THEORY OF COMPLEXITY IN A SMALL BRAZILIAN MICROENTERPRISE SITUATED IN THE WESTERN AMAZON

TEORIA DA COMPLEXIDADE EM MICROEMPRESA BRASILEIRA SITUADA NA AMAZÔNIA OCIDENTAL

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Abstract: This work has as general objective to elaborate a study of the application of the principles of the theory of complexity in face of the practices adopted in Brazilian microenterprise located in the Amazon. Therefore, the following specific objectives were listed: (I) to characterize the principles related to the theory of complexity; (II) to identify relationships between complexity and organizational theory through the characteristics of complex management; (III) to identify factors present in the micro enterprise related to complexity. As for the method, the research is descriptive, using quantitative analysis. The questionnaire used was adapted from the study by Ramalho, Locatelli and Silva (2018). Among the results, it is highlighted that the reductionist principle was identified in the company when the individual attitude affected the organizational collectivity. The principle of retroactivity was observed from the high positive consistency of the responses obtained through mutual feedbacks. The principle of recursion was found from the synergy between people and the ability to establish dynamic relationships. The limitations of the study permeate the performance of a quantitative study. Future studies may involve replicating the in-depth research using a qualitative method in public and private organizations of different sizes.

Keywords: Complexity Theory, Amazon, Microenterprise.

Resumo: Este trabalho tem como objetivo geral elaborar um estudo da aplicação dos princípios da teoria da complexidade em face das práticas adotadas em microempresa brasileira situada na Amazônia. Para tanto, foram elencados os seguintes objetivos específicos: (I) caracterizar os princípios relacionados à teoria da complexidade; (II) identificar relações entre a complexidade e a teoria organizacional por meio das características da administração complexa; (III) identificar fatores presentes na microempresa relacionados

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à complexidade. Quanto ao método, a pesquisa é descritiva, com utilização de análise quantitativa. O questionário utilizado foi adaptado do estudo de Ramalho, Locatelli e Silva (2018). Dentre os resultados, destaca-se que o princípio reducionista foi identificado na empresa quando a atitude individual afetava a coletividade organizacional. Já o princípio da retroatividade foi observado a partir da elevada consistência positiva das respostas obtidas por meio de mútuos *feedbacks*. O princípio da recursividade foi encontrado a partir da sinergia existente entre as pessoas e a capacidade do estabelecimento de relações dinâmicas. As limitações do estudo perpassam a realização de estudo quantitativo. Estudos futuros podem envolver a replicação da pesquisa em profundidade com a utilização de método qualitativo em organizações públicas e privadas de diversos portes.

Palavras-chave: Teoria da Complexidade, Amazônia, Microempresa.

1 Introduction

The emerging science at the beginning of the 20th century proposes a new relationship between subject and object, starting from the empirical, the contradiction, the order and the disorder. Such aspects are considered "errors" or "deviations" in classical science, which is guided by the paradigm of simplicity, admitting the intrinsic separability of the parts of the whole. However, complex thinking understands the supposed "deviations" as encompassing the essential aspects of the subject, his relationship and his existence. The complexity began to germinate in the study of sciences from 1811, with the study of the Fourier heat flow, and its full consolidation occurred with the discovery of the laws of thermodynamics, with the emergence of the General Theory of Bertalanffy Systems (1968) and Cybernetics and Information Theory, in the 19th century (ROBERTO, 2008). The thinking of traditional science, among which Taylor and Fayol are some of the main authors, directed the development of management theories until the mid-20th century, whose main objectives were efficiency and control. It was based on classical theory with a vision focused on the ideal structure, internal interrelationships and coordinated functioning, and was also based on scientific management, in which *homo economicus* was visualized and the focus was on the execution of tasks (ONDAY, 2016; RAMALHO, LOCATELLI; SILVA, 2018).

Recently, the complexity paradigm has shown itself to be applicable in the study of organizations due to its comprehensiveness in understanding the internal and external relationships that affect them, helping employees and managers to understand the scope and complexity of business administration, which can directly influence the actions of organization. Information technologies have brought about exponential changes in many economic sectors. The great flow of information in today society and the context of the global crisis with constant transformation of the countries' economies have profoundly affected organizations, requiring a high degree of adaptability of companies. Thus, micro and small companies are at a competitive disadvantage (OLIVEIRA; SIMONETTI, 2010), due to the less capacity to adapt to external oscillations.

In this context, the problem that the study seeks to answer is: to what extent are the principles related to the theory of complexity present in the organizational environment of a small Brazilian company located in the Amazon? This work has as general objective: to elaborate a study of the application of the principles of the theory of complexity in face of the practices adopted in a small Brazilian company located in the Amazon. Therefore, the following specific objectives were listed: (I) to characterize the principles related to the theory of complexity; (II) to

identify relationships between complexity and organizational theory through the characteristics of complex management; (III) identify factors present in the small company related to complexity.

