

# Order and Chaos in Economic Systems

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## ABSTRACT

*The economic history of several countries, including Brazil, demonstrates that no matter how much one plans, economic and social chaos can be present in their economies. This fact reveals that the old views on determinism, control and predictability of economic models are not confirmed in current times. The chaos and complexity of the business environment leave governments, companies, and people with the impression that they are being pulled into a vortex that goes beyond political, economic, and social activity. At all institutional levels, organization and complexity can occur by generating order out of disorder and information out of chaos. This complicated pattern of evolution can happen through the systems identified as self-organizing that are part of General Systems Theory.*

Keywords: business, organizations, determinism, complexity.

## INTRODUCTION

We can start by saying that economic and social crises and expansions are verified in many countries of the world, which justifies the idea that their political, economic and social systems are chaotic, unpredictable and sensitive

to the initial conditions (PAIVA <sup>(1,2)</sup>). These systems are characterized by the inability to predict their future actions because a small change in their initial conditions can have major implications for their future behavior. According to KINOCHI <sup>(3)</sup>, something analogous to Chaos Theory occurs, which suggests that the Universe has a cycle of order, disorder, order, disorder and so on. Small changes can lead to big changes that lead to new unknown goals, perhaps better, although we cannot predict exactly where we will end up.

According to PRIGOGINE and STENGERS <sup>(4)</sup>, all systems contain constantly fluctuating subsystems, and sometimes a single variation in one of them can be so powerful that it breaks the entire existing organization. Behind the apparent disorder in the economy, there is a dynamic that can be explained through appropriate mathematical and statistical techniques, typical of this theory. In dynamic systems, such as the economy, which constantly change over time, small changes in a given moment can be the cause of large changes in the future. This characteristic implies that it is necessary to plan the economy recognizing that chaos and complexity are present and that this scenario must be dealt with in the best possible way. We live in a chaotic world that, despite attempts at economic and social planning in several capitalist and socialist countries, has not been successful in the search for order and economic and social stability.

As mentioned by OREIRO <sup>(5)</sup>, the economic crisis of 2007/2008 evidenced a transformation in the history of capitalism. As a result, many countries adopted monetary and fiscal policies with the sole purpose of avoiding the bankruptcy of the world capitalist system. This affected all businesses, from finance to credit, from stock exchanges to trading. It involved the international context and was very deep and turbulent, causing a symptom of a worldwide lack of liquidity in dollars. This fact changed the terms of trade for the worse, as a result of the decrease in commodity costs. The American financial bubble was considered the biggest since the great depression of 1929.

This recession expresses an atypical state, as it ends the resources acquired and enjoyed until now. Furthermore, it is capable of causing a condition of scarcity and difficulties for most of those involved. In short, the occurrence of

a financial crisis can be understood as disturbances, turbulence and uncertainty in the economy, based on economic facts (OREIRO <sup>(5)</sup>).

## **THE UNPREDICTABILITY**

Based (ALCOFORADO <sup>(1)</sup>) on Newtonian physics and the differential equations associated with it, it was believed that nature was deterministic and, therefore, it was possible to predict the occurrence of all phenomena. However, at the beginning of the 20th century, modern developments in natural sciences and mathematics, especially the Theory of Relativity, Quantum Physics and Chaos Theory, cast doubt on the Newtonian mechanistic vision. Quantum physics introduced the uncertainty principle, which in management can be written as: Any addition of information increases the level of precision in actions but does not provide absolute certainty that a given event will occur (ALCOFORADO <sup>(1)</sup>).

On the other hand, chaos theory represented a notable evolution in scientific research in the 20th century, undoing the dichotomy that existed in the traditional view between determinism and randomness. Chaos theory contains disordered factors, a fact that reveals that nature is not rigorously described by the Newtonian model, which is predictable and certain.

For PRIGOGINE and STENGERS <sup>(4)</sup>, chaos is a combination of order and disorder that arises from so-called dissipative structures, which suggest that nature has a cycle of alternating order, disorder, order, disorder. So that order leads to disorder and vice versa, indefinitely. Many of these concepts are being used by administrators as a way of expanding their vision of the business world, understanding that their decisions affect the competing market and can result in results that are opposite to those desired.

## **CHAOS AND THE COMPLEXITY OF THE BUSINESS ENVIRONMENT**

According to ALCOFORADO <sup>(1)</sup>, the economic history of several countries, including Brazil, shows that no matter how much each country plans, economic and social chaos will prevail in its economy and also in the world economy. All of

this demonstrates that the old beliefs in determinism, control and predictability of economic models are not sustainable in the contemporary era. The chaos and complexity of the business environment make governments, companies and people feel as if they are being swept away by a hurricane that permeates all political, economic, and social life. This means that, to understand and manage a complex economic and social system, one must think more comprehensively and act using concepts and practices that are at least comparable to the complexity of that system.

