An exploratory study on the presence of cognitive biases in project management decisions at a research institute

Um estudo exploratório sobre a presença de vieses cognitivos nas decisões de gestão de projetos em um instituto de pesquisa

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ABSTRACT
Most of the analytical models used in Operations Management assume that managers are fully rational or at least can be induced to behave rationally. In view of the need to investigate the influence of cognitive biases on the decision-making process of project managers, this exploratory study based on self-report aims to detect evidence of the presence of two types of biases in the decisions of a small sample of project managers at a Brazilian research institute: anchoring and overconfidence, and to derive hypotheses based on this evidence. This study shows only partial results and aims to contribute to the literature on behavioral operations, exploring behavioral and cognitive factors in project management, demonstrating how biases can deter managers from making optimal decisions. Subsequently, a follow-up study based on controlled experiments will be developed to test the hypotheses derived from the preliminary evidence presented here.

Keywords: Behavioral Operations Management, Biases, Project Management, Anchoring, Overconfidence.
RESUMO

A maioria dos modelos analíticos utilizados na Gestão de Operações assume que os gestores são totalmente racionais ou pelo menos podem ser induzidos a se comportar racionalmente. Diante da necessidade de investigar a influência dos vieses cognitivos no processo de tomada de decisão dos gestores de projetos, este estudo exploratório baseado em auto-relatos tem como objetivo detectar evidências da presença de dois tipos de vieses nas decisões de uma pequena amostra de gestores de projetos em um instituto de pesquisa brasileiro: ancoragem e excesso de confiança, e obter hipóteses baseadas nessas evidências. Este estudo mostra apenas resultados parciais e tem como objetivo contribuir para a literatura sobre operações comportamentais, explorando fatores comportamentais e cognitivos na gestão de projetos, demonstrando como os vieses podem impedir os gestores de tomar decisões ideais. Posteriormente, um estudo de acompanhamento baseado em experimentos controlados será desenvolvido para testar as hipóteses derivadas das evidências preliminares aqui apresentadas.

Palavras-chave: Gestão comportamental de operações, vieses, gestão de projetos, ancoragem, excesso de confiança.

1 INTRODUCTION

Human beings are critical to the functioning of most systems of operations, influencing both the way these systems function and their performance. However, formal analytical models of operations management assume that managers are fully rational, or at least that they can be induced to behave rationally [1]. It is in this context, of the interaction between behavioral and cognitive attributes and operating systems and processes, that the area known as Behavioral Operations becomes an essential element in understanding how the human factor influences the operational result [2][3][4].

The Behavioral Operations area is strongly influenced by Cognitive and Social Psychology [3]. Social Psychology studies the nature and cause of human behavior and considers that people are moved by aspects such as justice and reciprocity, aspects related to organizational context and the context of interaction [1]. Cognitive Psychology recognizes that individuals are not entirely rational in their choices, being influenced by biases and heuristics, such as overconfidence and anchoring [3].

Normally, people rely on a limited number of heuristic principles to simplify judgment operations. These heuristics are quite useful, but they can cause biases that distort, or limit, the ability to make rational decisions [5].

A bias arises when a heuristic is inappropriately applied in making a decision. The suppression of logic favors the establishment of a vicious circle, since the results of judgments made by heuristic rules are often satisfactory for the decision makers, making their use more frequent, and therefore the errors and biases a constant [6].

In the literature it is possible to identify studies investigating cognitive bias in various areas of knowledge [6] [7] [8], highlighting the Financial Market, with one of its main references, the
American economist, Richard Thaler. A basic premise of his studies is the idea that human beings are not always rational and that their choices are based on subjective and cultural questions - factors that often count more than rationality [9].

Thus the main question of this research arises: what is the degree of susceptibility of project managers to specific cognitive biases? The general objective of this work is therefore to identify evidence of the existence of cognitive biases in managers' decision making. This case study shows only partial results and is based on a small sample of managers. The results are useful to derive hypotheses and point directions for future studies (one of which is already underway), but they do not present enough evidence to fully validate the study; the results are not generalizable.

2 LITERATURE REVIEW

Although project managers are trained and conditioned to make efficient decisions in their organizational environment, they may still be subject to cognitive biases in their choices, especially in their personal context. Thus, the intent is to present the relationship between behavioral aspects and cognitive biases in the management of innovation projects. In order to do this, we decided to divide the contents into three key topics:

- Behavioral Operations;
- Project management;
- Cognitive Biases.

