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dparamo@uninorte.edu.co

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Bohórquez Arévalo, Luz Esperanza

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The absence of response of organizations to changing business environment conditions: a complex management problem

Ausencia de respuesta de las organizaciones empresariales a las condiciones cambiantes del entorno: un problema de gestión de la complejidad

Luz Esperanza Bohórquez Arévalo

leboborqueza@udistrital.edu.co

Doctor en Ciencias de la Dirección, Magister en Administración de Empresas, Ingeniera Industrial.

Correspondencia: Calle 23 No. 75-50 Bogotá – Colombia.

Abstract

This paper argues that the inflexibility, weakness and slowness of business organizations to respond to changing environmental conditions arise from the mismanagement of the complexity that characterizes the dominant paradigm of management. The traditional administration seeks to reduce the complexity of a system that permanently increases. In the article are featured characteristics of the dominant administration paradigm, and the criticisms that have been made by different authors towards the lack of response from the traditional administration.

Keywords: *Complexity, dominant paradigm of management, linear, hierarchical control, functionalist approach, failures of management.*



Resumen

El presente documento plantea que la inflexibilidad, fragilidad y lentitud de las organizaciones empresariales para responder a las condiciones cambiantes del entorno surge de la deficiente gestión de la complejidad que caracteriza al paradigma dominante de la administración. La administración tradicional busca reducir la complejidad de un sistema, que permanente la incrementa. En el artículo se presentan las características del paradigma dominante de la administración y las críticas que han sido realizadas por diferentes autores frente a la ausencia de respuesta de la administración tradicional.

Palabras Clave: *Complejidad, paradigma dominante de la administración, linealidad, control jerárquico, aproximación funcionalista, fallas de la administración.*

1. INTRODUCTION

Business organizations, and broadly human social systems are systems of increasing complexity. These systems are characterized by a permanent increase (generation and profit) of circulating information. In the increasingly complexity, information and knowledge increase in a rapid pace, stimulating the emergence of new situations, properties, and / or conditions rapidly changing, which are usually difficult to predict and control, resulting from the interaction between people and those with the environment (Ellis and Mitleton-Kelly, 2014), (Allen, Maguire, and McKelvey, 2011), (Mitleton-Kelly, 2003). The emergence of new situations is closely related to randomness, volatility and turbulence of the business environment and the impact of such changes on the performance of organizations (Patellar Cornell, 2015) (Milliken, 1987), (Bourgeois III, 1985), (Duncan, 1972).

The purpose of this article is to show that the traditional schemes for managing organizations become inadequate, and in the best of cases insufficient to treat increasingly complex systems. The absence of response from the dominant paradigm of management emerged to try to reduce the complexity of systems characterized by permanent increase complexity.

The absence of response from the dominant paradigm of management is manifested in inflexibility of business organizations to adjust to new situations, fragile to continue operating successfully in spite of the changing environment, and slow to make decisions in environments characterized by high flows of information. That is, inflexibility, fragility and slow business organizations arise from the limited ability to address the growing complexity of the environment.

The term dominant paradigm of administration, and / or traditional pattern, refers to organizational and administrative theories that are part of the functionalist approach of the sociology of organizations initially raised by Burrell and Morgan (1979), and subsequently addressed by various authors such as Alvesson and Deetz (1996), Jackson (2000), Tsoukas and Knudsen (2005). The functionalist approach that includes theories usually emphasize the importance of order and stability, as well as ways

in which they can be achieved and maintained in society (Burrell and Morgan, 1979).

The first part of the document refers to the characteristics of the administrative and organizational theories of the dominant paradigm of organizational management. The second part presents some of the elements that show that theories and administrative organizations that are part of the functionalist approach treat improperly the complexity of the organization, which explains its inflexibility, fragility and slowness in decision making. Finally, the discussion and conclusions are presented.

