Project Management in Light of Cognitive Biases: A Public Sector IT Organization Case

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Abstract: When making judgments, people rely on heuristics, or general rules of thumb. In other words, they use mental "shortcuts", which may lead to rational solutions and good estimates. In certain situations, however, these simplification techniques can cause inconsistencies and promote cognitive biases. One root cause of almost all project failures is human error or misjudgment. Although the ability to make right decisions is considered a main indicator of project management professionalism, many project managers are unwilling to try to improve the quality of their decisions. Because project managers rarely have enough time and resources to perform a proper analysis, and a decision analysis expert is not always available, there is always the temptation to make intuitive decisions. Even having enough knowledge of a particular area, some natural limitations to thinking mechanisms can lead to potentially harmful choices. Since people tend to rate themselves as above average when asked to characterize their abilities, they tend not to see their own biases. This paper proposes to shed light on the susceptibility of project managers to cognitive biases and how they deal with them, including techniques and tools they use to minimize their negative effects. This study evaluates ten cognitive biases: anchoring bias, exposure effect, pseudocertainty effect, certainty effect, hindsight bias, halo effect, planning fallacy, sunk-cost fallacy, availability-related bias, and Parkinson´s law effect. The qualitative approach was based on semi-structured interviews with seven experienced project managers in a Brazilian large public sector IT organization. Other three project managers participated in the triangulation process in order to validate the concepts map resulted from this process. All project managers recognized susceptibility in eight of ten cognitive biases. Some agile practices such as use of burndown chart for daily monitoring of planned versus accomplished activities and bottom-up planning from short activities were suggested as alternatives to minimize planning fallacy. The last technique was also indicated to minimize Parkinson´s law effects along with daily team meetings. Opinion of others, including experts, was the most mentioned alternative method by project managers, aiming to reduce the negative impact of seven biases. Although its limitations, we believe that this work may help to improve project managers' awareness of cognitive biases and also their susceptibility to these systematic errors, eliciting common tools and techniques used to minimize their negative effects, which can lead to better decisions, and thus, to better project´s outcomes.

Keywords: project management, decision making, cognitive biases

1. Introduction

“A project is a temporary endeavor undertaken to create a unique product, service, or result” (Project Management Institute, 2013, p. 2) or, according to Söderlund (in Morris, Pinto and Söderlund, 2011), it is a temporary organization, with an intentional death, purposefully designed to provide benefits for a permanent organization or certain stakeholders through complex problem solving processes.

Despite efforts to define recognized standards, methods and processes for Project Management, we must recognize we are not dealing with an exact science following given laws or established rules. It is, rather, a complex set of tasks largely based on human relations and the specific knowledge, experiences, character, observation, and cultural background of each individual (Hogberg and Adamsson, 1983). Problems in project management context involve multiple objectives, multiple risks and uncertainties, multiple stakeholders and can be complex (Virine and Trumper, 2008). Faced with the need to understand the complexity of their problems and to know how to manage the factors involved in this process, project managers incorporate their intrinsic values, using unconsciously, personal resources and experience to find a solution (Thomaz, 2005). Even having knowledge of a particular area, some natural limitations to our thinking mechanisms can lead to potentially harmful choices.

According to Kahneman (2011), the human mind works in two ways: one is fast and intuitive and the other is slower, but more logical and deliberative. Whereas the first form handles with automatic and involuntary cognitive activity, the second comes into play when you have to perform tasks requiring concentration and

self-control. This organization allows the development of sophisticated abilities and the accomplishment of complex tasks with relative ease. However, it can be a source of systematic errors, or cognitive biases, when intuition is influenced by stereotypes and other factors.

A considerable number of empirical studies have been carried out providing further support to the prominence of cognitive biases in strategic decision making (Bateman and Zeithaml, 1989; Bukszar and Connolly, 1988; Das and Teng, 1999; Lant, Milliken and Batra, 1992). However, there is a lack of empirical studies relating project management to cognitive biases, specifically in Information and Technology context. Considering that instrumental approaches for project management are not sufficient for such a flexible product, uncertain, innovative and weakly defined as software and that the feature that allows the software to become "almost everything" hinders planning, monitoring and control in classic terms (McBride, 2008), the project success depends on how project managers deal with the problems.