This article is divided into four sections. It begins with the theoretical framework on the principles of complexity, the principles of complex administration and the characteristics of micro and small companies, moves on to the section on methodology, presentation and discussion of data, and finally the final considerations, in which discusses the propositions about the research made by the authors and about the limitations of the study.

2 Theoretical and Conceptual Review

Complex thinking, unlike the traditional model of thinking, is represented by complementarity and the varied dimensions existing in realities. The complexity, in addition to covering the theories of systems, cybernetics and information, also considers the contradiction between the concepts of "order" and "disorder" and the combination of order-disorder-organization as its epistemic support (ROBERTO, 2008). From the aspects mentioned, Edgar Morin, the main representative of complex thinking, develops concepts related to self-organization, based on principles that will be explained below.

2.1 Principles of Complex Thinking

Among the principles of complex thinking, six will be cited in this section: Dialogical principle, Holographic principle, Systemic or Organizational principle, Retroactivity principle, Recursion principle, Autonomy / dependency principle and Principle of reintroduction of knowledge in all knowledge, presented independently their degree of importance. The dialogical principle is the principle that unites the antagonists who should repel each other, that is, it allows the complex association of apparently opposing instances, but both are necessary for the existence, functioning and development of an organized phenomenon and thus allows that are reconciled with duality within our own being. The living being is an open system, according to complex thinking, which performs energetic and material exchanges with the external environment, but although these flows adorn the unstable system with increased entropy, the metabolism of the living being compensates for this imbalance by generating increased order (negentropy) through its internal biological system. Through the lens of chemistry, order and disorder, when mediated by organizational metabolism, they constitute the living being (MORIN, 2005). Thus, one must also understand human and social relationships (ROBERTO, 2008).

This principle is naturally present in the life of living beings, from the elementary organization of physical and chemical processes, to biological organization, as previously mentioned, and the ethical and moral principles. The universe is heterogeneous in bio-psycho-social aspects, and each space has its particularities, and it is necessary to respect the "truths" that originate from each of them, as within society there are different ideals and backgrounds, and it is incompatible to impose a single truth to all individuals. A notion about a phenomenon cannot be understood as unique and certain (MORIN, 2005). In short, the dialogical principle helps to think logics that contradict each other, but that complement each other in a dynamic system without excluding or canceling each other, such as order / disorder / organization, autonomy /

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dependency, individual / social totality, life / death (bringing the idea of continuous regeneration from the death of the cells themselves) (ZAMPIETRO, 2004).

The holographic principle is present in the biological micro-universe and in the macro social universe. Just as each molecule of deoxyribonucleic acid (DNA) contains all the genetic information of a living organism within a society, the individual is a part of society and society, representing the whole, is present in each individual through language, culture, and the norms acquired by these individuals that compose it (MORIN; MOIGNE, 2000). In this way, this principle proposes that each part contains practically all the information of the represented object (holographic operator), in which each cell contains our genetic heritage, and each individual contains the society in which it is inserted. Its maxim is 'the part is in the whole, and the whole is in the part' (ZAMPIETRO, 2004). But each part (or subsystem) also contains its own specificities without being reduced to the whole (MINAYO, 2011).

The Systemic Principle (or Organizational Principle) is opposed to reductionism by reconnecting the knowledge of the parts with the knowledge of the whole and vice versa. Through the lens of this principle, language is a system of systems, that is, language is seen as a whole (system) formed by interdependent and interconnected subsystems (text, phrases, morphology, phonology), interacting mutually towards creative chaos. Thus, the organization of the whole produces properties that are more complex than the isolated parts (MINAYO, 2011; ZAMPIETRO, 2004).

The Principle of Retroactivity (or of the retroactive cycle) breaks with linear causality, because, according to this, the informational retroactive effect on the cause and allows the system's organizational autonomy (ZAMPIETRO, 2004). In other words, causes act on effects and effects act on causes, promoting a dynamic balance that regulates the system and organizes disruptions through mutual feedback (PADERES, RODRIGUES; GIUSTI, 2005). In this sense, it destroys the illusion of linearity in the acquisition of knowledge: knowledge does not add up linearly, but retracts from previous knowledge, rethinking it in new contexts (ZAMPIETRO, 2004).

The Recursion Principle (or the recursive cycle) also breaks the idea of linearity between cause and effect (MORIN, 2005), since they are both products and consequences of a certain fact or act and are also producers and originated from what they produce. However, when it comes to linearity, it goes beyond the retroactive principle, as it brings self-producing and self-organizing dynamics when supported by an external flow, that is, products are necessary for the generation of the process, dealing with the indispensability of the final states for the generation of the initial states (MINAYO, 2011; ZAMPIETRO, 2004). In the social dimension, organizational recursion is an important characteristic for maintaining harmony (ROBERTO, 2008). Individuals produce society through social interactions and relationships, and society, while emerging, produces the humanity of these individuals, making them apprehend the language and culture of the context in which they are inserted (MORIN; MOIGNE, 2000).