BEHAVIORAL OPERATIONS

Operational models see people as predictable and controllable. In contrast, Behavioral Operations understands that people are not passive agents, and have behaviors that affect processes. Their intentions, actions, and reactions, as well as feelings of trust and fairness, and the relations formed between groups also determine the operational standards that are actually executed, with these standards being influenced by each individual’s cognitive abilities [10]. These precepts confront the traditional operations approach and challenge the formal rules established by operations management, since managers, just like any decision makers, are subject to lapses in the decision making process [11].

With the behavioral factor being highlighted and the need for operational responses closer to reality, behavioral economics and decision-making theories influenced behavioral operations in relation to how people actually decide, compared to the normative decision [3]. This is because operations management studies consider that decision makers are homogeneous when in fact they have different characteristics that may explain varied results [12].
Such results derive from the cognitive reflection of the decision maker, that is, from personal judgment, which affects not only the decision to be made but also causes variations in operations, especially in more critical environments [12]. These facts render the traditional operational factors insufficient for explaining the organizational success of a company, and lend a relative importance to the individual and social aspects that permeate the organization [13], such that understanding how behavior affects the operations area can contribute to operational practices more aligned with organizational goals [14].

PROJECT MANAGEMENT

According to the PMBOK® Guide [15], one of the main references in project management, in general, project managers are identified as responsible for handling the requirements of the task, the team, and the individual. In the view of the PMBOK® Guide, since project management is a critical strategic discipline, the project manager becomes the link between the strategy and the team. Projects are seen as essential to the growth and survival of the organizations, since they create value in the form of improved business processes, are indispensable in the development of new products and services, and make it easier for the company to respond to changes related to the environment, the competition, and the market. Thus, the role of the project manager is seen as increasingly strategic.

With regard to the interpersonal skills of a project manager, the PMBOK® Guide emphasizes that effective project managers must possess important interpersonal skills, especially: leadership, team building, motivation, communication, influence, decision-making, political and cultural awareness, negotiation, trust building, conflict management, and coaching.

However, while defining the interpersonal and therefore individual and specific skills of each project manager as important, the PMBOK® Guide defines a single standard for project management, even in diverse economic sectors. According to Pinto and Covin (1989) [16], "the predominant tendency among most scholars has been to characterize all projects as fundamentally similar." The view of many academics, as well as the PMBOK® Guide, could be represented by the axiom: "a project is a project." Similarly, other guides and manuals generally concentrate on a universal set of project activities such as organization, planning, control, and monitoring, emphasizing the same approach of treating all projects as similar and identifying a universal set of functions, tools, and techniques needed to manage a project.

In this scenario, one can classify the approaches represented by the PMBOK® Guide and other guides and manuals as the rational expectation view of project management. They assume that project leaders follow a rational and consistent approach to project management and strive to achieve specific organizational objectives [17]. It is a vision that emphasizes what "should" be done. There is,
however, another view, and its focus is the way that individuals within an organization actually behave and make decisions, that is, the "behavioral" view of project management that emphasizes what individuals and groups "actually" do and how managers make decisions involving values and risk preferences [18].

HEURISTICS AND COGNITIVE BIASES

According to the PMBOK® guide, considering the inputs, tools, and outputs of each process, it is possible to identify innumerable decisions that project managers have to make routinely. Even with all the importance given to managers' decision-making, it is observed that in the applied literature on project management, more specifically, innovation projects, cognitive and social aspects regarding the limited capacity of humans to deal with complexity are not considered. Some empirical studies have explored patterns, best practices, or benchmarks involved in the management decisions related to project management. However, these theoretical models, proposed in the literature, have not become commonly used tools in management practice due to their great complexity [19] [20]. Thus, companies often use heuristics to manage project decision-making, rather than trying to improve them. This decision-making behavior is still widely accepted, but studies on the impact of specific heuristics on project performance are still very limited [21].

Considering that the personal susceptibility of each manager varies, it is quite possible to highlight innumerable cognitive biases. According to Tversky and Kahneman (1974) [5], such biases are errors that have their roots in the form of information processing.