Decision-making is a skill that can be improved with experience and training (Hastie and Dawes, 2001) and thus project managers can learn and teach themselves on how to make better choices by overcoming common mental traps. In this sense, it is important to shed light on IT project managers' awareness about cognitive biases, and also on their susceptibility to them, eliciting common tools and techniques used to minimize their negative effects.

This study evaluates ten cognitive biases: anchoring bias, exposure effect, pseudocertainty effect, certainty effect, hindsight bias, halo effect, planning fallacy, sunk-cost fallacy, availability-related bias, and Parkinson's law effect. The qualitative approach was based on semi-structured interviews with seven experienced project managers in a Brazilian large public sector IT organization.

The remainder of this paper is organized as follows: Section 2 presents a discussion about decision making in project management context, including the concepts of heuristics and cognitive biases; Section 3 details the research method; Section 4 details the data related to each cognitive bias extracted from interviews; Section 5 consolidates the findings; and, finally, Section 6 presents our conclusions.

2. Project management and decision making

According to the Project Management Institute (2013), in addition to any area-specific skills and general management proficiencies required for the project, effective project management requires that the project manager possesses the three following competencies: knowledge, performance and personal. The first one refers to what project manager knows about project management; the second one refers to what project manager is able to do or accomplish while applying his or her project management knowledge; and the last one refers to how project manager behaves when performing the project or related activity, which encompasses attitudes, core personality characteristics, and leadership.

These competencies are also referred to as hard and soft skills (Gillard, 2009; Sukhoo, 2005). While the first one refers to processes, tools, and techniques, the second one includes, among others skills, communication, team building, flexibility and creativity, leadership, decision making, and ability to manage stress and conflict.
Among soft skills, decision making capacity aims to be one of the most important. In many cases, the problems involve a great variety of factors to be considered when a decision has to be made. When people think consciously, they are able to focus on only a few things at once (Dijksterhuis et al., 2006). The more factors involved in the analysis, the more difficult it is to make a logical choice. In this way, a project manager will manage a project based on how he or she perceives the project.

Simon (1957) suggested the concept of bounded rationality, that is, humans have a limited mental capacity and cannot directly capture and process all of the world's complexity. Instead, people construct a simplified model of reality and then use this model to come up with judgments. We behave rationally within the model; however, the model does not necessarily represent reality. In this sense, Virine and Trumper (2008) emphasize the importance of pause and consider the following questions: *Are you motivated to see the project in a particular way? What do you expect from this particular decision? Would you be able to see the project differently without these expectations and motivational factors?* However, in the hasty search for solutions, it is hard for project managers to have this sensibility, and thus, making them susceptible to cognitive biases.

2.1 Heuristics and cognitive biases

Decision makers are known to rely on a few judgmental rules, or heuristics, to simplify complex decision situations. Although these "rules of thumb" are often necessary and useful, they also introduce cognitive biases that can lead to severe and systematic errors in decision making (Kahneman, Slovic and Tversky, 1982). Thus, cognitive biases can be viewed as a negative consequence of adopting heuristics.

Based on extensive lab experiments, Kahneman, Slovic and Tversky (1982) reported that biases may result from three major heuristics: representativeness, availability, and adjustment and anchoring. Representativeness is described as the tendency to judge the probability that A belongs to B by how representative or similar A is to B. It refers to the tendency to imagine that what we see or will see is typical of what can occur. Availability is the tendency to judge the frequency of an event by the ease of remembering specific examples. Decision makers also tend to make judgments based on an initial assessment as anchor, but fail to make sufficient adjustments later on. It is the tendency to rely on one trait or piece of information when making decisions.

