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PITFALLS IN CASCADE DOWN PROJECT RISK MANAGEMENT: AN ACTION-RESEARCH IN AN ENGINEERING COMPANY

ARMADILHAS NO GERENCIAMENTO DE RISCOS DE CIMA PARA BAIXO: UMA PESQUISA-AÇÃO EM UMA EMPRESA DE ENGENHARIA

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Resumo: O estudo tem como objetivo identificar as falhas na implementação do gerenciamento de riscos, focando tanto nos aspectos hard quanto soft do gerenciamento de riscos. A pesquisa foi baseada em uma pesquisa ação em uma empresa de engenharia que desenvolve projetos em quatro diferentes mercados: hidrocarbonetos, mineração, infraestrutura e meio ambiente, e energia. O resultado mostra a importância do engajamento top-down na implementação do gerenciamento de riscos e, por outro lado, as suas armadilhas, reduzindo o gap entre o que é dito e o que é feito.

Palavras-chave: Risco. Projeto. Gerenciamento de riscos. Gerenciamento de projetos. Teoria da contingência.

Abstract: This study aims to identify the pitfalls in risk management implementation, focusing both on hard and soft sides of risk management. The research design was based on an action-research performed in an engineering company that develops projects in four different markets: hydrocarbons, mining, infrastructure and environment, and power. The result shows the importance of top-down engagement in implementing risk management and, on the other hand, the pitfalls in cascading down the implementation drivers, reducing the gap between what is said and what is done.

Keywords: Risk. Project. Risk management. Project management. Contingency theory.

1 INTRODUCTION

In the last years several studies have been conducted about project management and project risk management (PRM). However, in the construction field, few theories can be found (Lyons and Skitmore, 2003). Among the existing literature, the most relevant are from the 1980s and 1990s. What can be inferred is that, although those researches are from decades ago, it seems that the scenario has changed little.

Despite the fact that the research has been conducted in countries such as Australia or the United Kingdom, the described scenario and the scenario in some Brazilian companies are very similar. Consequently, PRM may be not effective. Regarding its effectiveness, a factor that can also hinder its implementation is cultural resistance (Uher and Toakley, 1999).

Several other factors that influence PRM implementation can be raised. The strategy to implement the process (top-down or bottom-up) is one of them (Kezner, 2011). Not only risk strategy impacts the implementation, but also the company strategy itself is relevant. The alignment between risk and company vision is required (Jorgensen, 2005). Moreover, the soft side of risk management is significant for the project success (Carvalho and Rabechini, 2015). Following this logic, the organizational structure is also determinant to the process (Hertz and Thomas, 1983). Although an organizational structure itself forms a barrier to implement PRM, some structures are more favorable than others (Uher and Toakley, 1998).

The knowledge about PRM is also an important factor. It is not unusual misunderstanding risk and risk management (Uher and Toakley, 1998). As a result, techniques to manage risk are poorly used (Akintoye and MacLeod, 1996). Another thing that can also influence risk management implementation is the concept of risk appetite. Finally, the type of contract has influence on how risk management will be undertaken in the project (Carvalho and Rabechini, 2011).

The literature presents different articles, each one discussing a few aspects of the PRM, but not all of them consider both technical and cultural aspects of the implementation. In this context, this paper aims at discussing the pitfalls in risk management implementation focusing on both aspects. The methodological approach was an action research in a Brazilian branch office of an Australian worldwide company that develops engineering projects.

The next section (section 2) provides a theoretical framework on the concepts of risk and risk management, including tools and techniques and factors to be considered on PRM implementation, followed by the description of the research method (section 3). Finally, the results and its discussion are presented in section 4 along with the conclusions, in section 5.

2 LITERATURE REVIEW

The following sections explore the literature on risk and project management.

2.1 Risk and uncertainty

The literature presents several definitions for risk. PMBoK (PMI, 2013), for instance, defines risk as an uncertain event that, when occurs, has a positive or negative impact on the project objectives. Kezner (2009) defines it as function of likelihood and consequence of not achieving the project's goals. For Hillson (2001) risks are events that may have negative (threats) or positive (opportunities) impact on the project.

Most of the risk definitions involve the concept of uncertainty. As PMBoK defines risk as an uncertainty event, one may incorrectly consider risk and uncertainty as synonymous (Perminova et al., 2008).

Perminova et al. (2008) propose a difference between risk and uncertainty: whereas risk can be measured about its likelihood and consequence, uncertainty cannot. Still, Perminova et al. (2008) considers risk and uncertainty with a relation of cause and effect: an uncertainty is the cause of a risk.