Main features of the dominant paradigm of administrative and organizations theories

This document refers jointly to organizational and administrative theories considering complementarity between these and their proximity and relationship in their origins, representative authors, theoretical influences, and field of study. This under the premise, as posed by Ramirez Vargas and de la Rosa, (2011), that apart from their differences, The most important is to recognize their ties as a basis for comprehensive understanding of organizations and their administrative practices.

The dominant paradigm or functionalist approach is strongly rooted in the sociology of regulation and the objective approach to the social sciences. Regulation describes sociology theories focused on the pursuit of status quo, social order, consensus, integration, social cohesion as well as the need of satisfaction. The objective approach of the social sciences is characterized by realistic, positivist and deterministic approach.

The most commonly used metaphors to describe this approach are the metaphor of the machine, the organism, and the flows and transformations (Burrell and Morgan, 1979), (Morgan 1996). The machine metaphor is widely represented by the theory of bureaucratic administration, the theory of scientific management, operations research, systems analysis and systems engineering. The organization metaphor arises from the proposed organizational equilibrium theories, socio-technical systems, and contingency theory. For its part, the metaphor of the flows and trans-

formations refers to the theories of open systems and dynamic systems (Table 1).

Table 1. Organizational theories from the functionalist approach and some contributions to the mainstream of management thinking.

METAPHOR	THEORY	CONTRIBUTION TO APPROACH OR DOMINANT PARADIGM FUNCTIONALIST	SOME AUTHORS
Machine metaphor	Theory of bureaucratic administration	Division of labor, hierarchical structures and establishment of forms of government supported in rules and control mechanisms	Weber (1964)
Machine metaphor	Scientific management theory	Proposals aimed at increasing profitability, productivity and business efficiency through systematic patterns of work and organization.	Taylor (1975) Fayol (1973)
Machine metaphor	Operations Research	Identification and measurement of factors affecting business efficiency such as men, materials, machinery and capital as well as the opportunities and risks.	Ackoff and Sasieni (1968) Boothroyd (1978) Churchman, Ackoff, and Cook, Cook and Luck (1984) Eilon (1983) Muller-Merbach (1984)
Machine metaphor	Systems Analysis	Identification of the regularities in the system from the systematic review of cost, effectiveness and risks. Regularities facilitate the definition of policies, strategies and courses of action that suggests the idea of greater control and predictability of the expected results.	Hitch (1955) Miser and Quade (1985) Quade (1963)

Continúa...

METAPHOR	THEORY	CONTRIBUTION TO APPROACH OR DOMINANT PARADIGM FUNCTIONALIST	SOME AUTHORS
Machine Metaphor	Systems Engineering	Design of complex systems by identifying interrelated subsystems. It aims to increase efficiency and predicting outcome.	Hall (1962) Jenkins (1972)
Organization Metaphor	Theories of organizational equilibrium	Organizational behavior arise from emergent properties that can be explained in terms of individuals and / or their relationships. The work of Simon explains behaviors in the organization from the bounded rationality of individuals. Barnard's proposal emphasizes the establishment of the social structure that work towards a common purpose as a condition for a group of people receive the organization name.	Simon (1964) Barnard (1938)
Organization Metaphor	Theory of socio-technical systems	The behaviors in the organization arising from the relationships between social, economic and technological dimensions in which the system is divided. From this perspective the survival of the system is achieved to the extent that jointly optimize the organization and display in constant interaction with the environment.	Trist y Bramforth (1951), Emery y Thorsrud (1969) Blacker y Brown (1980) Emery y Thorsrud (1976) Hill (1971) Pasmore et al. (1982)

Continúa...