According to the Autonomy / Dependence Principle (Self-eco-organization Principle or Adaptation Principle), the reality of different facts and social processes cannot be analyzed without the dialectical binomial of dependence versus autonomy, because although each system has its own dynamics itself, is sustained by a relationship of dependency with the surroundings (PADERES, RODRIGUES; GIUSTI, 2005). In other words, it is about the ability of living beings to use the energy and information of the environment that are necessary for their functioning, which makes them both self-organizing and dependent on these sources (MINAYO, 2011). This

principle is always applicable to human beings, as they develop their autonomy depending on their culture (PADERES, RODRIGUES; GIUSTI, 2005).

The Principle of reintroducing knowledge into all knowledge concerns the intellectual translation of all cognitive heritage that has been accumulated by society within a given culture, since all knowledge in the world is reconstruction or translation done by a mind that works in a culture and determined time. This principle suggests that all knowledge produced is ephemeral and tends to be overcome during history when producing a new culture, along with other possibilities for understanding the world (PADERES, RODRIGUES; GIUSTI, 2005).

After the presentation of the previous principles, it can be said that, while the paradigm of traditional science separates and reduces, the paradigm of complexity gathers and distinguishes simultaneously, according to Edgar Morin (MINAYO, 2011). In the context of organizational studies, such principles can be emphasized in the internal and external management of a company, as the ability of employees to understand business administration in a comprehensive and complex way can directly influence the organization's efficiency and effectiveness.

2.2 Principles of Complex Administration

Complex Administration focuses on four fundamental axes, namely autonomy, cooperation, aggregation and self-organization, which will be explained below according to Agostinho (2003). Autonomy is the individual's ability to orient himself according to his own judgment, which increases the possibility of the members of a company becoming decision makers, and not simply executing commands and functions.

This aspect enhances the following characteristics: adaptability, as it reduces hierarchical levels by attributing decisions (raising the hierarchy) to employees who previously only performed activities; increasing diversity by ensuring the generation of new ideas and solutions by encouraging creation; learning, as it allows the individual to put his judgment into action and adjust his behavior to achieve the desired goals; the reduction of errors, as autonomous individuals have a tendency to review their actions and correct them according to the observation of their peers; and local and immediate conflict resolution encouraged by organizational models based on autonomy.

Cooperation is an important feature when it is intended to take advantage of the knowledge that exists within the organization, and the greater the training of employees, the greater the need for spontaneous cooperation (AGOSTINHO, 2001), as this allows the flow of knowledge capable of contributing for the company's performance. The cooperation theory points out that cooperative work can emerge without the presence of a central authority or coercive forces, but from individuals who seek their own benefit and see gains through mutual aid, whose performance can be superior compared to actions separate, and that reciprocity is the key factor for cooperation.

The organization can be divided into subsystems with their respective objectives, thus forming a hierarchical structure with aggregates arranged in successive levels, and the more complex the system, the higher levels will be found. However, this hierarchy is conducted in two ways: by external restrictions, or by limits of competence of the members themselves. In both ways there are the so-called aggregate boundaries, within which a given level of employees has

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the autonomy to act, and from these boundaries, actions are directed by individuals of a higher aggregate level.

The self-organization aspect concerns the creation of a minimum structure through which an organization emerges, that is, the possibility of choosing how systems should operate, by directing resources (human, financial, among others) by identifying more relevant flows and more and less effective points, creating conditions for the system to self-organize. In the scope of micro and small companies, which will be characterized in the following topic, the principles of complex administration are also relevant, considering that this type of company must constantly adapt to the external environment, even more in comparison with large companies, as it has reduced capacity in your change.

2.3 Characteristics of Micro and Small Enterprises

There is no unanimously accepted concept for micro and small companies, as it becomes complex to seek unique parameters for organizations that operate in different contexts. There is variation in the criteria for each country and among the sectors responsible for regulation. In Brazil, Complementary Law No. 123, of December 14, 2006, instituted the National Statute for Small Business and Small Business, defining the size of companies according to their annual turnover, but does not consider the company's line of business and disregards the financial aspect by leveling a business partnership, a simple partnership and an individual entrepreneur, while the Brazilian Micro and Small Business Support Service (SEBRAE) distinguishes the types of company by the number of employees working in the organization. Despite differing in the adopted criterion, both have similar essences (BATISTA et al., 2012).

Small and medium-sized companies are commonly managed by their owners, have reduced human resources, do not have a prominent position in the market, are not linked to large economic groups and the value of their capital and annual sales are low (Batista et al., 2012). Even so, of the 6.4 million establishments in Brazil, 99% are micro and small companies, responsible for 52% of formal jobs in the private sector (SEBRAE, 2018b), and for 27% of GDP in 2011 (SEBRAE, 2018a). In this way, nationally and internationally, micro and small companies are recognized as engines of the growth and development of nations (GILL; BIGER, 2012). These types of organizations are the result of greater competition and bring social benefits, being potentially more representative than large companies (CRAVO, GOURLAY; BECKER, 2012).