About uncertainty, Pitch et al. (2002) distinguish four types of uncertainty: variation, foreseeable uncertainty, unforeseeable uncertainty, and chaos. Variation and foreseeable uncertainty can be called as risk.

2.2 Risk management approaches

As risk has different, but similar definitions, the management of risks has also different approaches with different processes.

According to PMBoK (PMI, 2013), there are six processes to manage risks: planning, identification, qualitative and quantitative analysis, response planning, and monitoring and control. For ISO31000, managing risks consists in establishing the context, risk identification, analysis and evaluation (risk assessment), risk treatment, communication and consultation, and monitor and review. Thus, it can be summarized in four clusters. The more strategic cluster includes establishing the context (ISO31000), planning (PMBoK), and communication and consultation (ISO31000). The second cluster is the risk assessment (ISO31000) that can be divided into risk identification, qualitative risk analysis and quantitative risk analysis. The third cluster is risk treatment that encompasses risk response planning. The final cluster is monitoring, reviewing and controlling.

2.3 Risk management tools and techniques

An extensive list of tools and techniques to manage risks in projects is available in the literature. This section briefly presents some of them, according to the risk management phase it belongs to.

The main outcome of the planning phase is the risk management plan, which describes the activities that must be done regarding risks to achieve the desired outcome for the project (Kezner, 2011). Zwikael and Sadeh (2004) also point out the relevance of having a good project planning to enhance the project success. In their research, they find point out that the practical solution to deal with high project risk is improving the project plan.

For risk identification, the most common approach is brainstorming (Raz and Michael, 2001) and its variations, such as brainwriting (Carvalho and Rabechini, 2011). It is

also possible to identify risks using a SWOT matrix (PMI, 2008), which has the advantage of inducing the team to think not only on the downsides but also on upsides.

Risks are also categorized during their identification. They can be internal or external, technical or organizational, and so on (PMI, 2008). To have a systematic categorization, it is recommended to develop a risk breakdown structure (RBS), or to use diagrams (Carvalho and Rabechini, 2011). Kmec (2011) suggests that visualization tools are extremely important for risks logs to make sense. He defends that risks develop over time, and that diagrams can represent this movement.

Hillson (2000) states that good risk identification should include a description of the risk event, cause and consequence. PMI (2008) also recommends identifying risk triggers.

Qualitative risk analysis is usually performed by determining the likelihood of the risk occurrence and its impact on the goals of the project (Raz and Michael, 2001). The combination of likelihood and impact results in a risk map, making possible to rank risks in some areas according to its severity (Kezner, 2011). The size of the area translates the company's risk appetite (Carvalho and Rabechini, 2011).

Quantitative risk analysis is usually performed after the qualitative analysis, using expected value technique, decision trees or modeling and simulation (Chilcott, 2010). An alternative approach suggested by PMI (2000) is performing a sensitivity analysis to identify the most critical factors that have potential to affect the project's success.

After risks are analyzed and evaluated, appropriate treatment plans must be developed. The risk treatment phase plays the proactive role in the risk management process (Fan, Lin and Sheu, 2008). Raftery (1994) identifies four possible strategies: to eliminate, transfer, accept (retain) or mitigate (reduce likelihood and/or the magnitude of the consequences).

Although some scholars propose models and frameworks to select the proper approach to manage risks (Fan, Lin and Sheu, 2008; Seyedhoseini, Noori and Hatefi, 2009), the choice of a specific strategy depends on the risk situation and the project's characteristics and context.

2.4 Risk management implementation

Shenhar (2001) argues that different projects are managed in different ways, and there is not a *one-size-fits-all* management approach. Barki et al. (2001) explores the contingency theory to show that project performance depends on the fit between risk management and risk exposure. Nevertheless, the literature contributes with some factors that facilitate or inhibit the process.

For Barki et al. (2001), PRM can be assessed through three dimensions: formal planning, internal integration and user participation. Projects with higher risk require higher levels of planning and oversight. Taylor et al. (2012) identifies some risk dimen-

sions related to project performance: criticality, uncertainty, complexity, size, project management experience, and stakeholder involvement.

Kerzner (2011) states that risk management implementation should be both bottom-up and top-down. The top management must be engaged in the process, fostering all the company to follow it. In the same way, the operational staff must be collaborative and compromised in adopting risk management practices.

Kwak and Stoddard (2004) identify some principles to have effective PRM: shared product vision, forward-looking search for uncertainties, open communication, value of individual perception, systems perspective, integration with the programs management, proactive strategies, systematic and adaptable methodology and outline, and continuous process.