Virine and Trumper (2008) categorized several cognitive biases into four types: (i) behavioral biases and biases related to perception; (ii) biases in estimation of probability and belief; (iii) social and group biases; and (iv) memory biases and effects. For the purpose of this study, ten cognitive biases were selected to be evaluated, which are described in Table 1.

Table 1: Cognitive biases considered in this study

Cognitive Bias	Description
Anchoring bias	Human tendency to rely intensively in a trait or piece of information without making sufficient adjustments.
Exposure effect	Human tendency to like something simply because it is familiar.
Pseudocertainty effect	Human tendency to exaggerate the weight of small risks and thus becoming very willing to pay a higher value than expected to eliminate them completely.
Certainty effect	Human tendency to assign insufficient weight to the existing certainty results.
Hindsight bias	Human tendency to be unable to reconstruct past states of knowledge or beliefs that changed later.
Halo effect	Human tendency to evaluate a particular item that may interfere in other thus contaminating the final result.
Planning fallacy	Human tendency to underestimate the duration of the project´s activities.
Sunk-cost fallacy	Human tendency to keep an action running even knowing that the expected results will not be achieved and that the cost that has already been spent cannot be recovered.
Availability-related bias	Human tendency to rely on rare events based on how easy an example can be remembered.
Parkinson´s law effect	Human tendency to procrastinate the execution of activities until the end date originally agreed.

3. Research method

The research method is based on a qualitative approach through semi-structured interviews. The use of open-ended questions in this qualitative study is due to the fact that this allows respondents to express their opinion, what they think, what they know, and what they practice without the influence of the researcher, thus not being limited to a set of alternatives. It facilitated the collection of information whenever occurred deviant responses, or unclear, derived from the questions. Each phase of the research method and its outcomes are shown in Figure 1.

3.1 Planning

This research was conducted in a large public sector IT organization which develops systems aimed to automate public policies of Brazilian government. The systems range from Business Intelligence products to web systems, handling a large amount of data. The projects are characterized by the existence of various stakeholders, both internal and external, which require a large ability from project managers to deal with various perspectives and so achieve the expected results. In this context, cognitive biases, if poorly controlled, can lead projects to failure.

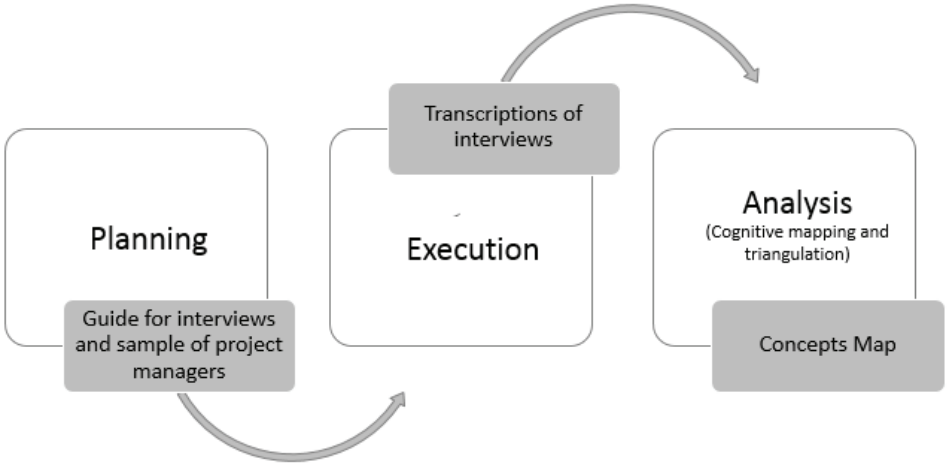

Figure 1: Research method

The sample of this study consists of seven experienced project managers. On average, their working experience managing projects was five years. Other three project managers, who did not participate of the interviews, were selected for the triangulation phase. An invitation was sent to each project manager contextualizing the research objective, the interview script and the cognitive biases to be analyzed with their respective descriptions in order to make them think beforehand and thus optimize the time of interviews.