HYPOTHESES

The literature of cognitive and social psychology clearly shows the use of heuristics and biases, among which two biases are included: overconfidence and anchoring. In this scenario we will propose the hypotheses to be derived from this work, intended to determine if managers' decision making can be influenced by the cognitive biases of overconfidence and anchoring.

ANCHORING

One of the heuristics identified by Tversky and Kahneman (1974) [5] is called "anchoring". According to this heuristic, when points of departure are given in the decision analysis, the estimates tend to be biased towards the initial values [8]. In other words, the anchoring bias causes previous exposure to a piece of information to lead us to strongly consider it in decision making or in the formulation of estimates, regardless of its relevance to what is decided or estimated. That is, individuals focus attention on recently received information and use it as a reference for estimating
or making a decision. The anchor is a relevant value that is available to the decision maker. People make estimates from an initial value, which is adjusted to produce the final answer. The anchor can be inserted into the formulation of the problem in question, or it may be the result of a partial analysis [5].

There are many studies focusing on anchoring, in different scenarios. For instance, Cen et al. (2013) [22] focus on the implications of the anchoring bias associated with forecasting earnings per share in the financial market. Mussweiler (2001) [23] found that the sentences given by judges are anchored on the sentence demanded by the prosecutor. Campbell and Sharpe (2009) [24] show how forecasts, made by experts, of monthly economic indicators are biased toward the value of previous months’ values. Brewer et al. (2007) [25] show how anchoring occurs in the judgements and choices of doctors and patients. Bucchianeri and Minson (2013) [26] show how listing strategies impact sales prices of residences, due to the anchoring bias.

Even though the presence of the anchoring bias has been found in many decision making scenarios, only one study focusing on project management could be found; the study by Skitmore et al. (1989) [41], that merely discusses how such a bias would and could occur.

As described in Chapter 1 of the PMBOK® Guide, managing a project typically includes balancing conflicting project constraints that include, but are not limited to:

- Scope,
- Quality,
- Schedule,
- Budget,
- Resources, and
- Risks.

The specific characteristics and circumstances of the project may influence the constraints, and these factors are related in such a way that if any of them change, at least one other factor is likely to be affected.

These constraints, when applied to innovation projects, pressure managers to run the projects within predetermined time, cost, and quality criteria, emphasizing efficiency versus effectiveness [27]. Thus, one of the hypotheses to be proposed by the preliminary evidence found in this work is: "Previous estimates, considering the success or failure of projects already executed, are used as an anchor in managers' decision-making processes for managing constraints in innovation projects."
OVERCONFIDENCE

De Bondt and Thaler (1995) [28] state that "perhaps the most robust finding in the psychology of judgment is that people are overconfident." In the literature it is possible to identify various studies that deal with this bias, however the financial market is where the studies are most notable due to a new field of studies, Behavioral Finance. In the financial market, understanding the thinking of investors can provide competitive advantages that allow the configuration of more specific strategies. In this way, Behavioral Finance disagrees with the supposed rationality of decision makers, adopted by modern finance, whose central paradigm is the rationality of economic agents [29].

While having confidence in one's own skills is necessary for managers to perform professionally and can inspire respect and trust among one's team members and other interested parties, overconfidence can be a barrier to effective professional decision making, as it may result in irregular beliefs and this implies a tendency to be excessively confident in estimating a parameter, such as the future return of a given action [6]. The more information becomes accessible, the more managers tend to assume that their decisions will be judged by virtue of having information that underlies the chosen decision. Normally, when people are more familiar with the occurrence of a certain event, the information is processed in a more automatic way, as these individuals come to believe in the repetition of the results of this same event [30].

There are many studies focusing on overconfidence, however, in a thorough review of the literature, no study focusing on project management decisions was found, except for Markovitch et al. (2014) [31], who, based on a regression study with a large sample, found that overconfidence was associated with a higher probability of overforecasting new product sales. There are, however, notable studies in other settings. For example, Ancarani et al. (2016) [32] studied overconfidence in inventory management decisions and suggested that managers should try to remove this optimistic bias by discounting their expectations. Similar conclusions were reached by Forbes (2005) [33], who also found that older entrepreneurs are more overconfident than young ones. Abbes (2012) [34] studied how the overconfidence of investors had a role in the volatility of equity markets during the global crisis. Doukas and Petmezas (2007) [35] show how overconfident managers who bid in acquisitions exhibit poor long-term performance. Ullah et al. (2017) [36] studied how detected the overconfidence bias in a sample of investors in the Islamabad stock exchange.

