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Trans-complexity: a management fad or a mathematical construct

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Abstract. Trans–complex organizations concept has been introduced in the management science, even becoming an object of study. In the global context, definitions, concepts, research and philosophical or practical proposals have emerged for the understanding of organizations from a trans-complex perspective. In this work, a critical position of trans-complexity is presented as a historical discovery that associates a new characterization of phenomena: for example, in exchange for trans–complex organizations, a trans-complex epistemic vision of social organizations is proposed. Thus, the trans-complexity is ratified not as a quality, but as a requirement of epistemic order of scientific research. From this perspective, that complex organization can be explained through elements such as uncertainty, chaos and self-organization, with an epistemological explanation of systems theory, decision theory and dynamic systems theory. This paper shows the trans-complexity more than a management fad, an analysis model or a management topic, as an element to be incorporated by researchers in the construction of theoretical frameworks and methodical designs of their researches in order to purpose significant contributions to science, and to the organization itself, based on such important mathematical theories.

1. Introduction

Trans–complexity is appropriate as an epistemological neo-approach that gives rise to methodological neo-approaches to undertake research on social phenomena. These methodological neo-approaches appear allowing the episteme emerge, since trans-complex dialogue is institutionalized by denoting the search for new directions; materializes as a new epistemological and methodological vision, aimed at understanding and intervening in social reality [1].

Indeed, in [2] the author refers in the context of trans-complexity, to the worldview, to multiple visions, or to argumentative and propositional reciprocities, when it comes to addressing social phenomena, none of which leaves off being complex. From this perspective, the management of highly complex social organizations is conceived as a social phenomenon, with multiple presumably foreseeable implications for human life. However, trans-complexity as an epistemological and methodological stance is used to analyze these implications. In this area, in

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exchange for trans-complex organizations, this article will talk about a trans-complex epistemic vision of social organizations. In other words, the organization itself is not presented as a trans-complex fact, but as a complex fact that merits a trans-complex epistemic and methodological position, for its comprehensive study.

In order to characterize social organizations from a trans-complex epistemic vision, it is necessary to know that "trans" means beyond or on the other side or through; while "complex" means that the social organizations have an endless number of elements that are interrelated in an endless number of ways, which must generate a balance to the organizational system. In [3], social organizations are defined as social entities, addressed to objectives, conceived as a system of coordinated and structured activities and linked to the external environment. Under this concept, the author refers to the existence in social organizations of an open, dynamic, synchronized and holistic organizational system, guided by a vision that requires the definition and internal and external configuration of the elements of the organizational structure. Figure 1 shows a scheme of the complex organizations. Such scheme describes six components of this complex organization and establishes that such components must interact with each other.

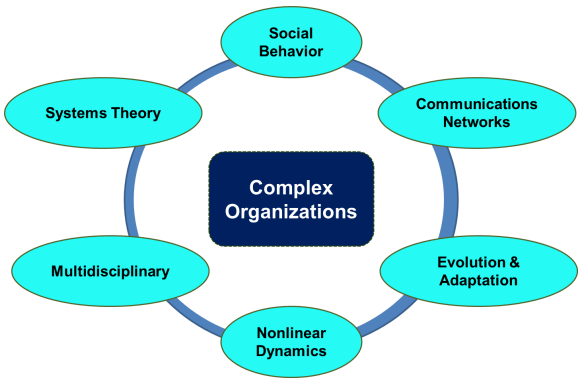


Figure 1. Complex organization scheme.

The organization cannot be studied without studying the man who forms it, since every organizational system is ruled by people. The organizational socialization studies performed in [4], were based on the behavioral sciences and the administrative sciences for understanding what happens to the individual when he enters an organization and accepts to belong to it; also the impact on the organization. It is about deepening in human and organizational aspects, such as values, attitudes, learning, communication, culture, inexorably concluding in a relationship of bidirectional impact and full relationships of interdependence. Among the fundamental aspects of organizational socialization, the aforementioned authors mention the goals, the means, the responsibilities, the behavior guidelines, the identity and individual and organizational integrity observation, all these aspects of the interrelation systemic structure of social organizations.

The elements to which reference is performed and their intrinsic characteristics is what establishes the complexity as a quality of social organizations; complexity underlies the quantity, the nature and quality of the interrelationships between these elements, in order to establish and keep the organizational system in dynamic equilibrium. The framework of highly complex organizations analysis should be the complexity paradigm through a concept proposed in [5], in which it is indicated that complexity is an approach that considers the organization as a space where disorder and order, reason and unreason, harmonies and dissonances coexist. From this, it follows then that the organization itself is a complex system, in which its own dilemma is to live with different thoughts, criteria and arguments that may be the dynamics of the daily work of a complex network of interpersonal and intrapersonal communications within itself.