3.2 Execution

During the interviews, for each bias, after presenting its description, it was asked the following questions: "Have you ever experienced a situation related to this bias in the context of project management?" and "If so, describe the situation and actions that was taken.". By using keywords selected by the researchers related to each bias, not accessible to the interviewees, the interviewer avoided deviant responses that were unrelated to the question.

In order to avoid inconsistent responses not related to reality, it was emphasized that the interviews would be recorded for the sole purpose of being transcribed to support the analysis, and that the anonymity of each interviewee was guaranteed. The interviews were recorded using the software QuickTime Player and were analyzed after each one in order to improve the following interviews. On average, the duration of each interview was 30 minutes.

3.3 Analysis

The content analysis of individual responses was performed by using two complementary techniques: (i) Strategic Options Development and Analysis approach (Eden and Ackermann, 1998) for the creation and treatment of cognitive maps, which includes aggregating and clarifying the concepts and its relations, and (ii) triangulation technique as a way to prevent the influence of individual analysis based on interviewer-researcher's personal opinion (Northcutt and McCoy, 2004). Three independent project managers participated of this phase. The analysis of semi-structured interviews was conducted by the following three steps:

- *Grouping the responses for each question:* As a starting point of creative thinking, all responses of each question were grouped to extract information about susceptibility, root causes, tools and techniques, with the objective of building a map with all the concepts.
- *Discussion of initial concepts map:* During the triangulation process, the concepts map was discussed with the three project managers who did not participate of the interviews in order to, interactively, review it by including, aggregating or disaggregating the concepts. This process was facilitated by one of the researchers.
- *Validation of the final congregated concepts map:* After the interactions developed in the previous step, it was obtained an updated concepts map with the contributions of each project manager. Through a group meeting, also facilitated by one of the researchers, they discussed, fitted and sought consensus in the final congregated concepts map.

4. Discussions

This section presents the relationship between cognitive biases, root causes, tools and techniques mentioned by project managers through a concepts map. The concepts related to biases consist of two poles: the main pole (first sentence) and the opposite one. In this case, the symbol "..." is read "instead of". The arrows indicate the direction of the connection of concepts. A positive sign (+) at the end of the arrow indicates that the origin of the arrow leads to the first pole of the bias, while a negative sign (-) at the end of the arrow indicates the origin of the arrow leads to the second pole of bias. In summary, the tools and techniques are related to the first pole (low occurrence of bias) and the root causes to the second pole (high occurrence of bias). In order to facilitate visualization of the concepts map, it was divided into three maps, illustrated in Figures 2, 3 and 4.