METAPHOR	THEORY	CONTRIBUTION TO APPROACH OR DOMINANT PARADIGM FUNCTIONALIST	SOME AUTHORS
Organization Metaphor	Contingency Theory	Emphasis on relationships between the different subsystems in which the organization is divided. The subsystems are interdependent and develop specialized and imperative for the survival of the system functions. Theorists have contingency agreement against what the imperatives subsystems, as these arise according to the surrounding conditions.	Lawrence y Lorsch (1967).
Flows and transformations Metaphor	Theory of open systems	Organizations are energy systems raw material-result in the outputs reactivate the system.	Katz y Kan (1978)
Flows and transformations Metaphor	Theory of dynamical systems	The principle of feedback can regulate the system, which facilitates the understanding of the evolutionary behavior of the organization and its intervention and manipulation.	Forrester (1961)

Source: prepared by author.

Functionalist approach theories share the vision of the business organization as an instrument designed to facilitate the achievement of objectives through hierarchical control systems. The objectives focus primarily on higher levels of profitability, productivity and efficiency. However, at some level, they move away from the regulatory and objectivity of the system; It is the mechanistic approach that offers the highest levels of restriction on individual performance, and the flows and transformations which, within the functionalist approach, raises as critical to the understanding of the organization as a machine.

Regulation and objectivity of the functionalist approach is closely related to the use of hierarchical control systems. The control can be top-down, bottom-up or middle-up-down. Top-down controls are defined and

implemented from senior levels to the levels subordinates and manifest through rules, regulations, policies and other mechanisms that seek to standardize and homogenize the capacity of action of individuals. Bottom-up controls are characterized decisions are made at the lower levels of the system. Senior managers give short orders and instructions and serve as sponsors of frontline employees. The operating principle is the autonomy and interaction. These organizations have a flat, horizontal, and usually three or four layers of management between senior managers and the frontcourt. In central control systems middle-up-down, people in mid-level positions play the central role in the process. These roles define when to involve people who are up and down the organizational ladder.

Hierarchical control systems is supported by design routes and / or best courses of action to achieve the purpose for which the company is created. The best results (ideal, better) correspond to those who manage to minimize or maximize certain measures of performance such as durability, performance, productivity, growth, competitive position, quality, among others.

Optimization requires knowledge of the conditions and / or variables that affect the phenomenon under study. To this end, the administration is usually supported on mechanisms to reduce system complexity; and consequently information is acquired to suggest the idea of handling higher level decision making. Reducing complexity helps to reduce the number of variables, elements, agents and relationships, to explore, control and manage to achieve the desired goal.

From the perspective of the internal complexity of the organization, at least four mechanisms reducing complexity can be identified: a) breakdown of the organization into simpler units, b) the expertise of the parties, c) standardization of the system, and d) central controller.

Decomposition and/or division of the company into functional areas, processes, departments, business units, among others, assumes that the system is a rigid body which can be divided into parts, and to the extent that such parts represent smaller level management, it is increased.

Specialization is associated with the assumption that the whole is equal to the sum of the parts, so that when any component of the system is affected, proportional impact on others and on the drive components is generated. In every area, specialization seeks to develop skills, competencies and strengths to achieve the defined objectives, and broadly, the desired future.

The central controller (leader, strategist), that makes reference position in the network that intermediate in the process of communication between different people, is responsible for taking the company from an initial state to the desired future state.

Meanwhile, standardization, defined patterns, rules and general guidelines ensure that the actions of people in the organization are framed within certain parameters. The canon of harmony from this element is in operating manuals, handbooks, responsibilities, characterization of processes, procedures, policies. Standards are fixed and can evolve to the extent that the administration sets new models.

The need to use hierarchical control systems is closely related to the assumption of individual rationality. Supporting rational economic behavior, it can be understood in three ways: a) to a more abstract level, when we say that everything real is rational. The irrational (the unknown) means the measure of our ignorance, b) a more operational level focuses on assessing the rationality of individuals with respect to their own purposes, and c) from a policy perspective, it is defined as rational all behavior orientation referred to achieving some objectives and how to implement them. Everything that escapes from this scheme is irrational (Passet, 1996). The assumption of rationality denotes the limited information (widely developed by Simon, 1979) the pursuit of private gain, selfishness, and broadly human propensity to opportunism. Hierarchical control systems have been the way to reduce risk in decision-making generated by the individual rationality (Williamson, 1975).