Unlike large companies, which have time available to devote themselves to understanding environmental changes and adequate instruments to make them favorable to internal processes, small companies have reduced capacity to promote changes in the external environment, aiming to satisfy their needs (LIMA, 1999). Also noteworthy are the planning, the lack of administrative experience of managers (especially on growth management), sales and marketing as the main issues related to small companies (HUANG; BROWN, 1999). The decision-making process is also complex because it involves factors such as previous learning and self-observation of situations. In the case of managers of micro and small companies, the limitation on the size of the organization, the tax burden and the lack of incentive from the state make decisions even more difficult (OLIVEIRA; SIMONETTI, 2010).

The greater difficulty in accessing credit and less competitive capacity leads to the high bankruptcy rate of small companies, and the lack of government incentive to invest in working capital also provides barriers to competition with large companies (BATISTA et al., 2012).

Research carried out within the scope of strategic management in small companies has many non-conclusive aspects, but reveals a fragmented approach to its strategic process, as strategic planning and company performance are not solidly linked. However, it is possible to affirm that the most appropriate strategy for this type of organization is the search to make its structure compatible with the characteristics of the environment in which they operate, mainly by exploiting market niches, which will enhance competitiveness (ANDRADE et al., 2004).

3 Methodology

The paradigm is the philosophical conception that communicates the research method, related, therefore, to the researcher's worldview (SACCOL, 2009). This work is based on post-positivism, whose logic is hypothetical-deductive, in which science starts from a fact or gap where hypotheses are generated and these are put to the test, in favor of their refutation or confirmation (SAUNDERS, LEWIS; THORNHILL, 2012, p. 176; SACCOL, 2009, p. 256; POPPER, 1974, p. 33; CARVALHO, 1994, p. 73). Post-positivism in the social sciences is characterized by quantification and statistical analysis, in order to avoid subjective and intuitive understanding of phenomena (BRUYNE, HERMAN; SCHOUTHEETE, 1977, p. 136). The post-positivist philosophical conception is, therefore, characterized by objectivist epistemology and realistic ontology, being guided by belief in reality as a tangible and relatively stable sphere, composed of observable phenomena (SACCOL, 2009). However, according to Hühne (2002, p. 178) and Popper (1974), scientific objectivity should not be seen as absolute.

According to Creswell (2010, p. 36), this study fits with the nature in the quantitative method, considering that it will involve variables with the purpose of testing theories or explanations. As for technical procedures, the research strategy was the survey (survey) of behavior and attribute variables (SAUNDERS, LEWIS; THORNHILL, 2012, p. 425) in cross section (LUKOSEVICIUS, 2018, p. 9). This research is characterized, as to the purpose, as applied, which according to Gil (1999) aims to create knowledge for application, use and immediate practical consequences, being directed to the solution of specific problems.

As for the objectives, the research is descriptive, as it has as a characteristic that the information sought is clearly defined and formally structured, using quantitative analysis. As for the location, the research is characterized as in the field, as it is a study that seeks to deepen the questions proposed in the concrete reality, according to Gil (1999).

The organizational environment chosen was a small food company located in Porto Velho-RO, Amazon Region of Brazil. The choice of the organization is justified because it is a small consolidated company, with more than 20 years in the market, and for that reason, it demonstrates knowing the possibility of knowing how to deal with internal and external complexities in favor of organizational survival. In addition, the applied study of the principles of complexity theory in small businesses is unprecedented. The collection of information took place through questionnaires applied personally to the respondents, in the month of November 2018, as shown in Figure 1. The small company has seventeen employees, and all of them

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participated in the data collection, carried out in November 2018. From then on, descriptive statistics were performed for data analysis.

The questionnaire was measured using the Likert scale, comprising 17 (seventeen) statements related to the Principles of Complexity, according to Figure 1. The objective questions contained 05 (five) possible answers: I totally agree; Partially agree; Indifferent; Partially disagree; I totally disagree. For the analysis of the degree of agreement of the participants who answered the questionnaire, the verification of the agreement or disagreement of the questioning was carried out, so that values less than 3 are considered as discordant and values greater than 3, as concordant. For the analysis of the results, techniques of descriptive statistics of the construct of principles of complexity theory were used.

Figure 1 - Constructs on Principles of Complexity Theory

Guiding Principles	**Questions**
- Systemic **- Friendly hologr** **- Dialogic**	1) People have an overview of the company's work processes.
	2) The problems are understood in a broader context and not in isolation.
	3) Contrary ideas are accepted and the best alternatives to be adopted are evaluated.
	4) The absence of a colleague does not impact the final activity.
-Retroactivity	5) The comments received are analyzed and compared to the existing internal processes.
	6) People transmit their knowledge to others on a daily basis.
- Recursion **- Reintroduction of Knowledge**	7) Team synergy is high, and people are in sync.
	8) The work environment is dynamic, marked by an accelerated change in demands.
	9) It is possible to acquire new knowledge in your work environment.
- Autonomy / Dependence	10) People know all the activities and organize themselves whenever a colleague is absent, without the need for the leader to direct what each one should do.
	11) There is no monitoring of activities because people are self- coordinating and know the activities they need to perform.
	12) People have the freedom to propose and implement improvements in activities.
- Cooperation	13) People cooperated spontaneously.
	14) Cooperation is visible between employees (same level).
- Aggregation	15) There is a team spirit because people understand that working together is the best.
	16) There are different skills, knowledge and profiles among employees.
	17) People identify and there is spontaneous interaction between them, even outside the work environment.

