the mechanical organization are:

" Of rigid nature
" Very centralized
" Information guided according to flowchart.

The organic organization is characterized with:

" Transfunctional and transhierarchical work teams
" Department orientated
" Freely directed information among the work group

Another mentioned aspect, is the variety in the factors that enter and they leave the organization (products and/or services), those which, are generally taken into account to measure the complexity of an organization. The variety of factors in an organization ordinarily requires of a larger amount of resources and energy.

The organization uses diminishes and amplifiers to control some of the effects of the environment's variety of factors, that is to say, in order to increase or to reduce the effects of the factors on the organization.

Inside the organization, we can exemplify the diminishers like: the use of them IT, or specifically the technological nets, to minimize errors and to speed up processes in the systems of information. While for the amplifiers, we can mention the personnel's training and motivation, who will be able to have more options to manage the variety. The amplifiers are known as points of leverage of the organization and intent to cause an exponential effect with an initial effort that is not proportional. It should be objective of the organization to identify and to apply these points of leverage.

The given relationship between the resources and the required variety can be presented in three states:

a) The resources are larger than the required variety; cost excess in the system.

b) The company has the necessary resources to assist the required variety; dynamic balance.

c) The company has insufficient resources to assist the required variety; The company is seriously threatened and loses too much energy that can take it to death.

The current dynamics, require from the organizations to reduce their production cycles and to provide higher quality and variety in the products and/or services.

The Organization and Technology

The technology in the organization, has not only eliminated several routine works, but it has also restructured the processes and functions inside it. Technology has allowed the companies to evolve and face the dynamics of its environment.

Historically, technology has allowed the production of goods and services to change from handmade to a highly scientific, systemic and systematic way. As a consequence, the required human resource should not only count on manual abilities, but rather, also needs to have knowledge and to be qualified to develop the inherent activities to their functions. (See Figure 7).

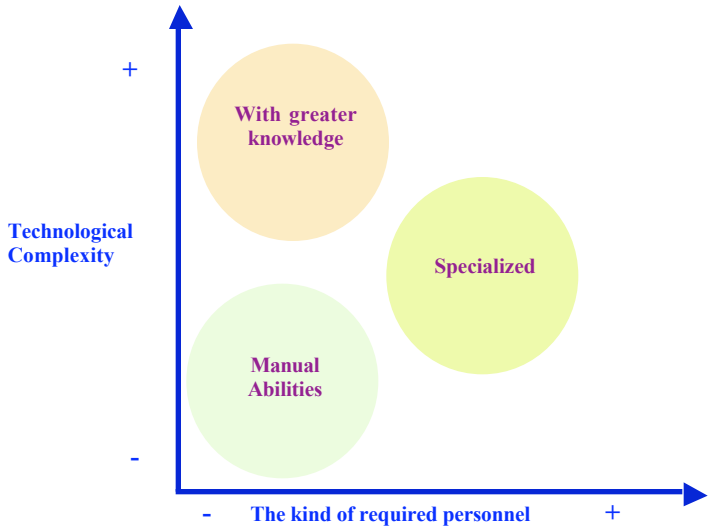

Figure 7. Degree of Technological complexity and the job specialization.

The technological innovation has allowed that, the organizations can respond to the environment, with products and/or services of higher quality, lower cost and lager variety. However, technological innovation itself, has propitiated that the complexity in the organizations grows in an exponential way, due to the increase in the number of personnel and variables involved in the processes.

There should be a balance between the used technology and the organization, since otherwise, we would be wasting resources and energy. In fact, given the great participation that the human element has in the organization and taking into consideration that in great measure this element on which the organizational performance relapses, is necessary to take into account its relationships and kind of communication.

Organizational Development, Complexity and Dynamics of Systems

Administration in the Complex Systems

To carry out the administration in the complex systems it is necessary to start from an analysis of the surrounding and of the context where the system is immerse, in addition to the perception of risks and uncertainties that potentially receive the control.

Later on it would be necessary to have an analysis of the organizational structure, of the processes and functions carried out in the organization, that is to say, an internal analysis.

The external and internal analysis propitiates the base to determine the magnitude of change and control in an organization. The changes can go from an improvement in the existent processes up to their reengineering.

Methodology for the Administration of Complexity in Organizations

The methodology for the administration of Complexity is divided in a simple Cycle of stages:

- Diagnosis.

- Comparison between Current State vs. "Should be"
  (Desirable and feasible changes).

- Process of Change.

- Learning.

In the different stages it is required the resolved participation of the personnel that works in the organization, coordinated by the leaders who will have to be coordinating and monitoring the process in its different stages.

Organizational Development

The O.D. can be defined as: "A process that is focused on the culture, the functions and the structure of the organization, using a global view of the system. The OD is an interactive process of diagnosing, to undertake an action, to diagnose and to undertake an action". Another definition can be the one of Porras and Robertson, "The organizational development it is a series of theories, values, strategies and techniques based on the sciences of the behavior and guided to the planned change of the work scenario of an organization, with the purpose of increasing the individual development and of improving

the organization's performance, by means of the alteration of the behaviors, the investigation and the theory."