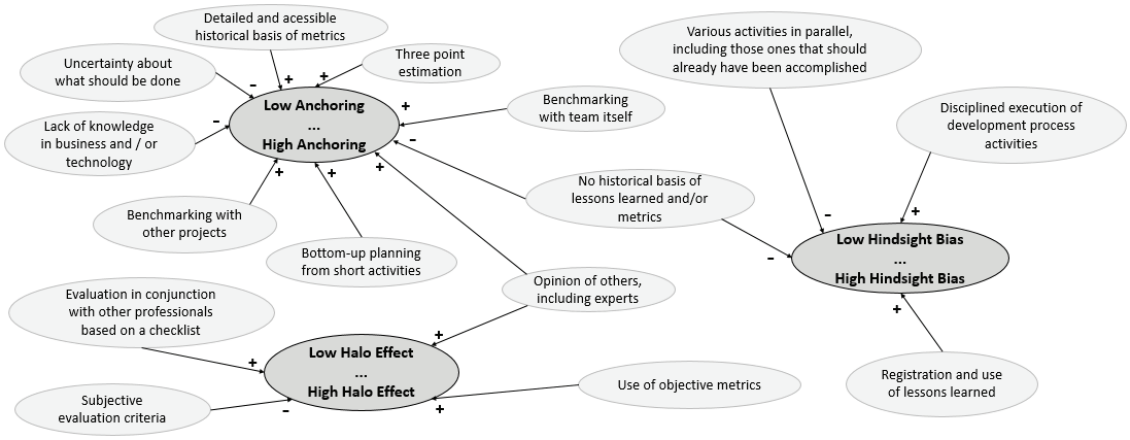

Figure 2: Concepts map of anchoring, halo effect, and hindsight bias

When referring to anchoring bias, all project managers described situations about time estimation. Lack of knowledge in business and/or technology, uncertainty about what should be done and the absence of a historical basis collaborate for anchoring initial estimate. To minimize its effects, an alternative presented was detailing development process activities that led to such estimate, so it can be questioned and discussed. Other techniques presented are related to benchmark the estimates of the most critical activities using data from the own team and from the other projects, which requires an organizational historical basis and culture in measurement and analysis (Jones, 2008). It was also mentioned the three-point estimation technique (PMI, 2013), which provides an expected duration of activities and clarify the range of uncertainty around the expected duration by considering an optimistic, pessimistic and most likely view. Opinion of others was considered important through knowledge exchange with team members, other project managers, the Project Management Office (PMO), and so on. This socialization process is characterized by social interaction through which tacit knowledge is transferred and shared in face-to-face meetings (Nonaka and Takeuchi, 1995).

When questioned about halo effect, project managers presented the use of subjective evaluation criteria as root cause, which gives rise to the judgment caused by the first impression. To address this deficiency, it was suggested the evaluation of an artifact or team member together with other professionals based on a checklist so everyone can have a clear idea of the items to be evaluated. The necessity to consider opinion of others, from inside or/and outside the project, was also considered. The use of objective metrics (Jones, 2008) was also indicated, whenever possible, to minimize the negative impact of this bias.

When referred to hindsight bias, the lack of historical basis of lessons learned including what went right and wrong was considered as root cause. This issue is reported by some authors, as the difficulty in storing information/data that can be retrieved easily (Pemsel and Wiewiora, 2013) and that is systematically organized (Barclay and Osei-Bryson, 2010). Other root cause was the performing of various activities in parallel, including those that should have already been accomplished, which generates confusion about what should have been done at the time. In this sense, alternatives approaches to control this bias were the registration and use of lessons learned and discipline about the sequence in conducting the development process activities.

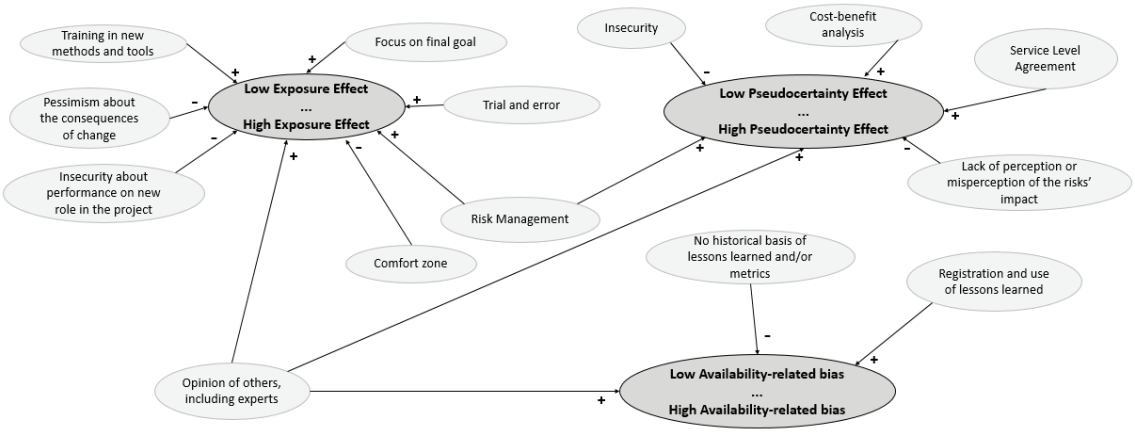

Figure 3: Concepts map of exposure effect, pseudocertainty effect, and availability-related bias