Using hierarchical control systems as a means to try to reduce the complexity of the system to facilitate maneuverability, evidence that the dominant paradigm of administration is characterized by the linear ap-

proach. Linearity as a perspective for understanding business organizations assume that the system has one or some alternative solutions, usually encompassed by aspects such as vision, the commitment stage, objectives, among others, and therefore it is necessary to define the optimal route, ideal or feasible, to allow to reach it.

Linearity is a mathematical concept associated with homogeneity principles and overlapping (Gabel and Roberts, 1994). Homogeneity is met when the output is proportional to the input: small changes produce small effects, and great ones cause large effects. The superposition states that the sum of the whole is equal to the sum of the parts.

The homogeneity principle or the search of proportionality on the dominant management paradigm appears in the tendency to identify causal relationships between various organizational phenomena in order to allow the future of the system to be planned, foreseen or explained. The dominant paradigm of management success of a product, a business or an organization is proportional to a number of factors of merit or relevance. A product is consolidated in the market because it meets customer requirements of design features and of technical standards. The entrepreneur is successful for their leadership, the ability to listen, and their vision of the business. The business organization is successful in the organizational culture, customer focus, management commitment, and high quality standards, among others. In the conventional approach, success is the effect generated by one or more causes. Consequently, business results are studied, understood and planned *ex ante* (Watts, 2006).

The superposition principle in the dominant paradigm of management is evident in the division of the system into parts and functional areas, processes, departments, and projects, among others. The division of the system involves the idea of easier to manage. If people from the production area conduct their business according to certain objectives, the Human Resources team works according to certain procedures, and the sales team acts in compliance with protocols; the sum of the results of the different areas will achieve the vision, the objectives, or achieve the goal.

Searching for linearity of traditional management by means of the above elements reduces system complexity. This approach is suitable to act for stable and simple environments where levels of interaction between the organization and the environment are low and, therefore, the information does not change or is done slowly. That is, to act in environments characterized by permanent increasing complexity manifested in increased information and, therefore, novelties, such as business organizations, the use of systems of hierarchical control, reduced complexity, and broad system linearity are irrelevant, thus generating more disadvantages than benefits for the organization.

Reviews and failures of the dominant paradigm

The linearity that characterizes mainly the current administration thought is explained by the hypothetical-deductive character taken from the physical and natural sciences. The methods and approaches of the social sciences come from classical physics and engineering (Maldonado, 2009). Hence the analogies of the company as a machine, people and system parts, the search for maximum business efficiency, and the use of control systems that maintain the stability of the system.

The linear approach that characterizes the organizational and administrative theories of greater application in the business context means that one can control and determine the behavior of a social system through the laws that govern the physical world. From this perspective, social reality and the reality of organizations is immobile, fixed, periodic and regular. Organizational theories supporting linearity maintain the idea that the state of the world determines exactly how things will unfold in the future, being equivalent to an orderly world in which everything can be planned and controlled.

The approaches of organizational and administrative theories of the functionalist approach are consistent with the one presented in classical physics. Whatever the dynamic studied (business organization, economic sector, etc.), the form of the laws of motion ($F=m.a$) remains as a valid system. Broadly, it can be said that the dominant paradigm for understanding business organizations, rather than to refer to mass and

acceleration, talks about system attributes, and instead of forces, it refers to how relations between the parties are made. That is, the dominant administration paradigm modified the empirical content of laws of classical physics, but not their form, characterizing it by universality, determinism and reversibility. Three aspects covered extensively by Prigogine and Stengers (2002) in the study of dynamic systems.

