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Phd Thesis - Abstract

The usage of a sustainable cybernetic model as a crisis management instrument

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Summary

This thesis aims to develop a cybernetic model with applicability in crisis management, in the context of sustainable economic development. This model makes a transition to a society without crises, supporting economic growth and increasing quality of life, developing a tool that determines technical solutions in the development of applications through the analysis of theories and research based on cellular automata, feedback, and projective geometry. A society in which there are no crises is based on educating the population in the use of thinking tools that allows understanding the complexity of the Universe, the natural environment, but also human capabilities. In opening up to such a society, it is necessary to focus on existing industry and on programs that involve the recovery of balances in nature and in the socio-economic environment.

In describing effective crisis management strategies, it is essential to develop a model based on market economy principles that not only take into account human needs but also take into account the needs of the natural environment, so that there are no imbalances and pollution.

The chosen theme "Using a sustainable cyber model as a tool in crisis management" is the possibility to move from the current model of the economy to a sustainable model, by changing the principles of operation of this type of economy and by identifying economic and ecological circuits, so as to consolidate a sustainable economic system.

This doctoral thesis addresses an economy described through crisis management, in the context of sustainable economic development, addressing transdisciplinarity, defined by the cybernetic model, but also biodiversity, defined by the sustainability of the natural environment.

The thesis consists of five chapters.

The first chapter presents the essential elements of crisis management theory, starting from the definition of the crisis from various perspectives. The crisis is seen as a normal accident, in which the problems of some companies/organizations can become the success of others, having as a characteristic element the lack of precision (Mittroff, Pearson & Pauchant, 1992; Santana, 2003). Also, the crisis is associated with risk (natural, biological, personal, occupational risks, etc.) (Bénaben, Hanachi, Lauras, Albi, Couget, and Chapurlat, 2009).

Merriam and Webstern consider that a crisis is an unstable state that leads to decisions with great uncertainty (Merriam and Webstern 2015; Muenzberg, Gericke, Oehmen, and Lindemann, 2016).

Also in this first chapter are described the main aspects of crisis management. Management is a process of managing a distractive event, being described by a "series of measures prepared in advance", necessary for the organization/company to control and coordinate an emergency situation, leading to maximizing the chances of success (Nudell, Mayer, Antokal, Norman, 1988). The most important weapon in case of a crisis is communication, being an emerging reference that entails mutual understanding and trust within the company/organization (Yolles, 2006; Luhmann, 1982). From a cybernetic point of view, communication is a notion of semantics, identifying three types of problems that can arise from the semantics of communication: effectiveness, technique, and semantics.

The second chapter of the thesis describes a short history of cybernetics, but also the significance of the cybernetic system/model. Cybernetics was introduced as a science by Norbert Wiener in 1948, called the science of control and communication between living things and robots, and later in 1967, Beer called it "the science of efficient organization," in which any cybernetic system can control alone (Leonard 2002).

Also in this chapter, the second, the cybernetic system and the cybernetic model are described, which is characterized by a feedback loop. A cybernetic system is a quantitative system due to the dynamics of information, which is based on a computational problem defined as the fundamental purpose of the system. The cybernetic model is described as a science of human and non-human organisms, extracting the similarities between biological organisms and technical devices.

Chapter three of this thesis describes the sustainable vector model based on the technique of trivalent logic and hexavalent logic. Trivalent logic, also called three-valued logic (Borkowski, 1970), was the basis of the first system that analyzed each instance of failure as an instance of unknown value, continuing this process until all possible values had the same result (Kleene, 1952). Also based on the logic of trivalence, Prigogine argues that any phenomenon can be characterized among courts: a source, representing the key point of the phenomenon, a sensor that assesses the influence of the source on the context, and a decision-maker describing possible solutions for further development of source (Prigogine and Nicolis, 1985). From another perspective, trivalent logic is based on triangular structures that contain a generation operation, by adding the meanings of the vectors, completing the nodes, but also the meanings of the vectors that connect these nodes, with semantics (Colceag, 2001).

The hexavalent logic used in this model results from the reality that has multiple appearances, giving different perspectives on reality, starting from the trivalent logic, but in which new triangular schemes with new properties are formed.

The theoretical basis of this model includes fundamental notions of projective geometry, cellular automata, automorphisms, feedback, and the feedback described in algebraic fractals.