Regarding to exposure effect, project managers mentioned root causes, tools and techniques they use to deal with it in their teams. Comfort zone, pessimism about the consequences of change and insecurity about performance on new role in the project, because he/she is already recognized in his/her current function, were indicated as root causes. In order to overcome this limitation, the trial and error through execution of pilot tasks was referred as an alternative to review the new approach either concerning role changes in teams, use of new technology or new development method, with the possibility of going back, if necessary. It was also emphasized the necessity to focus on the final goal, in which project manager has an important role for motivation, emphasizing the benefits of change, and managing the potential problems related to changes in form of risks. Project risk management is an important aspect of project management. According to the Project Management Institute (2013, p. 310) project risk is defined as "an uncertain event or condition that, if it occurs, has a positive or negative effect on one or more project´s objectives such as scope, schedule, cost, and quality". Risk management is one of the ten knowledge areas in which a project manager must be competent. Opinion of others was referred to provide an outside view of project team, which increases a change's credibility. Capacitation of team members in new methods and tools was also considered important.

Few project managers presented susceptibility in pseudocertainty effect, pointing to insecurity and lack of perception or misperception of the risks' impact as the main villains. As alternatives to minimize its negative effects, besides opinion of others and risk management, project managers mentioned Cost-Benefit Analysis (CBA), a technique that is used to determine options that provide the best approach for the adoption and practice in terms of benefits in labour, time and cost savings (Boardman, 2006). Other technique was the Service Level Agreement (SLA), which is an agreement between two or more parties that includes segments to address such as definition of services, performance measurement, problem management, customer duties, and warranties (Blokdijk, 2008). It aims to be important since the project team don´t waste work force in activities that are not necessary. Regarding to certainty effect, project managers did not present evidences on being susceptible to this bias. They did not refer to situations in which they assigned insufficient weight to the existing certainty results that could describe this systematic error in software projects.

Regarding to availability-related bias, the lack of historical basis was also referred as a root cause. Accordingly, the regular recording of lessons learned during the project was considered important, not only at the end of the project. More important than knowledge storage is how it is stored. In this sense, the Project Management Office (PMO) aims to have an important role (Desouza and Evaristo, 2006). Opinion of others, including experts, once again was presented as important.

When referred to sunk-cost fallacy, beyond the comfort zone and stubbornness inherent to some project managers or stakeholders, the short-term view without long-term benefits analysis was referred. In this case, considering scenarios in which the benefits of an immediate change were proved, it was preferred to extend it despite the immediate cost and the time required for the change to be implemented. Some cases related to changing technology and refactoring software code were mentioned, thereby increasing the cost of future change. Being flexible to alternative plans, which requires experience from the project manager, were cited as a solution. Opinion of others, including experts, once again was considered important to provide an outside view from project. In this case, project managers emphasized risk and cost management.

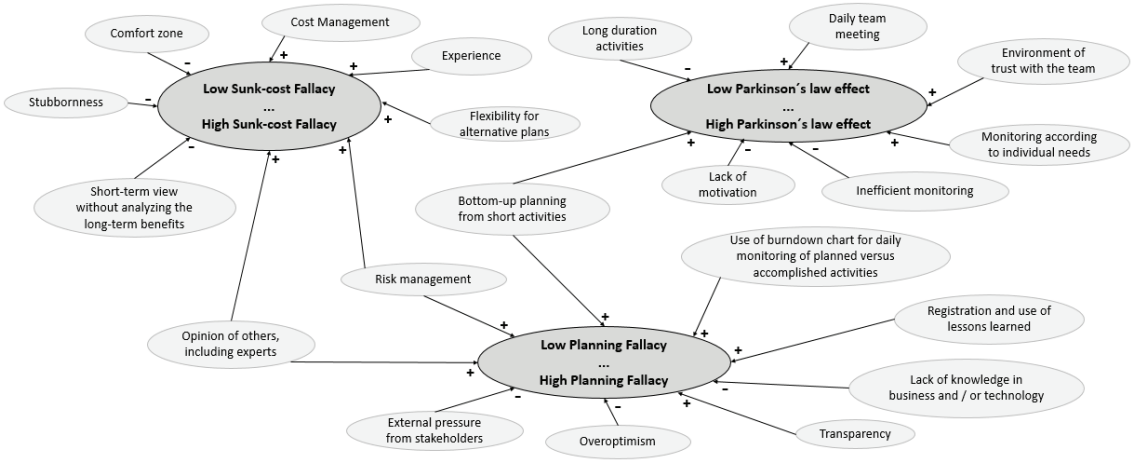

Figure 4: Concepts map of sunk-cost fallacy, Parkinson´s law effect and planning fallacy