Although overconfidence does not necessarily lead to erroneous decisions, this cognitive bias can negatively influence learning and improvement for future decisions, and may lead to higher-risk behavior than is conventional for that individual. Therefore, the hypothesis to be proposed based on the evidence found in this exploratory study is: "Innovation project managers can have excessive confidence in their decisions, which leads them to make decisions less correctly."
3 RESEARCH METHODS AND TECHNIQUES

This work is an exploratory case study focused on the managerial practice of behavioural aspects in innovation projects for the development of products and processes of a scientific research institute. Its intent was to obtain personal reports from the managers interviewed, and through these self-reports, to obtain evidence of the presence of cognitive biases in their project management decisions. Since the study is being based on only one case, its conclusions will need to be validated further.

The use of self-reports has many limitations. For instance, they are not necessarily based on the actual reality experienced by subjects; they do not allow causal conclusions to be drawn [37]. However, they can provide important insights and be useful for deriving hypotheses about people’s behavior [37].

Data was collected through semi-structured interviews where questions were raised that were supported by theories and hypotheses related to behavioral operations and the cognitive biases that may influence the decision-making of managers.

In formulating the questions, some precautions were observed, especially, regarding the items listed below:

- Language: use of expressions and situations commonly used in project management and familiar to managers;
- Form of the questions: More evaluative questions, avoiding complications that impede the research, seeking to open perspectives for analysis and interpretation of ideas; and
- Definition of the sequence of questions: Setting a rhythm, pacing the time, not allowing the interview to become tiresome, and enabling the interviewee to provide the information necessary to conduct the research.

The questionnaire that was used as a guide during the interviews had 31 questions, which were reviewed by two scholars from the Psychology field, and were complemented by other questions inherent to the momentary circumstances of the interview, so that it was possible for information to emerge more freely, that is, the answers were not limited to a standardized set of alternatives [38]. The questions used to assemble the questionnaire were based on Tversky and Kahneman (1974) [5] and Bazerman and Moore (2006) [39].

The case study object of this work was focused on the reported decisions of a group of managers of innovation projects with high complexity or high investment value, developed at a scientific research institute. These projects are related to various knowledge areas, especially Robotics, Software Engineering, Electrical, Mechanical, and Materials Engineering, as well as,
Mechatronics and Industrial Automation. The case study method [40] allowed the establishment of criteria, procedures, and techniques for the elaboration of the research, provided information about the object of this research, and guided the formulation of hypotheses. Documentary data collection and interviews with the managers involved in the projects were carried out.

The field research presented here was carried out between September and November 2017. Eight (8) project managers were selected and will participate, but up to now only three were interviewed; Therefore, only partial results are being presented. These managers have various professional backgrounds and work in different areas of knowledge. Before the interviews with the managers, a pre-test of the questionnaire was carried out with 10 masters’ students in industrial management, in order to make the interpretation of the questions more precise and to determine the average completion time, which was 60 minutes.

4 RESEARCH ANALYSIS AND RESULTS

The projects of the research institute, managed by the interviewees, are Research, Development, and Innovation (RD&I) projects and are coordinated by the Institute's Project Management Office (PMO). They make use of advanced financial engineering with facilitated access to various funding programs and economic grant modalities for RD&I projects. The research institute is one of the main developers of innovation projects in Brazil, and other sources of RD&I funding are prospected and identified, with the intermediation and assistance of the institution. It is important to point out that the majority of the projects refer to products, processes or technologies that are developed due to an external demand, i.e., the institute is hired to develop these projects.

The projects presented in the interviews have a mean duration of 24 months, with teams of 4 to 5 people, and an average investment value of approximately $10,000,000.00 (ten million dollars). Their goal is to conduct research and innovation for the development of the industry, and therefore they are distributed in 7 major areas of competence: Robotics, Software Engineering, Electrical, Mechanical, and Materials Engineering, Mechatronics, and Industrial Automation.

The partial sample consisted of three respondents, out of a total of 12 project managers at the research institute. Five other respondents will be interviewed next. The mean length of service of the managers at the institute is 5 years.

