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Fractality and Decision Making Processes: A Proposed Applied Approach – A case study

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Abstract

Background: The study of mathematical tools correlated with fractal geometric aspects and decision making processes. Some applications other than this are already investigated in the literature (Hernández *et al*. 2019; Iliasov *et al*. 2019; Turvey *et al*. 2019; Kim *et al*. 2007; Roberts and Turcotte, 1998). The idea is innovative and we generated it after a brainstorming meeting.
Objective: The objective of this paper is to propose a subjective tool for data collection about family agricultural production. Due to the low educational level of these Brazilian families, the use of more robust analysis tools becomes unviable, ineffective and mathematically incompatible with the management of this information. In this perspective, we realized that it would be interesting to create a didactically more accessible tool, and geometrically more coherent with mathematical concepts that provide the decision making process. The main hypothesis of the work is around the difficulty of mapping in communities or groups of empirical entrepreneurship. Due to low education, we realized that the application of usual tools became unviable. For that, we created a geometry-based tool, and from it we can diagnose the business model in question and propose decisions for the business analyzed to increase its efficiency. Thus, we use fractal geometry to understand mathematically how these intelligent data analysis processes can be used due to the complexity of the mathematical model.
Results: Using an adapted map, we can list the main points of the business model in question, understanding how we can increase the efficiency of this business. This became possible after analyzing the adapted map using basic knowledge of fractal geometry. We hope that by applying this model, other researchers will be able to use similar concepts to analyze data in situations where those involved have low education or need more primitive interviewing tools.
Conclusion: We have created an agro mapping tool and through knowledge of fractal geometry we can measure which strategic decisions we must make, so as to increase the likelihood of success of an amateur business in a community near our institution. The approach proved to be innovative and effective for managing information and mathematically measuring the possibility of success. Through the mathematization of social phenomena, physics proves to be extremely interesting and provides students involved in the project with greater

Keywords: Fractality, Decision Making Processes, SocioPhysics

INTRODUCTION

Fractals and complex systems

Firstly discovered in 1979 by Benoit Mandelbrot, fractal geometric structures or also known as autosimilars, created from simple repetition patterns, at first understood as chaotic structures, presented a certain order in the midst of this chaos.

These structures have demonstrated applicability in the most diverse fields of science. Association between statistical data on the frequency of forest fires and wars behave in a fractal manner (Roberts and Turcotte, 1998), in the physics of complex systems (Kim *et al*. 2007) and even in the field of risk analysis of some commodities in the financial market (Turvey *et al*. 2019). Recent

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studies show the applications of these mathematical structures in biology (Hernández *et al*. 2019), justifying the efficiency of the functioning of the respiratory system, for example. In quantum physics (Iliasov *et al*. 2019), in investigations of the energy spectrum of fractals at the quantum level.

In nature we constantly come across seemingly irregular geometrical forms, but with a repetition worthy of admiration. They are self-similar and semi-scale forms. An example of these repetitions is the Koch snowflake (Koch *et al*. 1906). Such structures are known as fractals.

Through models created to describe practical situations, we can analyze mathematically through these results we can interpret how such mathematical results result in physical explanations for a particular problem. Also, it is common to use fractal geometry to try to understand complex systems (Koch *et al*. 1906; Pena, 2001).

In this paper, we propose a project management analysis tool that transposes it to a less subjective assessment by migrating to this data from an interview in the field of geometry. The initial objective of the work was to present this management analysis tool for an agroecological project. However, the tool proved to be extremely applicable and adaptable for other applications, such as: project analysis, opinion survey analysis and other proposals that present subjectivity in its nature of gathering information. Thus, it is possible to apply the tool to several proposals that require data analysis, and consequently, decision making for the success of the analyzed proposal.

When we migrated to the field of geometry, we realized that the tool produced fractal geometric figures. And so, the purpose of this paper is to present the tool and show that through the fractality established in the results it is related to the decision making to be sent to the analyzed project.

How to interview low-income farm families?

The objective of this paper is to propose a subjective tool for data collection about family agricultural production.

Due to the low educational level of these Brazilian families, the use of more robust analysis tools becomes unviable, ineffective and mathematically incompatible with the management of this information.

In this perspective, we realized that it would be interesting to create a didactically more accessible tool, and geometrically more coherent with mathematical concepts that provide the decision making process.

Thus, we use fractal geometry to understand mathematically how these intelligent data analysis processes can be used due to the complexity of the mathematical model.

Agro-Management Circular Map

In order to analyze the information provided by the interviewed families, it was necessary to create the tool described in this section. Such a tool can be adapted to the reality of each decision-making process and evaluated on a case-by-case basis.