The sustainable vector model is based on the principle of triangulation of information in feedback, based on three defining elements: semantic, semiotic, and symbolic.

For a good understanding of this model, we will describe a hexagonal geometric shape, divided into levels of granulation and fractalization, based on the mechanism: any two elements (information from nodes), generates the third.

Also in this chapter is described the sustainability of the model that comes from the definition of the three elements of the sustainability cycle (source, sensor, decision-maker), leading to cycles that are self-generating and self-sustaining.

The sustainability model is based on the triangular category of dissipative systems that lead to a balanced vector and fractal formations that determine a mirror symmetry. It consists of two overlapping triangles that have the following meaning: the triangle with the tip-up is the phenomenon to be modeled, and the triangle with the tip down represents the context in which the phenomenon comes to life, leading to a system that calibrates according to its own dynamics, and through the information circuit inside, governed by the main commutative diagram, it acquires its own balance. The model becomes sustainable due to the switching diagrams and cycles it encompasses. There are four main commutative diagrams surrounded by three cycles with common sides and four main cycles surrounded by three commutative diagrams with common sides.

Chapter four describes the applicability of this model. The purpose of the applicability of the sustainable vector model is to describe a tool in the successful management of a crisis in the context of sustainable economic development.

The main objectives that determined the development of this model are represented by the strategies of poor management in case of crisis, offering solutions that do not slow down economic progress, recovery of resources or damage caused by the crisis, through its realistic management, development of useful programs for expansion and developing the workforce, creating opportunities in terms of sales of local products, maintaining existing businesses and the possibility of obtaining new business.

On the last level of fractalization, the sustainable vector model includes the essential principles for sustainable management in the context of sustainable economic development, described in hexagon seven: environmental sustainability, reducing the negative impact of an organization/company's actions on the environment, social sustainability, management able to provide generations undisputed future social and environmental programs, economic sustainability, poverty reduction.

The sustainable vector model treated in this paper is an evolutionary model based on the fractalized approach, so new levels of fractalization can be created, on different levels of granulation. This model evolves from two overlapping triangles and reaches hexagonal shapes described on different levels of complexity.

The main decision that was the motivation for modeling a system whose main phenomenon is crisis management that takes place in a context of sustainable economic development, was represented by the fact that we are in times of crisis that comes from many reasons and points such as: The environmental crisis due to people, but also the technological crisis that brings enormous disorders in the environment without finding the possibility of self-regulation between the environment and humanity; the crisis of lack of human resources stems from the fact that everything is becoming more and more artificial, being a consequence of economic, educational or other policies that are deeply erroneous and inappropriate to the interest of humanity; the economic crisis that comes from the two previous crises due to the fact that the emphasis is not on the environment, but also on the human potential.

In the last chapter, the fifth, the contributions to the current research are described, including the applicability of the sustainable vector model on different fields such as innovation generation, economic stock market analysis, but also theoretical studies included in the current paper. Also, this last chapter includes the directions of future research that aims to include the application of the sustainable vector model described in this paper, in various fields, such as IT, due to the parallel that can be made with graph theory, part of this field, but also developing necessary models in crisis modeling. You consider that this sustainable model allows, both the evaluation of the influences of one field on another field and the appreciation of the consequences that can appear by taking some measures.

At the same time, I would like to mention that I will focus on developing the application that underlies this sustainable vector model that currently has only five levels of analysis, but it is necessary to complete up to level eight because it helps to develop the system by recognizing strengths and weaknesses that can generate future crises (level six), exit from the crisis due to the possibilities of evolution (level seven) and the development of possibilities to anticipate and prevent possible crises by using the recovery or replacement of affected resources, possibility that comes from the intersection of feedback and road initiation, which can be described in level eight of the application.

The results of the research of this doctoral thesis includes: an article in the journal Mathematics, the special issue "Advanced methods in mathematical modeling of financial markets", indexed in Scopus, Web of Science, etc., with Impact factor: 2,258 (2020), and five-year Impact Factor: 2,165 (2020), two ISI-Proceedings articles, at The 20th International Conference on Informatics in Economy (IE 2021) and the International Economic Conference of Sibiu, 28th International Economic Conference - IECS 2021, but also four articles published in BDI indexed journals.