Long duration tasks and inefficient monitoring were suggested as the main root causes of Parkinson's Law effect. In this sense, in addition to bottom-up planning from short activities, lasting between one and three days, project managers indicated daily team meetings as a good alternative, both agile practices (Schwaber, 1997). If necessary, monitoring activities should be conducted according to individual needs. Furthermore, the creation of an environment of trust with the team proved to be important.

When referring to planning fallacy, lack of knowledge in business and/or technology, overoptimism to meet stakeholder expectations and external pressure from stakeholders were mentioned as the main factors causing this bias. In this case, in addition to opinion of others, such as the participation of project´s stakeholders in planning, ensuring transparency and consensus, it was mentioned the bottom-up planning from short activities and use of burndown chart for daily monitoring of planned versus accomplished activities. The last one facilitates identification of possible deviations and on time decision making. Such practices are common in agile processes (Schwaber, 1997). In this sense, as well as in other biases, risk management proved to be essential.

5. Findings

There was unanimity for susceptibility in eight of ten cognitive biases. Only a minority of project managers recognized susceptibility to pseudocertainty effect, which can be explained by the urgency inherent in IT projects where there is a considerable focus on the development of what is most important, letting events that are unlikely to happen in background. Regarding to certainty effect, project managers did not present evidences on being susceptible to this bias since they did not refer to situations that could describe this systematic error in software projects.

Some of techniques mentioned to minimize the negative effects of cognitive biases were related to agile practices such as the use of burndown chart for daily monitoring of planned versus accomplished activities and bottom-up planning from short activities which were suggested as alternatives to minimize planning fallacy effects. The last one was also indicated to minimize Parkinson´s law effects along with daily team meetings.

Opinion of others was the alternative mentioned to reduce the majority of biases: anchoring, halo effect, availability-related bias, pseudocertainty bias, planning fallacy, sunk-cost fallacy and exposure effect. Although the project manager is responsible for making final project decisions, it shows a concern to consider opinion of others, such as consultants, Project Management Office members, other project managers and the project team itself with the objective of obtaining a better base for their decisions and not depositing all confidence in their own experience. The most mentioned root causes were related to comfort zone and absence of historical basis. The difficulty in storing information/data that is systematically organized and that can be retrieved easily is one of the most problems in knowledge management in project´s context (Barclay and Osei-Bryson, 2010; Pemsel and Wiewiora, 2013).

6. Conclusions

The primary challenge of project managers is to achieve all project goals and objectives while honoring the preconceived constraints, such as scope, time, quality and budget. In the hasty search for solutions, bad decisions can be made simply because they do not stop to think about what should be done, increasing susceptibility to cognitive biases. This situation worsens when the product being developed is flexible, uncertain, innovative and weakly, such as software is.

This study aimed to shed light on IT project managers' awareness and susceptibility to cognitive biases as well as the tools and techniques used by them to minimize their negative effects. Agile practices and knowledge management activities with emphasis on knowledge storage in lessons learned bases and knowledge sharing in order to gain opinion of others, including experts, were cited as alternative solutions to minimize the negative effects of cognitive biases.

Although the sample is composed by only ten project managers, including those ones who participated of interviews and triangulation, this study resulted in important insights, contributing to human aspects of project management. In future studies, a larger sample of project managers can be used, including those ones from different organizations and from different industries in order to give a broader overview of this issue. In addition, other biases should also be evaluated.

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