A social organization that requires a trans–complex epistemic vision is then configured, such as one whose complexity makes the understanding of the organization merit from the particular and/or holistic understanding of its elements. Therein lies the significance of each element, towards its relationship with the whole. Then the different disciplines of the sciences appear, especially the psychological, the sociological and the managerial ones, which give the epistemological base to organizational trans–complexity. Note that here reference is performed to trans–complexity in the understanding of the organization, and not to the trans-complex organization; that is, trans-complexity is not seen as a qualifying adjective of the organization, but as an epistemological, and even methodological fact.

In this work, a documentary research is initially considered in order to establish the theoretical bases of the called trans–complex organizations, without forgetting that they correspond to organizations with high degrees of complexity. And then, from these theoretical considerations a mathematical construct that supporting the trans–complexity as perspective to understand the phenomena associated with social organizations is proposed.

2. Materials and methods

Taking into account the objective and the information nature, the research process is established as a qualitative approach, being that it seeks to conclude about the validity of an analysis scheme based on the comparison the information provided in a theoretical framework. In fact, the qualitative approach of scientific research focuses on finding the depth of meanings, reasons and details of the phenomena investigated [6].

The level of investigative scope of this research is descriptive, by virtue of which the nature of the theoretical approaches must be defined, and the informational capacity of the documental sources determined; the contrast of both perspectives will attest to the practical usefulness of the second. Meanwhile, the descriptive studies seek to specify the important properties of the phenomenon that is subject to analysis [7].

Regarding the investigation design, this research is focused on the documentary review due to the fact that it corresponds to a strategy based on the analysis of data obtained from different sources of printed or digital information, for public or private use, data from which the researcher generates new information and establishes conclusions regarding the phenomenon studied [8].

3. Results

3.1. Trans-complexity in the social organizations: a historical overview

According to [9], all philosophy is born and develops framed within a horizon of historical requirements. Meanwhile, the emergence of the paradigm of trans-complex organizations, with its origins and meanings, must be referred to those historical demands coming from the context, referring to social-organizational problems and ideals, which surely were debated in light of current events and historical-cultural horizons [10]. However, trans-complex organizations as a topic, began with the formal epistemological contributions presented in [11, 12], converging on the characterization of trans–complex organizations, affected by the management of the diverse, due to multi-ethnic, multipurpose factors and uncertain in today's business world.

This is how trans-complex organizations emerge, without being a novel requirement, but rather as the ratification of the permanent requirement to enhance the particular behavior of the organization and the organizational actors, in the face of the changes brought about by the environment complex dynamic. The stance presented in [11] is based on the modernity crisis and modern knowledge, characterized by the agony of basic categories of modernity: reason, subject, progress, history, scientific method, by cultural displacement, mutations cognitive, revolutions in all instances, among others. Instead, the aforementioned author argues that only through a postmodern, trans-complex and multidisciplinary perspective can knowledge be created and an

adequate base established in order to think the problems of a polemical humanity. In [11], the requirement to take into account the trans-disciplinary and trans-complex epistemic practices, and characteristics of a specific intellectual movement (the postmodern) is raised in order to create knowledge in complex contemporary societies in the midst of a civilizing crisis.

Meanwhile, in [12] aims to spread a new episteme to respond efficiently to the social complexity experienced by the Western world and the difficulties of traditional logic, self-discipline of modernity. In that work, it is suggested that the complex thought is primarily a thought that relates, considering the closest meaning of the term *complexus* (which is woven together). This means that in contrast to the traditional way of thinking, which divides the field of knowledge into entrenched and classified disciplines, complex thinking is a mode of making connections between the whole with the parts and the parts with the whole [13].

According to [14], the disjunction of all human processes is currently observed, in a didactic effort, and this has caused the incomprehension and the disintegration of the whole into parts, which has led civilization to an uncertain course. In accordance with [15], in the last thirty years, the greatest techno-scientific development in the entire history of humanity can be seen, and yet there is also a setback, a gradual involution of everything that brings us closer to a greater understanding of the humanity as an essential part of progress.

Currently, societies are in a process of self–transition as a result of the formation of the knowledge society, which is affecting all areas, generating a series of changes in the social-eco-planetary environment [16]. Knowledge management allows the self-generation of new organizational capacities as well as the improvement of effectiveness, performance and productivity in self-eco-organized communities. Knowledge management is taken as a transversal and transdisciplinary approach that integrates multiple contexts, dimensions and disciplines, which requires an adequate meta-vision and meta-strategy to achieve effective management, as well as attractors and retractors for developing the theoretical foundation underlying to trans-complex perspective of the organizations. In Figure 2, a representation scheme of the epistemological emergence of trans-complex organizations is presented.

