

Challenges and Opportunities of Complex Thinking as an environmental Management Issue

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Abstract: This essay attempts to describe the historical aspects of complex thinking (CT); with a current example of the impact that this concept has had on the subject of Environmental Management; considering that to carry out environmental management within the framework of sustainable development it is necessary not to have a reductionist and deterministic approach to the environment but should be framed in the theory of complexity. In this order of ideas, the arguments that we handle about the paradigm of complexity are rooted amid adverse conditions, but with the hope of enhancing and recovering so much means lost in the weeds of a disjunctive, reducing, and simplifying thought.

Keywords: Complexity, Complex thinking, Sustainability, Sustainable development.

Overview

The paradigm of complexity, according to various authors, is a set of theories, ranging from Von Bertalanffy's systems theory [1], or dynamical systems, to the theory of complex adaptive systems, nonlinear dynamics, non-equilibrium theory, and chaos theory. Edgar Morin takes it as a starting point for the elaboration of his epistemology of complexity, which will be useful as a wide application in the field of social sciences and education. It is in this area where the expression *complex thinking* (CT) is inserted, conceived as the thought that deals with uncertainty and can conceive the organization and articulation of knowledge as an active circular process, it is the thought suitable to unite, contextualize, globalize, but at the same time to recognize the singular, the individual and concrete. In his work "*The seven knowledges necessary for the education of the future*" [2], the author tells us that the knowledge of reality is affected by a series of mental/intellectual reasons, and paradigmatic blindness errors. The author points out that to overcome these biases we must take into account the situation, the relationships between the whole and the parts, and the set of the many causes and the historical and cultural roots. Research has also been done on the development of the concept of CT in education, arriving at conclusions that, to achieve educational goals, should be necessary for a teacher to get a change of mind and learn "teaching to think" "as an educational innovation [3].

A new interpretation of knowledge

The term "complex thought" (*pensée complexe*) is coined by Edgar Morin (known as the father of the CT), and includes multidimensional elements of the reality of the world; it is a strategy of thinking that reflects what we have in front of us: it sees the world as an inseparable whole [4]. It proposes a multidimensional approach, based on three principles: a) Dialogic; b) Recursion; and c) Holographic. Considering that a Paradigm is a mental and cultural structure under which reality is viewed; in the words of Edgar Morin the problem of complexity is about thinking and living, which does not mean a conquest of knowledge, but giving an adequate description of reality, and that antagonistic versions must be thought together [5].

The environment is undoubtedly a complex system and as such is a representation of a part of reality and is conceptualized as an organized totality (hence the name system), in which the components should not be "separable" and, therefore, should not be studied in isolation [6]. Consequently, to carry out environmental management within the framework of sustainable development, it is necessary to go beyond their reductionist and deterministic approach to the interpretation of the environment, to explain, not only the structural aspects of the systems, but the processes through which the environment evolves, develops, and changes.

For the approach to environmental problems, the participation of transdisciplinary teams is essential, which implies recognizing the impossibility of understanding the multiple dimensions of environmental reality from a single discipline. For this reason, when we approach environmental management, we must analyze these dimensions, which entail the use of multiple theoretical and practical references. Thus, in our case, when working in environmental management, it is necessary to incorporate diverse perspectives, knowledge, and feelings that validate both intersubjectivities and descriptive analyses from different fields such as

administrative, biology, mathematics, economics, geography, physics, law, cybernetics, sociology, waste management, water management, engineering, urban planning, education, participation, among others [7].

When we speak of a paradigm shift concerning the understanding of reality, it incorporates, not only everything we can imagine but also the deconstruction of the set of precepts and accepted assumptions that function as the structural basis of our forms of understanding. And if we can interpret in a multidimensional way all the phenomena around us, this will involve thinking, rethinking, and seeing what we thought differently. Thus, the possibilities of creativity and innovative capacity emerge and are amplified, as one of the immediate consequences. Learning to integrate multiple disciplines, including other knowledge, implies relieving the capacity for reflection, innovation, and problem-solving. This, in turn, allows for increasing the creative capacity which leads to a mental transformation. Integrating consists of establishing connections between all kinds of knowledge and experiences; in the case of environmental sustainability occurs when natural resources are preserved. Monocropping, pesticides, and fertilizers all deplete good soil. When that soil becomes sterile, it can no longer produce food.