Akintoye and MacLeod (1997) identified reasons for both contractors and client for managing risks. They believe that PRM is essential to profit, to ensure they are often more right than wrong, to assess project feasibility, to determine if the firm is making an adequate profit on a particular project, and to control factors that will deter completion of projects within the budget and the schedule.

Although Akintoye and MacLeod (1997) have identified benefits for having risk management in place, in practice companies do not always follow risk management process. Wieland, Høgberg and Strømseng (2000) argues that a risk-averse culture, an inadequate management infrastructure to support risk management and a lack of a systematic and repeatable strategy to identify, analyze and follow-up risks are some reasons why companies do not practice risk management.

Moreover, despite the large number of tools and techniques available to manage risks, Zwikael and Ahn (2011) show that only a small set are actually used, and often used with low quality, because of the complexity, the effort needed and the lack of perceived effectiveness.

Dedolph (2003) also contributes to the subject, listing cultural factors that contribute to organizational resistance: teams are rewarded for solving problems and not for their prevention.

Organizational factors should be also considered during the risk management implementation (Uher and Toakley, 1998). Hull (1980), and Hertz and Thomas (1983) state that implementation success is contingent to organizational and behavioral forces, such as readiness to adopt PRM, engagement of high and medium level management, availability of high quality data and team work.

Jorgensen (2005) states that in order to have a good risk management implementation, it is necessary to understand the organization and its context. Furthermore, it is essential to have the risk management vision aligned to the company's overall vision and strategy.

Kwak and Stoddard (2004) identified that the critical aspect to effectively implement risk management is not technical but behavioral. This is also related to cultural as-

pects, pointed by Uher and Toakley (1998). The authors emphasize the need to build interpersonal relationships based on mutual respect, trust and transparency, stimulating teamwork, increasing group synergy and helping to generate new ideas and explore new concepts and paradigms.

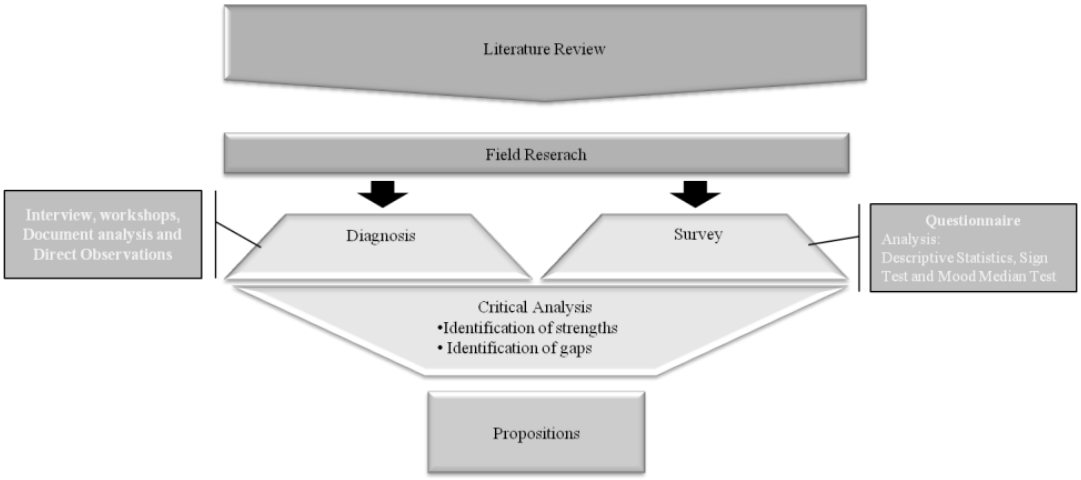
Zwikael and Ahn (2011) show also that risk perception varies among different countries and industries, and there is not a single approach that fits all cultures (Ellingson, 2009).

Another factor to be considered is risk tolerance (Ward et al., 1991; Akintoye and Macleod, 1994). Finally, PRM is also related to the contract type. For Carvalho and Rabechini (2011), a turn-key contract, for instance, is riskier than a reimbursable contract, which is why prices are higher.

3 RESEARCH METHODS

To achieve the objectives of the research, the study was developed as an action research, in three phases: first, a literature review, followed by a diagnosis of the risk management process in the company, and finally a survey about risk management with the key stakeholders. The second and third steps are part of the field research. Figure 1 shows the scheme of the research methodology.