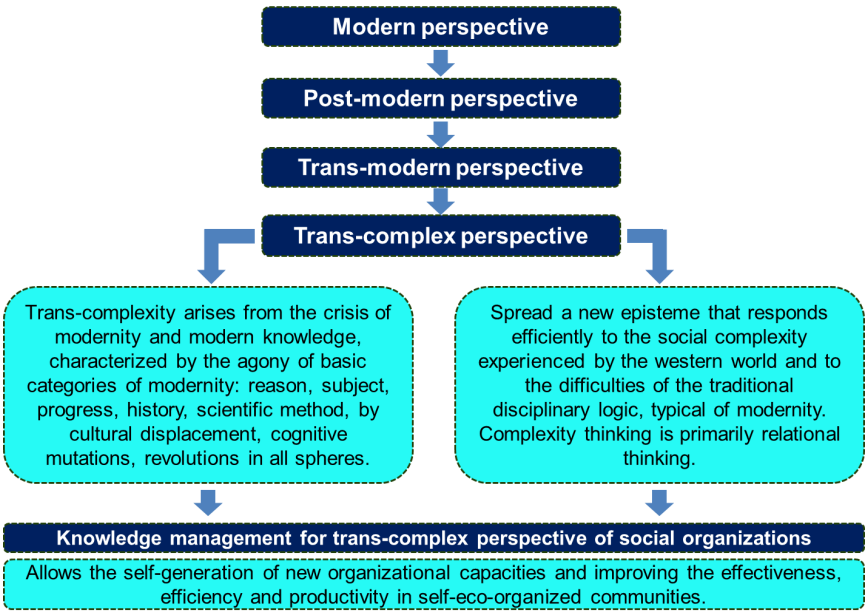
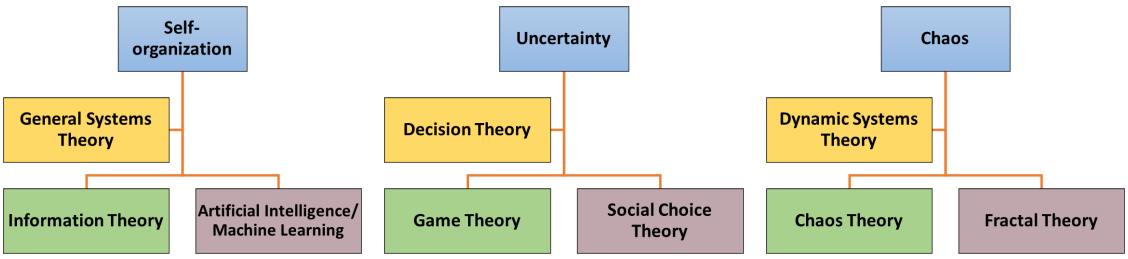


Figure 2. Diagram of the epistemological emergence of trans-complex perspective.

3.2. Trans-complex organizational phenomenon

Those organizations that require to be observed from the perspective of complexity are organizations immersed in a problematic context, which must be addressed by the management team considering different procedures than those traditionally used in the readdressing of the organization. The determining elements of the trans-complex phenomenon in social organizations are uncertainty, chaos and self-organization. Due to the systematic nature of social organizations, these elements must initially have an epistemological explanation based on general systems theory [17]. However, that explanation must also be based on decision theory [18] and dynamic systems theory [19].

The general systems theory supports the interdisciplinary study of the abstract organization of phenomena, regardless of their nature, type or space or time scale of existence. This theory uses information theory [20] and artificial intelligence/machine learning [21] to support the interdisciplinary framework of the regulatory structure of both physical and social systems. Based on this theoretical framework, self-organization conceived as the tendency of spontaneous ordering in complex systems, allows a social organization to develop the capacity of adaptation and orientation to a goal. Figure 3(a) shows the theoretical framework proposed for explaining the self-organization as an element associated to trans-complex phenomenon.



(a) (b) (c)

Figure 3. Trans-complex phenomenon. (a) self–organization; (b) uncertainty; (c) chaos.

The epistemological explanation of uncertainty can be reached through decision theory [18], which deals with analyzing how a person chooses an action that, from a set of possible actions, leads him to the best result given his preferences. Such a theory addresses the formal nature of individual decisions and analyzes various decision criteria based on the informational context in which the individual operates. However, the game theory [22] is fundamental to analyze individual decisions that are influenced not only by the contextual information available, but by the decisions of others. The game theory meets the formal study of strategic decisions, in which what a person chooses depends on the information you have about what others do. Additionally, in order to explain what would be a collective preference given the preferences of a group of people, the social choice theory [23] is considered, focused on studying and proposing criteria that allow adding individual decision functions in a single social decision function. The proposed theoretical framework of this research in order to explain the uncertainty as an element associated to the trans–complex phenomenon is shown in Figure 3(b).