We inhabit and act in a universe that can no longer be considered in terms of the principles of Newtonian mechanics, Descartes' traditionalism, and Laplacian determinism. GRATÃO and BARROS <sup>(6)</sup> mention that economic and organizational models and factors related to them cannot be treated in isolation and disconnected from the whole. A significant example of this occurs in the stock exchange market, where, after purchasing shares in the capital market, the price future of these actions can be estimated in the short term. However, in the long term, the value of these shares probably cannot be accurately predicted.

Scientifically, conditions of unpredictability gained notoriety in the early 1960s, when Edward Lorenz discovered that apparently simple phenomena can have very chaotic behavior. PRIGOGINE and STENGERS <sup>(4)</sup> developed the theory of dissipative structures, which are those that are far from equilibrium. In some phases, the elements of the system behave in a deterministic way and in other phases, near the so-called bifurcations, it operates in a non-deterministic way. Based on this observation, science is associated with a more realistic view of the business world, that is, considering that most phenomena that occur in nature are complex and unpredictable.

## **CHAOS AND GOVERNABILITY**

ARRIGHI and SILVER <sup>(7)</sup>, authors of the book *Chaos and Governability in the Modern World System*, mention that the international system has alternated between cycles of chaos and governability throughout history over the last 500 years. According to ARRIGHI and SILVER <sup>(7)</sup>, financial expansions were a driving factor behind previous hegemonic crises and the transformation of these crises

into collapses. This expansive movement ends up leading to the so-called "structured chaos", the escalation of social conflicts and the emergence of new configurations of power. These authors consider that processes like those that have already occurred in the hegemonic transformations of the past with some countries also affect the United States and suggest the beginning of a process of crisis and hegemonic rupture. In this context, it is important to note that China is the main creditor of the United States since it buys a large part of American debt securities and that it depends on the North American market and investments. In the view of these authors, the globalization of the economy has been undermining the power of States and weakening the regulatory capacity of large nations. The process is like that of the Dutch trading and shipping companies, which, while giving 17th century European nations the power to operate globally, also emptied the functions and power of states. North American multinational companies, despite appropriating part of the income of the countries where they are located, have not provided an equivalent increase in the income of United States residents or their government. A reflection of this is the lack of global governance today, as global governance no longer exists.

ARRIGHI and SILVER <sup>(7)</sup> still defend the thesis that, after the current hegemonic rupture, the center of world power must be concentrated in East Asia. The region's consolidation as the most dynamic center of large-scale capital accumulation processes has enabled the emergence of a productive structure antagonistic to the North American one.

## THE POINT OF CHAOS

LASZLO <sup>(8)</sup> in the book entitled *The Point of Chaos*, understands that a dynamic system, whether it occurs in nature, in society or in a computer simulation, is governed by attractors. These define the phase portrait of the system: the way it behaves over time. Stable attractors pull the system's developmental trajectory into a recurring, recognizable pattern, leading it to converge at a given point (if the system is governed by point attractors) or to cycle through different states (when it is under the command of periodic attractors). However, dynamical systems can also reach a state in which the attractors that

emerge are not stable, but 'strange'. According to LASZLO <sup>(8)</sup>, an attractor is the set of points in phase space to which a system tends to converge as it evolves. The attractor can be a single point, a closed curve (limit cycle) that describes a system of periodic behavior, or a fractal (also called a strange attractor), when the system presents chaos. Still according to LASZLO <sup>(8)</sup>, systems enter a state of chaos when fluctuations that were, until then, corrected by self-stabilizing negative feedback become out of control. The trajectory of development becomes non-linear: prevailing trends collapse and, in their place, various complex developments emerge. In chaotic systems, movement never repeats itself, although it often has to occur within certain limits. Thus, only a complex figure - a fractal - can represent this trajectory that never repeats itself in phase space. Change and time are the two fundamental aspects of chaos. Chaos mainly refers to something that evolves over time.

Chaos theory explains the functioning of complex and dynamic systems. In these systems, countless elements interact in an unpredictable and random way. This is the case in the capitalist market economy because there is no effective governance of the economic system. PRIGOGINE <sup>(9)</sup>, commenting in "The Laws of Chaos" on bifurcation points in chemical reactions, states that they demonstrate that even at a macroscopic level our prediction of the future mixes determinism and probability.

At the bifurcation point, the prediction has a probabilistic character, while between the bifurcation points, we can speak of deterministic laws. Rarely is chaos a prolonged condition; in most cases, it is just a transitional period between more stable states. When fluctuations in the system reach levels of irreversibility, the system reaches a critical point at which it collapses into its individual stable components (collapse) or undergoes rapid evolution toward a state resistant to the fluctuations that have destabilized it (revolutionary breakthrough). If this path of revolutionary advancement is selected, the system evolves to a state in which it has an enhanced information processing capacity and greater efficiency in the use of free energy, as well as more flexibility, greater structural complexity, and additional levels of organization. Experts say that the international financial system no longer works as it used to.