Source: Adapted from Ramalho, Locatelli e Silva (2018).

4 Study of Perception on Complexity Theory Principles

Next, the characteristics of the collaborators and managers of the small company analyzed are presented, followed by the analysis of the relationship established between the principles of

complexity theory in the context of a small company, thus presenting a descriptive approach to the findings.

4.1 Characteristics of employees

The table below shows the profile of the respondents, considering the age group, sex, level of education and length of experience in the company. From the analysis of Table 1, it is evident that most employees are 26 to 39 years old, a percentage that corresponds to 41.2% of the total. There is an equal proportion of employees in the age group of 18 to 25 years and 40 to 52 years, which demonstrates a balanced workforce in terms of age differences. This can favor an adequate prism regarding complexity within the organization, due to the sum of multiple views.

With regard to sex, there is also proportionality between them, so that 47.1% are men, and 52.9% women. Regarding the level of education, the majority of 70.6% of employees have completed High School, followed by 17.6%, who have completed Higher Education, and by 5.9%, who have Graduate Studies. This fact can show the level of ease or difficulty of the collaborators to deal with the contingent demands of the daily business, which will be verified later, in the following sections.

Table 1 - Characteristics of employees in relative numbers

Age group of the person consulted	**Percent**
From 18 to 25 years	23.5
From 26 to 39 years	41.2
From 40 to 52 years old	23.5
From 53 to 64 years	5.9
Above 65 years	5.9
Sex of the person consulted	**Percent**
Male	47.1
Feminine	52.9
Education level of the person consulted	**Percent**
Not literate	0
Complete primary education	5.9
Complete high school	70.6
Complete Higher Education	17.6
Postgraduate studies	5.9
Time working in the company	**Percent**
1 year	17.6
2 years	0
3 years	17.6
Four years	11.8
5 or more	52.9

Source: Research data.

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Finally, 52.9% of the employees declared that they had more than five years of work in the company, which provides consistency to the survey, since they are aware of the organizational reality.

4.2 Analysis of the Principles of Complexity in a Small Company located in the Brazilian Amazon

4.2.1 Guiding principles: Systemic, Holographic and Dialogic

The systemic, holographic and dialogic principles were assessed using the questions in Table 2.

Table 2 - Data obtained through a survey concerning the Systemic, Hologrammatic and Dialogic principles of Complexity Theory, in relative numbers

Guiding principles: Systemic, Holographic and Dialogic	**Cod.**	**DT (%)**	**SD (%)**	**Indifferent (%)**	**CP (%)**	**CT (%)**
1) People have an overview of the company's work processes.	Q1	5.9	5.9	5.9	76.5	11.8
2) The problems are understood in a broader context and not in isolation.	Q2	11.8	5.9	5.9	23.5	52.9
3) Contrary ideas are accepted and the best alternatives to be adopted are evaluated.	Q3	5.9	5.9	5.9	41.2	41.2

Source: Research data.

As shown in Table 2, it was shown that in statement Q1, 88.2% of the respondents totally or partially agreed that people have an overview of the company's work processes. Regarding item Q2, 76.5% of respondents agreed to some extent that the problems are understood in a broader context and not in isolation.

The high rate of agreement obtained in the first two questions demonstrates compliance with the systemic and holographic principle within the organization studied, given that there is the whole view and the exchange of influences between the whole and the parts. Regarding item Q3, 82.4% of employees reported that the contrary ideas are widely accepted and evaluated in the context of the organization, which reveals a high presence of the dialogical principle in the organization. Finally, 58.8% of respondents considered that the absence of a colleague impacts on the final activity, which demonstrates the strong systemic entanglement between the activities developed.

According to Minayo (2011), this principle is opposed to the reductionist view, so that the organization of the whole is more complex than the interaction of isolated parts. In small business studied, evidence that the others do affect the community, and there is high adhesion to the holistic view of the organization.

4.2.2 Guiding Principle: Retroactivity

According to Table 3, the data show that in question Q5, 82, 4% of employees agreed to some extent that the comments received are analyzed and compared to the existing internal processes. Regarding question Q6, there is a high degree of agreement, in the order of 76, 5%, with the assertion that people transmit their knowledge to others in their daily work.