Universality refers to the possibility of knowing the expected behavior of the system from certain input data (eg identifying key success factors for the development of innovative, enduring, sustainable organizations, etc). Determinism is evident in the importance of initial conditions (knowledge of the current situation), as well as the power to influence system performance through the use of control systems. Reversibility acts in the manner of an imaginary experiment in which the movement of a ball, from the structure of certain equations, makes it possible to know its future speed or speeds past certain points in time. It is based on the knowledge that provided certain initial conditions, it is possible to define the future state of the organization (vision, commitment stage), or the objectives to be achieved to strengthen the desired future.

Universality, determinism, and reversibility are traits of conservative systems in which, as the name implies, disturbance memory is preserved along the entire future. Its dynamic is invariant with respect to time investment; and therefore, it is completely at the mercy of disturbances acting on them (Nicolis and Prigogine, 2007).

The linear approach is suitable to act in stable and simple environments where the emergence of new situations is slow. However, trying to plan, predefining the future of the business organization, which is characterized by increasing complexity, means maintaining the system in balance, which is irrelevant because it supposes the organization and its surroundings do not change or exchange information in time (Kickert , 1993).

Broadly, it can be said that the linear approach to management, and more specifically the use of hierarchical control systems, has generated more disadvantages than benefits for management. Control systems hinder detection and timely implementation of changes that will enable the

organization to evolve and to respond to new possibilities (Jensen, 1993, 2010), diminish the diversity of people (Turnbull, 2002), and hinder the use of space of possibilities, because in trying to standardize the behaviors makes the response of employees and system to changing situations inflexible (Stansbury and Barry, 2007); They are permeable to corruption (Turnbull, 2002); and comprehensively respond poorly to the complexity of the environment (Watts, 2006).

In the same way, research by Jensen (1993, 2010) identified that the control systems operating in a high number of cases, when organizations are already reporting huge losses. For example, General Motors decided to change the CEO and the company's strategy after reporting losses of more than \$ 6.5 billion during 1990 and 1991. IBM changed its strategy after reporting losses of \$ 2.8 trillion between 1990 and 1992 and a decrease of at least 65% in added value. Similar cases were found in Kodak, Xerox, Westinghouse, among others.

Jensen (2010) also found companies like General Electric or General Mills, who took timely decisions to take advantage of certain market conditions. However, the author found little evidence that these decisions have resulted from control systems.

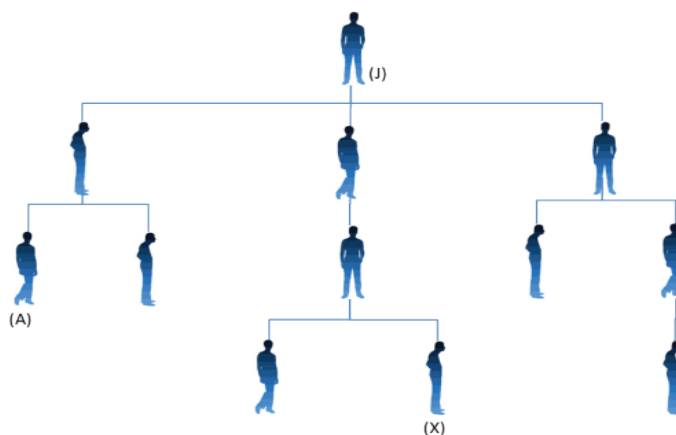
Stansbury's and Barry's work (2007), shows that the control systems, such as codes of ethics, generate indoctrination, politicization and atrophy of skills. Indoctrination refers to the inculcation of learning that limits the thought system and is based on the authority of the "professor" (Stansbury and Barry, 2007). The politicization involves the use of codes as tools and instruments of political use through which the balance of interests in the organization is sought, the alignment of employees towards some forms of behavior, etc. Atrophy of skills manifests the tragic effect of behavior patterns, as it affects negatively imagination, creativity and innovation, as well as reduces the adaptability of employees to new circumstances, something that, in complex environments, reduces the possibility of response.

Similar results appear in the work of Helin, Jensen, Sandström and Clegg (2011), who demonstrated empirically "the dark side of the codes" as

instruments of domination, coercion and application of negative forms of power, aimed at mobilizing employees for certain forms of action.