Figure 1 – Research Methodology



The action research was conducted initially with a diagnosis of the PRM of the company, using several sources of evidences such as interviews with the corporate risk manager, documentations and workshops, and direct observations. Through the analysis of the corporate documents related to risk and documents stating the company's mission, values and vision, it was possible to have some insights about cultural and strategic aspects of risk management implementation. The interviews with the corporate risk manager aim to understand how risk management was implemented in the Brazilian

office. An interview protocol was developed, with open-ended questions, to understand: 1) How PRM is done at the head office; 2) How it was done in Brazil, before the acquisition; 3) How it is done after the acquisition; and 4) How the team was trained to do PRM in the new process.

The participation in risk workshops and the direct observation allowed a better understanding of the company's risk appetite.

The questionnaire was divided into three sections: respondent profile, project characteristics and risk management processes, tools and techniques. Questions about the project characteristics include contract type, project size (according to contract value) and risk classification. Within the specific risk management questions, in addition to process, tools and techniques, some questions regarding the respondent perception about risk management were made.

3.1 Demographic sample

To understand the perspective of the different stakeholders in a more structured way, a survey was conducted. The target population for the survey was professionals involved in project management and risk management in the Brazilian unit of the business, as well as the professionals allocated in the risk area, proposal and project managers (usually the same person), production managers, coordinators, superintendents and business developers, and other internal stakeholders indirectly affected by risk management, totalizing almost 800 employees. The sample selection was not random, and was composed by 30 respondents, with the following profile: 13% from risk area, 20% of coordinators, 10% of project managers, 7% of productions managers, 10% of superintendents, 7% of business developers and 33% of other areas. Twenty-three out of 30 respondents answered the full questionnaire.

3.2 Data Analysis

Content analysis was applied to analyze the qualitative data gathered with the interviews. All the interviews were recorded and transcribed.

For quantitative data, the collected responses were then analyzed using statistical techniques, such as Mood Median Test and Sign Test, and descriptive statistics. The study investigated how the project characteristics could influence the risk management process, the use of the available tools and techniques, and the factors that affect risk management implementation and execution.

The statistical analysis was developed using Minitab®. In the first step, descriptive statistics was conducted, especially for risk management process, since the sample is not large enough to perform other analysis. Some non-parametric analysis was also done, given the use of the Likert scale.

The Sign Test was used to assess the development level of each risk management process. The test assesses whether the process relevance is higher or lower than moderate. Statistically, it means to test the following hypothesis:

$$\begin{cases} H_0 : Median = 3 \\ H_1 : Median > 3 \end{cases} \text{ or } \begin{cases} H_0 : Median = 3 \\ H_1 : Median < 3 \end{cases}$$

A similar analysis was conducted to understand the employees' perception about risk management.

To assess whether there is difference in risk management process in different types of project, we applied the Mood's median test to analyze differences between some contingencies: risk classification (A+, A, B), contract type (lump sum or cost reimbursable), contract size (major, minor or miscellaneous), scope (construction management, engineering, procurement, and construction management) and technological complexity (business as usual or non-business as usual).

4 ACTION-RESEARCH FINDINGS

The analyzed company provides engineering services, based in Australia, and has opened a branch in Brazil by acquiring an engineering company, which is the focus of this study. This company develops projects in four different markets: hydrocarbons, mining, infrastructure & environment, and power.

Risk management is mandatory, because the company is listed in the Australian Stock Exchange. Thus, risks are managed in two levels: business and project. At the project level, the management starts during the proposal elaboration. At the business level, the risks that can affect all the business in general are considered. The focus of the article is on the project level.

In both cases, the conduction of risk management is based on its corporate methodology, based on ISO 31000 standard. The decision to use ISO 31000 standard is due to its applicability to the business risks management and not focused on project risk management, such as the PMBOK.

The methodology is reflected not only in project-level procedures, but also in documents describing corporate guidelines (Risk Management Policy, a Framework of Risk Management and Procedure for Risk Management in Projects). The risk management framework also shows the functions of each professional in the risk management context. In the intranet tools and templates for risk analysis and the software are available. To verify if the appropriate actions are being taken, internal audits are conducted throughout the organization. Thus, it is clear that the implementation of risk management is top-down. However, concerning the engagement from the bottom-up it appears that there is little involvement of people from lower positions, and risk management is almost exclusively an activity of managers and senior position professionals.