ANALYSIS OF THE INTERVIEWS

Next we present the results of the analysis of the interviewees' responses.
OVERCONFIDENCE

Analyzing the interviews and considering the interviewees' responses related to Overconfidence, some evidence of this bias were observed because even though the interviewees consider that decision-making rests with the project manager, most of the time this is widely discussed so that there is consensus with the operational team. In addition, they reported using decision-support tools that help guide the decision-making process.

Subject A declared that “….my own expertise contributes hugely to the decisions I make about projects. I can say that a smaller part is contributed by formal tools and estimates. Experience is very important for a project manager……. It is very uncommon for me to feel that I should have relied less on my expertise and personal judgement”.

Subject B declared that “I am very open to considering various sources of support for decision-making, but most of the time I rely on my own interpretations of a situation or decision that has to be taken”.

In the interview with subject C, further evidence of overconfidence was observed, because when answering the same questions, he said: "I come from a school that is much more structured than this research institute (...) I have always assumed leadership positions, being a model for many others (...) I am very intuitive (...) as I already have 20 years of experience, this helps in leading a project, I have references in my head that I follow and I make my decisions (...) I am not frustrated by the results, (...) I tell this to everyone, believe in me."

According to the responses, what happens or could have happened are distortions in the development of action plans and project estimates, causing a divergence from the results intended by the research institute. Interviewees seem to overestimate their knowledge/skills, underestimating risks, and such behavior can lead to exaggerations in their ability to control and monitor projects.

ANCHORING

In analyzing the interviewees' responses to the questions related to Anchoring, respondents reported that results of past projects, successful or not, in terms of cost and time, influence the prospecting and planning of new projects. This could be clearly shown, for example, in the excerpted statement from interviewee B who said: "(...) the indicator that we take into consideration first is the timeline, second, the question of financial execution, and third, the issue of scope, the main indicators analyzed for decision-making in projects (...) here we have a lot of returning clients, most of the clients have more than one project, and we have already seen the engineering team bet on the second project, due to the result of the first (..), but the key had changed, the charge in the second project was different, it was more strategic and thus deliverables were requested in a different way (..) the
customer wanted to develop a product quickly but was unaware that the time needed to sell and industrialize the product was very long, and preferred to leave the second project on standby."

Another moment in which it could be seen that the results, in terms of costs and deadlines, influence future projects was in the interview with C who said: "I have a number of projects that I have already carried out and this experience helps to manage projects (...) I have some references in my head and I make my decisions."

Subject A declared that “Yes, I have, in the past, approved the development or approved to continue developing a project because of the influence of a success in another (previous) project. I believe that previous numbers can help me make decisions, since patterns can be repeated in the future, both in terms of outcomes and in terms of expertise/capabilities. I wouldn’t call that optimism because it seems logical to me.”

According to the responses from interviewees, what happens or what could have happened is that managers, due to previous exposure to the results of projects already carried out, end up giving them strong consideration in decision making or in formulating estimates for new projects, regardless of their relevance to what will be decided or estimated. Many of the daily tasks of a project manager require quantitative judgments, being prone to the effects of anchoring.

5 CONCLUSION

It is clear in the literature that achieving superior performance in managing the development of a product or process is ultimately based on people. The principles of management, systems, and procedures play an essential role, but the capabilities that create competitive advantage come from people, from their skill, discipline, motivation, problem-solving ability, and their capacity to learn.

Much of the research previously identified with behavioral operations suffered from insufficient fundamentals of behavioral theory, with a focus on identifying gaps between theoretical models about what should happen and what happened in practice. The theoretical basis used was generally restricted to some areas of behavioral research, such as bounded rationality and motivation theory [4]. Most current work on the role of human behavior in Operations Management focuses on identifying behavioral gaps between normative models and descriptive data. The behavioral operations area needs more explanations about how, why, and what could be done about these gaps [3].

The main contribution of this work is the identification of preliminary evidence of the presence of two cognitive biases in the management of innovation projects at the research institute that is the focus of the case study that was carried out. Two hypotheses were derived. The study, with a very limited degree of generalization for being based on only one case, and on partial results, found
evidence of the existence of anchoring and overconfidence biases. This is an ongoing research, and the next steps include interviewing the remaining managers and later conducting controlled experiments with a large sample of project managers to test the hypotheses derived by the study and validate the evidence presented here.

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