CT proposes a non-reductionist worldview that assumes the unity of the real, the union between mind and body, and between person and nature. treating the opposite or opposite, as complementary; associating the subject with the object of knowledge, with which knowledge is contextualized, and recognizing the integral, organic and relational relationship as fundamental to the learning process.

Final reflections on learning

Whereas to carry out environmental management within the framework of sustainable development, it is necessary not to have a reductionist and deterministic approach to the environment; but, within the framework of complexity theory; it is necessary to take into account the historical aspects of complexity and CT with a current example of the impact that this concept has had on the environmental concerns about the sustainability of natural resources.

Columbie Puig [8] visualizes the need to consider environmental problems from a complex approach; based on the fact that the environmental crisis is also cultural, and that to achieve a harmonious relationship between nature and society, "*new philosophical, epistemological, axiological and cosmovision conceptions are required*"; while Fernández and Gutiérrez [9] emphasize social, economic and environmental well-being for the present and future generations.

Redefining the concept of sustainability from CT is not a simple task. When it comes to including the social aspect to achieve sustainability, difficulties appear; since according to Luna-Nemecio [10] lacks a specific epistemology and it is not possible to define priorities that ensure urgent transformations to achieve sustainability and development, as well as to build a transdisciplinary process focused on collaborative training projects aimed at generating the urgent transformations that are required in social organization, education, production and consumption processes, urbanization and biodiversity protection. Although, Leff [11] differentiates between sustainable and sustainable development and accepts that both concepts hide "*the real environmental crisis derived from economic activity*", and blames the capitalist model as a degrader of the environment, in complicity with a utilitarian society that does not repair its environment; we cannot exclude that integrating consists of establishing connections between all kinds of knowledge and experiences that are reflected in environmental management.

All these connections are made with the purpose that the students can appropriate the concept of CT and transdisciplinarity as a non-fragmented whole applicable in the integral process of environmental impact assessment, with environmental management itself and its multiple remedial actions.

Approaching environmental management from complexity means then addressing it in thought all aspects of our daily lives, since if we recognize in our actions and interactions the constant construction and rebuilding of culture, we will then be founding consciousness and recreating structural models of adaptive behavior from the most basic actions such as walking, thinking or breathing, to the most complex ones such as local or global economic dynamics.[12].

The key to transdisciplinary work lies in the ability to question each other about environmental management and development, both dynamic, multidimensional, and interrelated concepts. According to Kuhn[13], scientific development is marked by profound changes (paradigm shifts), which occur in the contents of current theories and extend to practices, objectives, procedural rules, and evaluation criteria. Montuori [7] in his literature review of the complexity of transdisciplinarity, explores how this process can be approached from a complexity perspective and concludes that one of the main dimensions to address processes (in our case sustainability), is to apply systems theory and CT instead of reductive/disjunctive thinking. Previously, Bonil [14] had expressed the view that..."*The theory of complex systems is an explanatory model of the phenomena of the world with predictive capacity*"... and that "*complexity is an ideological choice, which assumes (believes or accepts) the contributions of the science of complexity and is the guide of a model of citizen thought and*

action". Other authors conceive of Complex Thinking as a mode of coupling defined both as (i) a coupling process (mode of coupling) and (ii) an outcome of that coupling process; this conception is influenced by a relational and enactive view of cognition, where cognitive activity is conceived as "a history of the structural coupling that brings forth a world" [15]. And of course, there is not a lack of criticism of the CT and Morin's theories, it is argued that CT does not have enough rigor because of its lack of the scientific method in complexity sciences and also that CT is based on a discursive nature [16]. However, Viguri [17] has some objections to this, and analyzes the implicit concept of scientificity in Reynoso's thinking and proposes the need to articulate philosophical thinking and empirical methodology to understand the complexity and its sciences.

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