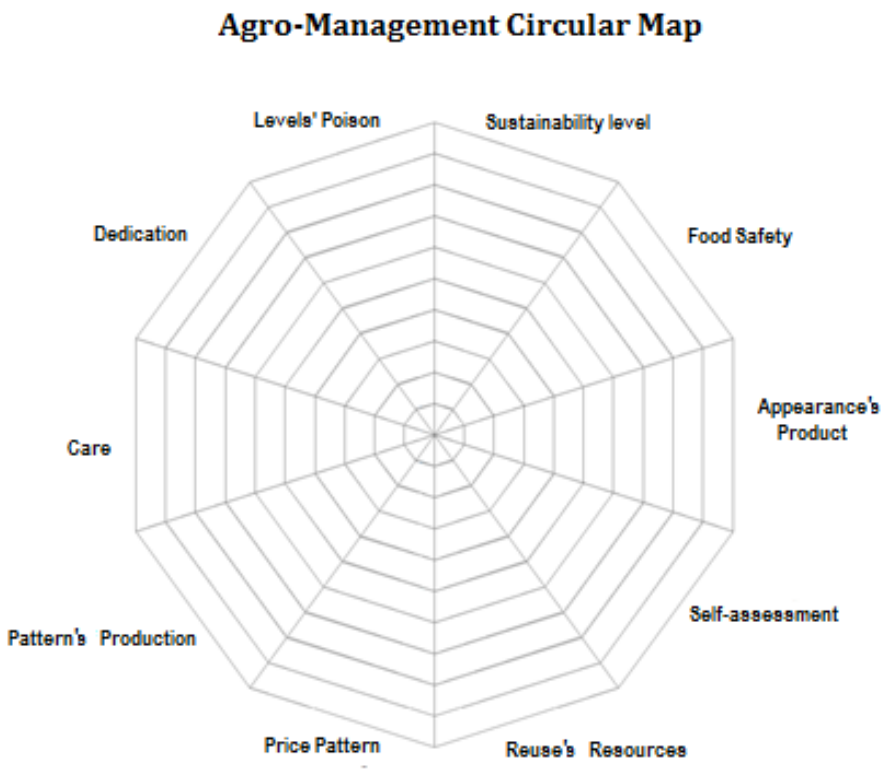

Figure 1:Agro-Management circular Map

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MATERIALS AND METHODS

For this job the necessary tool was created. We can evaluate this information geometrically.

The following is an illustrative example of how the tool is viewed when applied to a specific context.

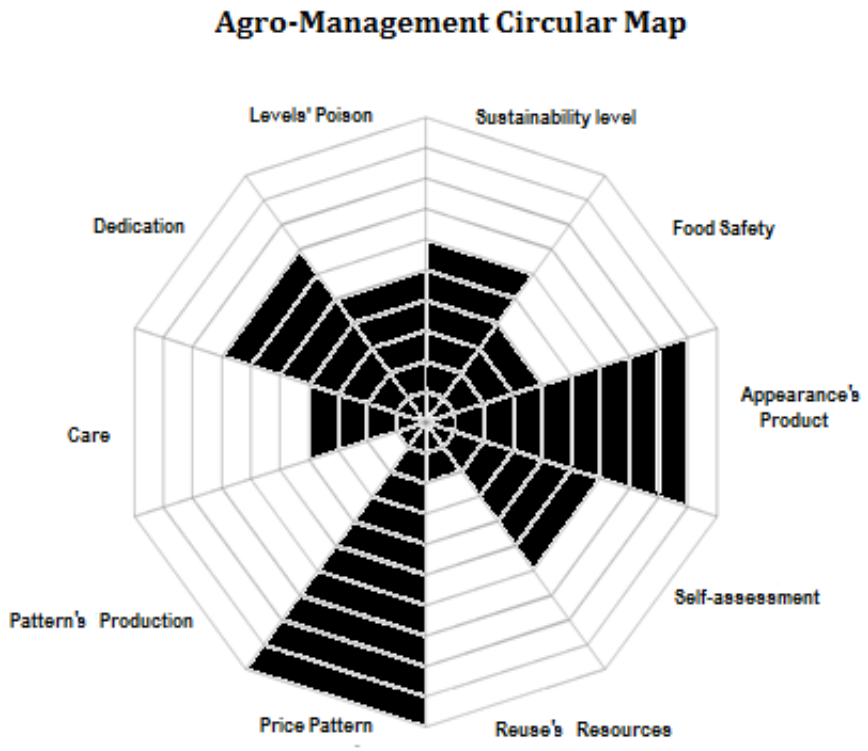

Figure 2:Agro-Management circular Map

RESULTS AND DISCUSSION

Through the fractal analysis of the figure in the previous section, we can perceive that the more cohesion, i.e. , the closer to dimension 2, the result becomes more efficient and the greater the radius of the circle.
However, from this analysis it is possible to perceive which elements are necessary to suit the expected results of that specific decision-making process.

CONCLUSION

That article was very interesting because of the way a geometric tool was approached.
Through general mathematical concepts, we can understand how to improve the decision-making process and achieve the desired goals.

ACKNOWLEDGEMENT

In short, the work has a great scientific contribution due to the innovative approach in the process of fusion between decision making processes and aspects of fractal mathematics. From these results, it became possible to establish a correlation between purely abstract aspects and real situations, common in interdisciplinary branches of physics such as sociophysics. Fruitful discussions like these serve to stimulate divergence of information management in the aspect of the mathematical field and by providing innovative solutions.

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