The paradigms are an important consideration to take in the OD, they value the growth and development of the organizations through participative processes , and of collaboration under an investigation spirit (Moriello, S., 2003).

We can mention that the organizations are social complex systems immerse in an environment which they are interacting with, receiving entrances, or elements and giving exits; they are open, permeable systems. The efforts made by the OD are guided to improve to the whole organization or at least large parts of it. The General Theory of Systems is a powerful tool that allows to understand the complexity and to undertake actions in complex scenarios. The OD is to improve to the organization, to improve its processes, the interrelations among these and with its environment. The OD allows to give the organization the characteristic of a homeostatic system, that is to say, to remain stable before the changes of the environment, to adapt to the new technologies, markets, and to the speed of the change itself.

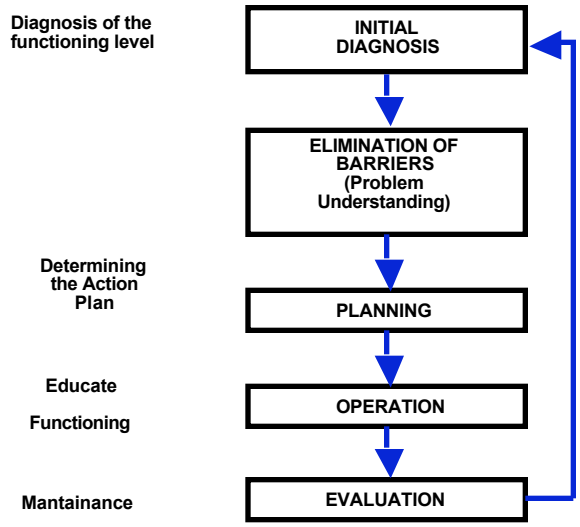

Figure 2. I Model of O.D. of recurrent nature structured in five phases.

Figure 2 shows a model of O.D. of recurrent nature structured in five phases: Initial diagnose, Elimination of Barriers, Planning, Implementation and Evaluation. It is focused in determining an appropriate intervention plan (of learning) in function of obtaining levels of operations wanted by the organization.

Dynamics of Systems

The dynamics of systems is a methodology to study and to administer complex systems of feedback (situation in which two systems are related among themselves), as the opposing ones in the organizations and other social systems. The Dynamics of Systems allows us the study of the problems as feedback systems, letting us find where our action will obtain the best results when acting on them. The maximum effectiveness place is known as point of leverage.

The Dynamics of Systems Methodology:

1) Definition of the problem

2) Definition of the current application policies (previous to the analysis)

3) The development of the Dynamic Hypotheses that explain the problem.

4) Modeling of the knots.

5) Test of the model.

The process is refined in successive steps.

Conclusions

The complexity is a wide concept that embraces all the stages of the administration. It is consequence of the opening to the environment, consequently the processes and activities have to be administrated under quota, due to the uncertainty of the environment.

The modern organizations ought to be of a flexible nature that allows them to respond to the speed of change, of the environment and of the involved factors.

The organizational development and the dynamics of systems are two important aspects that should be taken into account in the complex organizations, since they cooperate to maintain themselves a homeostatic balance, that is to say, it allows them to adapt to the environment, to survive and to be developed in it.

Thankfulness
This work was supported by Instituto Politécnico Nacional Program 206 and Project CGPI No. 20060364 and CGPI No. 20060283.

References

Cornejo Álvarez Alfonso, (1997) "COMPLEJIDAD Y CAOS", Ediciones Castillo.

Flood R. L. and Carson E.,(1993) – "DEALING WITH COMPLEXITY", Plenum Press.

Jo Hatch Mary, (1997) "ORGANIZATION THEORY", Oxford University Press.

Moriello Sergio A., (2003) Sistemas Complejos, CAOS Y VIDA ARTIFICIAL, "Red Científica".

Prigogine Ilya, (1982) "*The Challenge of Complexity",* University of Texas Press.

Robbins, Stephen, (1994) "*Administración. Teoría y práctica",* Prentice Hall, cuarta edición, México.

Robbins Stephen, (2004) "COMPORTAMIENTO ORGANIZACIONAL", Pearson, México.

Stoner, Freeman, (1996) "*Administración"*, Pearson Educación, sexta edición, México.

Vera Rezusta Carlos, Patiño Ortiz Miguel, (2005) "Los sistemas complejos y el Desarrollo Organizacional". Congreso de la Sociedad Mexicana de Ingeniería de Sistemas, Cancún, México.

Wendell L. French, Cecil H. Bell, Jr., (2000) "DESARROLLO ORGANIZACIONAL", Pearson.

Wood J., (2002) *Organización del negocio como sistema complejo*, Escuela de administración de negocio. http://www.tiplady.org.uk 701-702 Corea.