The neoliberal model that governed the world for the last 40 years is outdated, a fact that could lead to depression for many years. Given the existence of chaos that dominates the world economy, the time has come for each country and humanity to equip themselves as urgently as possible with the necessary instruments to control their destiny. To have control over its destiny, humanity needs to exercise governance over its economic systems within the scenario that is associated with the world economy.

## **DISCUSSION**

One of the great difficulties of the planning process is minimizing uncertainty when it is known that change is the only stable rule at the current moment and that the past serves less and less as a basis for projecting the future. The development of chaos theory from the 1970s onwards contributed to the formulation of a model very different from what had prevailed until then, which was basically deterministic and linear. In the model based on this theory, the world is more complex and fundamentally non-deterministic and non-linear. Chaos, in science, is not necessarily disorder, as there is an order that comes from chaos, according to what PRIGOGYNE and STENGERS <sup>(4)</sup> report. After the bifurcation point is reached, the system's behavior becomes erratic for some time, but tends to stabilize in a new equilibrium, but qualitatively different from the original. The system now presents new, structurally more complex modes of organization.

During the instability phase, the system "experiments" numerous variants of "possible futures", before "deciding" on their new stable level of complexity. To face the uncertainties of the future, public and private organizations must use the Scenarios technique, adopting as a premise that the future is multiple, many futures are possible and the path that leads to many futures is not necessarily unique (GODET <sup>(12)</sup>). The essential purpose of scenario strategy is to present organization executives with a meaningful image of probable futures and unexpected or unlikely futures over different time horizons. The alternative to be chosen will be the one that is the best among the worst options of all the



alternatives considered. In the optimistic view of the problem, it is assumed that the best possible event will occur.

## FINAL CONSIDERATIONS

Economics is a social science in which you do not have control over all the variables. So, it is difficult to make predictions. We must take into account that within chaos there is a certain order, according to Prigogine's laws of chaos, but that it may not contribute to the economy due to its unpredictable nature. According to GLEISER <sup>(10)</sup>, despite its great potential for applications, chaos theory leaves something to be desired when it comes to describing social systems.

Chaos theory is somewhat mechanical, although there is something mechanical about social behavior. It seems more appropriate for describing physical phenomena, such as weather conditions or the turbulence of fluids, than for describing human behavior. According to CUNHA <sup>(11)</sup>, chaos theory applied to the context of business administration is called Complexity. This theory sees companies as highly complex systems, where the best way to achieve control is by balancing on the edge of chaos, where neither too many restrictions nor total disorder is desirable.

It is worth remembering that organizations are groups of people, who do not act in the same way without considering the situation in question. They are complex systems, but self-organizing, that is, they represent people acting to do what is right, knowing correctly how and when to change things. And by proceeding in this way, order is obtained in chaos. Complexity helps in understanding how an organization must change to be able to deal with complex and unpredictable environments, establishing new frames of reference in strategic and organizational management.

One of the fundamental aspects of chaos is the great sensitivity to initial conditions, that is, the result of prediction, for a system, is very sensitive to the initial state of that system. At a time when everything changes quickly, it can be said (CUNHA <sup>(11)</sup>) that the principles that govern conventional management



models are outdated when applied in an economic environment like the current one characterized by instability. When fluctuations in the system reach levels of irreversibility, the system reaches a critical point (bifurcation point) at which it collapses into its individual stable components or undergoes rapid evolution toward a state of advancement resistant to the fluctuations that have destabilized it.

To be effective, the business and public planning process must necessarily consider instability and uncertainty, with their turbulence and risks. As mentioned by DI BIASE and SOUZA <sup>(13)</sup>, the information that exists today, interconnecting all areas of knowledge from the exact and biological sciences, as well as the human and social areas, and more specifically the area of administration, economics, management, and marketing, has demonstrated that we are living in a transformative moment in human evolution.

At all institutional levels, organization and complexity can occur through the generation of order from disorder and information from chaos. This complicated pattern of evolution can happen through systems identified as self-organizing that are part of the General Systems Theory. Currently, we live in an era of uncertainty and with an interconnected and globalized global financial system. Furthermore, this system has been attacked by frequent crises, which means that the moves in this global economic political chess game can have unpredictable consequences for business organizations. This demonstrates the importance of considering, in our analysis of human and social business systems, the values and human personality that are commonly forgotten or disregarded by most corporate systems.

We would like to end with the following phrase: “In the early was information and information was with God and information was God. All things were done by Him and in Him was life and life was the light of men”. This is a possible interpretation of the beginning of the Gospel of St. John in the bible.

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