The research of Turnbull (2002) shows that the greater the control of information by the hierarchy, the more difficult it gets to expose and / or alerting the parts involved. The controlling shareholders may require the directors or managers to develop actions that harm public interests. Hierarchical control blocks external feedback (from customers, suppliers, and society in general). Therefore, it threatens the existence of the organization, due to the ease to corruption.

Hierarchical systems respond poorly to the complexity of the environment because they are poor in the redistribution of information. Imagine a company where every activity is monitored, coordinated and approved by a chain of command, as displayed in Figure 1. If the person “A” is to send a message, for example, an information request or assistance to the person “X” in a pure hierarchy, the information must go through the chain of command before reaching the predecessor person in common (“J”) that can relay the message to the recipient. Yet, for the transmission of the information to occur adequately, it depends on each person performing the task of processing information. The problem is that not all people are equally loaded. As the information is further up the chain of command, more people transmit messages through that person and, consequently, the greater the burden of processing information, which generates congestion of information. In companies organized hierarchically, the information is so unequally distributed that, unless something is done to accommodate the load, the company fails (Watts, 2006).



Source: prepared by author.

Figure 1. Hierarchical Organizational Structure

Hierarchical control systems are vulnerable to breakdowns and failures related to congestion of information and, for the same reason, do not respond well to crises. If any of those who are found in higher levels in the chain of command fails, large chunks of the organizational structure will be isolated from other people in the organization, making communication impossible.

Hierarchical control systems seek to reduce complexity to ensure compliance with one or more predefined goals, but as a residual effect it generates deficiencies in the distribution of information in the system; and therefore business organizations are inflexible to adjust to new situations, fragile to continue operating successfully in spite of the changing environment, and slow to make decisions in environments characterized by high flows of information.

These failures demonstrate the ironic sense of using hierarchical control systems in the administration, given that, in their quest to achieve collective goals, they apply mechanisms that hinder the achievement of the latter (Bohórquez, 2011). However, the importance and need for control is so pervasive in the dominant administrative model, that failures are

accepted as part of the natural order of things (Turnbull, 2002). The need for control is supported by the idea that the interdependence between individuals characterized by diversity requires the implementation of mechanisms to ensure the compliance of the agreements and the fulfillment of the objectives set by management.

Importantly, failures in the management of organizations have been identified by various authors such as: Prahalad and Hamel (1994), they highlight the difficulty of implementation and obsolescence of administrative practices; Mintzberg H. (1994), who shows, among other things, the lack of flexibility of the models; Ormerod (1997), who criticizes the search for mathematical precision of the economy and by extension of the administration, and Schulman (2011), who points to the obsolescence of administrative models. Bruner (2002), Coffey, and Holbeche Garrow (2003); Dimara, Skuras, Tsekouras and Goutsos (2004) and Bohórquez (2010) show that the different business practices, such as those aimed at improving productivity, efficiency and effectiveness, do not generate the expected responses.

A science that proves and seeks system uniformity destroys the diversity, transdisciplinarity is destined to produce ugliness, danger and ultimately failure (Bateson, 2002 and Tiezzi, 2006). The main error of the current dominant administration thinking has been the broad tendency to reduce and linearize behaviors of organizations characterized by growing complexity.

Discussion and conclusions

Overcoming inflexibility, fragility and slow business organizations requires the development of theories, models and practices to exploit and increase the complexity of the system; and emphasize the relational behavior (adaptive) of individuals rather than their rationality. This approach is in clear opposition to the reductionist approach and rational management of the dominant paradigm (Table 2).