Table 3 - Data obtained by means of a survey concerning the Retroactivity principle of Complexity Theory, in relative numbers

Guiding Principle: Retroactivity	**Cod.**	**DT (%)**	**SD (%)**	**Indifferent (%)**	**CP (%)**	**CT (%)**
5) The comments received are analyzed and compared to the existing internal processes.	Q5	5.9	11.8	11.8	17.6	64.7
6) People transmit their knowledge to others on a daily basis.	Q6	5.9	5.9	5.9	5.9	70.6

Source: Research data.

As Zampietro (2004) teaches, the principle of retroactivity allows to undermine linear causality, so that the feedback and feedback from the system guarantee its dynamism. Thus, in the case at hand, it is possible to affirm that the small company studied seems to approach the principle of retroactivity, given the high positive consistency of the responses obtained in this construct.

4.2.3 Guiding Principles: Recursion and Reintroduction of Knowledge

The analysis d in Table 4, it emerges that to 82.4% of respondents, the synergy of the team is increased and people are in line, referring to the question Q7.

Table 4 - Data obtained through a survey concerning the principles of Recursion and Reintroduction of Knowledge, in relative numbers

Guiding Principles: Recursion and Reintroduction of Knowledge	**Cod.**	**DT (%)**	**SD (%)**	**Indifferent (%)**	**CP (%)**	**CT (%)**
7) Team synergy is high and people are in sync.	Q7	0.0	17.6	17.6	35.3	47.1
8) The work environment is dynamic, marked by an accelerated change in demands.	Q8	5.9	0.0	0.0	17.6	58.8
9) It is possible to acquire new knowledge in your work environment.	Q9	0.0	0.0	0.0	17.6	76.5

Source: Research data.

Regarding the question Q8, 76.5% of the employees totally or partially agreed that the work environment is dynamic, marked by the accelerated change in demands. Finally, regarding question Q9, there was unanimity, and 100% of respondents agreed to some extent that it is possible to acquire new knowledge in their work environment.

As taught by Morin (2005), the principle of recursion involves the idea that actions and products are the cause and consequence of what they produce it, bringing the notion of self-

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organization intrinsic in favor of achieving the harmonic state of things. In the small company studied, recursion is present, as there is synergy between people and dynamic relationships.

Regarding the principle of reintroducing knowledge, Paderes, Rodrigues and Giusti (2005) teach that knowledge is reconstructed and translated from other knowledge accumulated over time. For this to be possible, it is necessary to reintroduce and assimilate new knowledge, a characteristic widely present in the studied organization, as shown by the data.

4.2.4 Guiding Principles: Autonomy / Dependence

From the data present in Table 5, it is evident, in relation to question Q10, that the majority of respondents, about 88.4%, demonstrated to disagree totally or partially, or even, remained neutral. This assumes that the people in the organization do not know all of their activities, or that they do not have the capacity and self-organization in the absence of a co-worker, and there is still dependence on the figure of the leader and little autonomy. As for question Q11, about half of the respondents agreed to some degree with the statement that there are no strict monitoring systems, which could favor self- coordination. Finally, in relation to item Q12, 88.2% of respondents stated that people are free to propose and implement improvements in activities.

Table 5 - Data obtained through a survey concerning the principles of Autonomy / Dependence, in relative numbers

Guiding Principles: Autonomy / Dependence	**Cod.**	**DT (%)**	**SD (%)**	**Indifferent (%)**	**CP (%)**	**CT (%)**
10) People know all the activities and organize themselves whenever a colleague is absent, without the need for the leader to direct what each one should do.	Q10	11.8	35.3	35.3	17.6	35.3
11) There is no monitoring of activities because people are self- coordinating and know the activities they need to perform.	Q11	17.6	17.6	17.6	17.6	35.3
12) People have the freedom to propose and implement improvements in activities.	Q12	5.9	5.9	5.9	5.9	82.4

Source: Research data.

According to Morin (2004), the concepts of autonomy and dependence are complementary at the same time that they are antagonistic. So, for people having autonomy, the same have dependence on external factors such as culture and knowledge. In the studied organization, it was possible to notice that people do not consider that they have autonomy, as they see themselves as dependent on a leader and colleagues, who when they miss work, cause a great impact on their daily work. However, there is freedom in the organization to propose innovations, which is seen as a good level of autonomy by employees.

4.2.5 Guiding Principle: Cooperation

As can be seen through the analysis of Table 6, 76.5% of the respondents stated that there was a spirit of spontaneous cooperation between people (Q13), however, this fact is contradicted when compared to question Q14, where 52.9% of employees they partially disagreed with the statement that cooperation is visible between employees of the same level. This can highlight the need for managers to work to bring people together and foster cooperation between employees at the same hierarchical level.

Table 6 - Data obtained through survey concerning the principle of cooperation in relative numbers

Guiding Principle: Cooperation	**Cod.**	**DT (%)**	**SD (%)**	**Indifferent (%)**	**CP (%)**	**CT (%)**
13) People cooperated spontaneously.	Q13	5.9	11.8	5.9	47.1	29.4
14) Cooperation is visible between employees (same level).	Q14	0.0	52.9	5.9	11.8	29.4

Source: Research data.