In the trans–complex phenomenon, certain control techniques are required to avoid a possible chaotic response and force the system to reach a stable equilibrium point. The chaos element of complex phenomena can be defined and analyzed through the dynamic systems theory [19], especially if such elements evolve over time, as can be seen in the Figure 3(c). In a non–deterministic system, small changes can lead to totally divergent consequences. A small initial disturbance, through an amplification process, can generate a considerable effect in the medium and short term. Chaos theory [24] explains how coincidences and small details can greatly influence the future. In order to study similar characteristics of complex phenomena when they

are observed from different perspectives, the fractal geometry [25] is introduced. Thus, given an element with characteristics of self–similarity, if it has performed a succession of fractions in different sizes, the fractions of the resulting element will have generally similar characteristics.

3.3. The mathematical construct

As can be interpreted, there is a reciprocal relationship between disciplines around the proposition of a theoretical framework for understanding organizations from a trans-complex perspective. This interdisciplinarity implies exchange and collaboration between the theoretical and practical knowledge of various disciplines, as well as the transfer of methods from one discipline to another. For example, self-organization requires knowledge about fractal geometry as well as the theory of social choice. Each determining element of the trans–complex phenomenon in the social organization cannot only be explained with its corresponding theoretical framework (Figure 3). All the determining elements of the trans-complex organizational phenomenon must be able to be explained in an interdisciplinary way, by means of associated explanatory theories and sub-theories. A mathematical construct acquires its mathematical meaning of the theory, axioms, and theorems, in which it is included, and the propositions function as the postulates of meaning for the constructs of that theory [26]. Figure 4 shows the mathematical construct proposed to explain the trans-complexity as a social phenomenon in the management of social organizations.

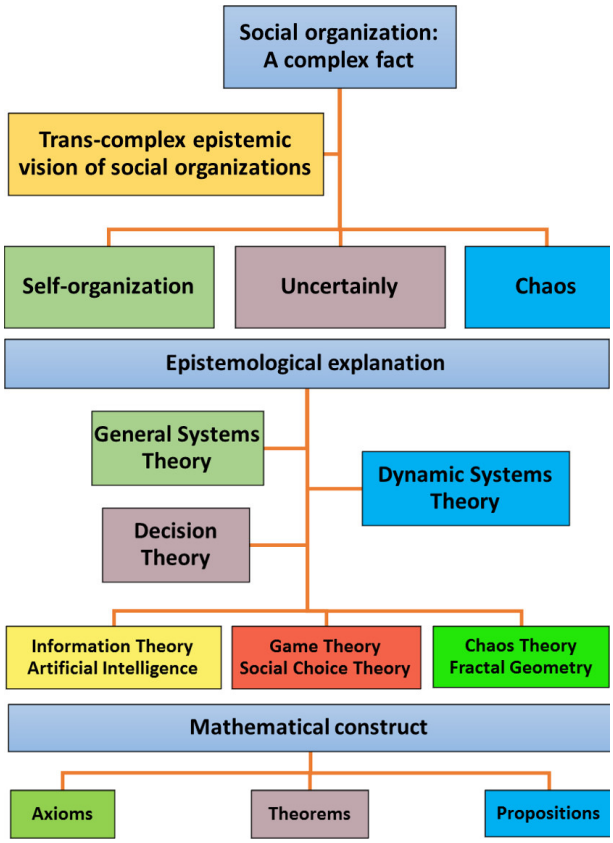


Figure 4. Mathematical construct for trans-complexity phenomenon in the social organizations.

4. Conclusions

This article starts from the premise that trans-complexity means, first of all, a break with the possibility of turning philosophy into a legitimizing discourse that displays a dominant ontological and cultural vision that restricts the consciousness of knowing. The configuration of knowledge from the trans-complex perspective allows the deepening of the reality levels, thus creating trans-relations so that new meanings, other identities and other interpretations appear that display a cognitive-sensitive apprehension. This last relationship induces a vision that combines the ontological with the epistemological, the objective with the subjective, aesthetics with research. Therefore, the trans-complex organizational phenomenon is increasingly popular in all contexts, with the pragmatic and the epistemological being the most important.

Trans-complexity is assumed not as a paradigm based on epistemological assumptions, or as a "new" style of understanding the social organizations. In fact, it is conceived as a "per se" ontological element of social organizations in its systematic quality, therefore complex. It is not chosen to understand of trans-complexity as a historical discovery that associates a "new" characterization of phenomena, ratifying the trans-complexity not as a quality, but as a requirement of an epistemic order of scientific research.

Trans-complexity phenomenon in complex organization can be explained through elements such as self-organization, uncertainty, and chaos, with epistemological explanation of general systems theory, decision theory, and dynamic systems theory. Additionally, trans-complexity is shown more than a management fad, an analysis model or a management topic, as an element to be incorporated by researchers in the construction of theoretical frameworks and methodical designs of their research.

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