Table 2. The contradiction between the dominant paradigm of administration and the nature of business organizations

	BUSINESS ORGANIZATIONS	DOMINANT PARADIGM OF ADMINISTRATION
General feature	increasing complexity	Reduced complexity
evidence	Permanent emergence of new situations, events and / or properties (randomness, business turbulence, uncertainty)	Using hierarchical control systems
implications	The organization has multiple behavioral alternatives	The organization focuses on the achievement of an alternative solution, usually encompassed in areas such as vision, objectives, strategies, etc.
Elements that generate complexity	Organizations are made up of people interacting.	Organizations are made up of people interacting.
Assumption underlying	Decisions of the people come from more rational adaptive behaviors	Decisions of people respond to their rationality

Source: prepared by author.

One of the fundamental aspects to harness and / or increase the complexity of the organization is the design of organizational systems characterized by the absence of hierarchical control. That is, systems that emphasize the emergence of collective behaviors from the interaction between various individuals who make decisions without the intervention of central controllers (leaders, strategists, etc.) that determine the behavior of the system.

The absence of hierarchical control systems allows to increase the system dynamics, which is not equivalent to chaotic organizations. The fact that there are not defined implemented mechanisms to homogenize or stan-

standardize the system does not mean that the organization does not exhibit behaviors as an organized whole.

The failure of business organizations supports the conclusion that the traditional administration has not only been insufficient to meet the requirements set forth in its own paradigm (fulfillment of objectives, achieving the vision, etc.), but has also generated large negative impacts outweighing greatly the benefits. This highlights the need for new theories, models and organizational and administrative practices that increase the degrees of freedom of the business organization; i.e. to grant greater autonomy and independent movement systems for decision-making. A greater autonomy and independence, better generation and spread of the information circulating in the organization; and therefore better ability to absorb the complexity of the environment.

In this line of thoughts, there is to date a large number of proposals and research. Harrison and D. Rouse (2014) demonstrate the importance of autonomy for decision-making and tensions (conflicts) in work teams as a means to collective behaviors that take advantage of emerging situations in the environment. Aime, Humphrey, DeRue, and Jeffrey (2014) demonstrate through empirical research the importance of heterarchies (power shifts) as a mechanism to increase creativity and align the capabilities of the team members with the changing environmental conditions.

Shipilov, Gulati, Kilduff, Li, and Tsai, (2015) remark the importance of networking interactions between people to facilitate adaptation to changing conditions. (Benedettini & Neely, 2012) suggest the importance of using technology-based alternatives to facilitate access to information and thus address the problem of the increasing complexity that characterizes the business environment. Tihanyi, Graffin, and George, (2014) highlight the importance of rethinking the organizational governance considering aspects that insert uncertainty to the concept of business environment such as interest groups, the implications of big data, social impact, overall dimensions, and others.

The antithesis to hierarchical control systems, regardless of how the control (up-down, bottom-up, middle-up-down) is present are self-orga-

nized (Bohórquez, 2014) systems. Self-organization has been understood as the emergence of collective behaviors from the adaptive interaction between the parties (Di Marzo Serugendo, Gleizes and Karageorgos, 2011) and in the absence of control systems that impose information to systems (Bonabeau, Theraulaz, Deneubourg, Aron and Camazine, 1997). Self-organizing systems are currently becoming the alternative to overcome the problem of poor management of complexity exhibited by ordinary use of control systems (Beer, 1981), (Camazine, Deneubourg, Franks, Sneyd, Theraulaz and Bonabeau, 2001), (Watts, 2006), (Laihonen, 2006).

To date, advances in the design and implementation of business organizations that act as self-organized without central controller systems are in early stages. The major approach, in human systems mainly come from the proposals made from the organizational cybernetics, and to a lesser extent the proposals supported in the sciences of complexity (Bohórquez & Espinosa, 2015).

The study of business organizations as systems of increasing complexity, and more specifically, as the absent of hierarchical control systems show important lines of research projects around issues such as business organizations as self-organizing systems, leadership and complexity, hierarchical organizational structures in absence of hierarchical control, decentralized decision-making organizations, emergent collective behaviors without the intervention of central controllers, and wide design of business organizations to harness the complex environment.

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