Agreeing with Agostinho (2001), environmental relations should foster cooperation, as the future is collectively projected. Only then will people cooperate, as there will be a common sense of reciprocity and common good. In a complex and changing environment, cooperation becomes essential, as the whole is bigger than the parts, creating an increased problem-solving capacity.

4.2.6 Guiding Principle: Aggregation

According to Table 7, it appears that 70.6% of the respondents totally or partially agreed with the assertion Q15, that there is a team spirit since people understand that the best is joint work.

Table 7 - Data obtained by means of a survey concerning the Aggregation principle, in relative numbers

Guiding Principle: Aggregation	**Cod.**	**DT (%)**	**SD (%)**	**Indifferent (%)**	**CP (%)**	**CT (%)**
15) There is a team spirit because people understand that working together is the best.	Q15	0.0	23.5	23.5	5.9	64.7
16) There are different skills, knowledge and profiles among employees.	Q16	0.0	0.0	0.0	41.2	58.8
17) People identify and there is spontaneous interaction between them, even outside the work environment.	Q17	0.0	11.8	11.8	29.4	47.1

Source: Research data.

Regarding question Q16, there was unanimity in the answers, and 100% of the respondents agreed to some extent that there are different skills, knowledge and profiles among employees. Finally, in question Q17, 76.5% of employees consider that people identify themselves and there is spontaneous interaction between them, even outside the work environment. Such positive aspects foster the principle of aggregation, according to which it is possible to aggregate differences in favor of improving and strengthening a larger system.

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As Agostinho (2001) demonstrates, aggregation is related to the interaction of complex systems that adapt, and such aggregation is an essential condition for the emergence of an aggregate larger than the sum of the parts. Differences, synergy and team spirit create the synergy of the whole, developing the aggregate with singularities of behavior. In short, the studied organization is capable of providing aggregation, it becomes more adequate to deal with the uncertain and dynamic environment, endowed with complexities.

5 Final considerations

Before the studies, it was possible to respond adequately to the problem of research, according to which it was investigated to what extent the principles related to complexity theory is present in organizational environment of a small company Brazil located in the Amazon.

At the end of this research, it was possible to observe that some principles of complexity proposed by Edgar Morin are more present than others. The reductionist principle, in the company, is identified when the individual attitude affects the collectivity. When treated with the principle of retroactivity, it is observed from the high positive consistency of the responses obtained from the feedback. The principle of recursion is found from the existing synergy between people and the ability of relationships between them to be dynamic.

The principle of reintroducing knowledge was strongly found in the research through the reintroduction and assimilation of new knowledge by the team as a whole. As for autonomy and dependence, it was found that employees do not feel that they have these characteristics, as they always depend on a leader or colleagues to decide, and in their absence prevents work from flowing. On the other hand, it was discovered that although employees do not feel autonomous regarding their decisions, there is freedom in terms of innovation, having as a positive and differentiated characteristic for employees and the organization, as it is possible to disseminate the creativity and versatility of employees.

Therefore, from the point of view of aggregation, the organization capable of providing aggregation becomes more suitable to deal with the uncertain and dynamic environment, which is complex. The limitations of the study involve application in only a small company and can be carried out in other small companies to better understand and with greater depth the reality of a greater number of organizations with similar characteristics and realities, as these characteristics have greater difficulties in remain in the market for longer periods of time.

The limitations of the study permeate a purely quantitative study. And future studies may involve research replication with the use of qualitative methods in public and private organizations of various sizes, to get ne not score the bigger picture in order to understand in depth the principles of complexity happen in various organizations.

References

AGOSTINHO, M. C. E. Administração Complexa: Revendo as Bases Científicas da Administração. *Revista de Administração de Empresas*, v. 2, n. 1, p. 1-18, 2003. http://doi.org/10.1590/S1676-56482003000100016

AGOSTINHO, M.C.E. (2001). A organização emergente: gerenciando o processo de autoorganização. (Tese de Doutorado em Engenharia. Universidade Federal do Rio de Janeiro, Rio de Janeiro, RJ, Brasil). Recuperado de http://www.sage. coppe.ufrj.br/index.php/publicacoes/teses/2001-1/37-marsia-cristina-estevesagos

tinho-marco2001/file.

ANDRADE, D. M. et al. Ciclo de vida, competição e estratégias em pequenas e pequena empresas. *Revista Eletrônica de Administração*, v. 10, p. 3, p. 1-30, 2004.

BATISTA, F. F. et al. Uma Investigação acerca da Mortalidade das Pequena empresas e Empresas de Pequeno Porte da Cidade de Sousa, PB. *Revista de Administração, Contabilidade e Sustentabilidade*, v. 2, n. 1, p. 56-71, 2012.

BRUYNE, P. de; HERMAN, J.; SCHOUTHEETE, M. de. *Dinâmica da pesquisa em ciências sociais: os polos da prática metodológica* (2nd ed.). Francisco Alves, 1997.

CARVALHO, M. C. M. de. *Construindo o saber:* metodologia científica - **métodos e técnicas** (4th ed.). Papirus. 1994.

CRAVO, T. A.; GOURLAY, A.; BECKER, B. SMEs and regional economic growth in Brazil. *Small Business Economics,* v. 38, n. 2, p. 217-230, 2012. http://doi.org/10.1007/s11187-010-9261-z

CRESWELL, J. *Projeto de pesquisa*: métodos qualitativo, quantitativo e misto. (3rd ed.). Booking: Artimed, 2010.

GIL, A. C. *Métodos e técnicas de pesquisa social*. Atlas, 1999.

GILL, A.; BIGER, N. Barriers to small business growth in Canada. *Journal of Small Business and Enterprise Development*, v. 19, n. 4, p. 656-668, 2012. http://doi.org/10.1108/14626001211277451

HUANG, X.; BROWN, A. An analysis and classification of problems in small business. *International Small Business Journal*, v. 18, n. 1, p. 73-85, 1999. https://doi.org/10.1177/0266242699181004

HÜHNE, L. M. (Org.). *Metodologia científica:* caderno de textos e técnicas. (7th ed.) Agir, 2002.

LIMA, E. O. A estratégia emergente na pequena empresa e sua complementaridade à visão estratégica. *Proceedings of Encontro da Associação Nacional dos Programas de pós-Graduação em Administração*, 23, Foz do Iguaçu, 1999.

LUKOSEVICIUS, A. P. Executar é preciso, planejar não é preciso: proposta de framework para projetos de pesquisa. *Administração: Ensino e Pesquisa*, v. 19, n. 1, p. 32-65, 2018. https://doi.org/10.13058/raep.2018.v19n1.765

MINAYO, M. C. de S. Da inteligência parcial ao pensamento complexo: desafios da ciência e da sociedade contemporânea. *Política & Sociedade*, v. 10, n. 19, p. 41-56, 2011. https://doi.org/10.5007/2175-7984.2011v10n19p41

MORIN, E.; MOIGNE, J. L. *A inteligência da complexidade*. Petrópolis, 2000.

MORIN, E. *A cabeça bem-feita:* repensar a reforma, reformar o pensamento. (9th ed.). Bertrand Brasil, 2004.

MORIN, E. *O Método V: A humanidade da humanidade*. (3rd ed.) Sulina, 2005.

MORIN, E. *O Método VI: ética*. Sulina, 2005.

ONDAY, O. Classical organization theory: from generic management of Socrates to bureaucracy of Weber. *International Journal of Business and Management Review*, v. 4, n. 1, p. 87-105, 2016.

OLIVEIRA, S. R. M. de; SIMONETTI, V. M. M. Intuição e Percepção no Processo Decisório de Pequena empresa. *Revista da Micro e Pequena Empresa*, v. 3, n. 3, p. 52-66, 2010. https://doi.org/10.6034/77

PADERES, A. M.; RODRIGUES, R. de B.; GIUSTI, S. R. Teoria da Complexidade: Percursos e Desafios para a Pesquisa em Educação. *Revista de Educação*, v. 8, n. 8, 2005.

POPPER, K. R. *A lógica da pesquisa científica*. (11th ed.). Cultrix, 1974.

RAMALHO, W.; LOCATELLI, R. L.; SILVA, S. C. D. Análise organizacional sob a ótica da teoria da complexidade: proposição e aplicação de um modelo. *Revista Gestão & Tecnologia*, v. 18, n. 2, p. 200-226, 2018. https://doi.org/10.20397/2177-6652/2018.v18i2.1391

ROBERTO, A. C. J. M. *Teoria da Complexidade: Uma contribuição para o serviço social*. [Masters dissertation, Pontifícia Universidade Católica de São Paulo]. Biblioteca Digital PUC-SP, 2008.

SACCOL, A. Z. Um retorno ao básico: compreendendo os paradigmas de pesquisa e sua aplicação na pesquisa em administração. *Revista de Administração da UFSM*, v. 2, n. 2, 2p. 50-269, 2009. https://doi.org/10.5902/198346591555

SAUNDERS, M.; LEWIS, P.; THORNHILL, A. *Research Methods for Business Students***.** (6th ed.) Pearson, 2012.

SEBRAE. *Participação dos pequenos negócios nas economias brasileira*, 2018a. http://www.sebrae.com.br/Sebrae/Portal%20Sebrae/UFs/SP/Pesquisas/dados_mpes_brasil_2014.pdf

SEBRAE. *Pequenos negócios em números*, 2018b. http://www.sebrae.com.br/sites/PortalSebrae/ufs/sp/sebraeaz/pequenos-negocios-em-numeros,12e8794363447510VgnVCM1000004c00210aRCRD

ZAMPIETRO, L. M. *O Pensamento complexo de Edgar Morin e a conjugação verbal em livros didáticos de PLE*, 2004.