The level of risk is determined when the proposal is submitted for approval to bid. The tool to determine the project risk level is a form with several questions concerning design features such as time, budget, project location, contract type, contract value, and so on. From the responses, the level of risk is determined and classified in four levels (A+, A, B or C). According to the risk level, approval may be beyond the company CEO's delegation in the country, and can move on to a regional leader or to the global CEO. This form must be completed not only at the beginning of the proposal, but also when the company gains the project, or whenever there are significant changes. The draft contract is also assessed to identify special risks (for example, working in a consortium or contract with unlimited amount of fines and indemnities payment). There is a document with guidelines for special risks. At the proposal stage, a risk analysis is conducted through a risk workshop with participation of experts and relevant people from the project team.

An important remark is that the procedures were developed in Australia, before opening the Brazilian office, and the intention was to implement exactly the same procedures in Brazil. However, the risk manager in Brazil realized that it was necessary to adapt the process to the Brazilian market context, especially regarding contingency calculation and management of the organizational structure risk. The contingency reserve in Australia was not always calculated, and it was sometimes arbitrary. Moreover, the risk management structure in Australia was decentralized and a specific risk department did not exist, while in Brazil centralized model was implemented. In operations in Brazil, during the proposal examination, usually only the manager of the proposal and a few people who participated in the preparation of the project's cost estimates are involved. In the design phase, the analysis already involves more people, from all project areas.

The beginning of the workshop is dedicated to the contextualization of the project: scope statement, client, type of contract, and other relevant information. It also seeks to identify stakeholders and critical success factors. Thus, adhering to the procedures of ISO 31000, the workshop first phase establishes the context.

Furthermore, the risk workshops at proposal stage aims to identify them using the brainstorming with the support of a list of keywords or historical risks brought by the workshop facilitator. Once identified, the risks are categorized and classified according to its probability of occurrence and impact before a risk response plan is deployed. The type of response to the risk is also determined (acceptance, impact reduction, probability reduction probability and impact reduction, share/transfer or acceptance), as well as risk response plans, classification of probability of occurrence, impact after treatment, and the ability to influence the cause of risk. A responsible person is also assigned for putting into effect the action plan established, with a specific deadline. All these steps are made in a single session that usually takes between two to four hours.

After the workshop, each responsible has the task of determining action plans and the severity of the risk, within the deadline previously determined. Although the op-

tion of making all classification of risks and developing treatment plans takes more time, in general it is more effective because, according to the respondents, the previous experiments have shown that people are not very responsive to the demands related to risk management, and even those seeking to meet the demand find difficulties to use the software for risk registry, which is an Excel spreadsheet. Due to some differences, the tool used in the Brazilian office is also an adaptation of the global tool.

To determine the impact and the probability, the participants consider the scale of likelihood and consequence. Among the documents made available by the matrix are the criteria for analysis of impacts. They are analyzed in relation to the following factors: health and safety; environment; financial sector; schedule; reputation; and impact on businesses. Once the impacts and probabilities are classified, the risk matrix is set with four regions: extreme risks – immediate action; high risk – immediate action; moderate risks – action as soon as possible; and low risk – low priority. Based on this evaluation and on the risk category, specific action plans and people responsible for deploying them are determined. Regardless of the type of project or contract, all projects go through a qualitative risk analysis; and specifically in Brazil, semi-quantitative analysis.

In the workshops of Brazil, it is customary to quantify the risk, in addition to the qualitative analysis, through the calculation of the expected monetary value. The calculated value is included in the project cost as a contingency reserve. It is important to highlight that this is a Brazilian procedure, while in other company offices the contingency reserve is a refereed, often subjective value. This occurs because in other localities clients usually work with reimbursable contracts, offering lower risk, and, in addition, as a conservative measure, adopt a relatively high contingency value. Some projects may also have quantitative analysis using Monte Carlo's simulation according to the following criteria: scope (usually done for EPC and EPCM), size of the contract and contractual mode (usually global pricing projects), and if there is enough time to develop the work. The simulation was performed with the Crystal Ball® software or @Risk®. Once the mathematical model is created, workshops are held with specialists to collect the simulation parameters.

At the end of the workshop, risks professionals develop a risk report and communicate the contingency. Depending on the characteristics of the proposal, a more complete report may be required.

Once the proposal turns into a project, the classification of risks is remade. Planning meetings are held for the definition of information for the preparation of the risk management plan and a new risk assessment is done.

Each risk receives a treatment plan that must be implemented by the responsible. Risk management leaders, in turn, are responsible for conducting the periodical monitoring of risks and their registry through workshops. The frequency of monitoring also depends on the characteristics of the project, which may be monthly or quarterly.

Another important exception is that for the organization there are two workshop types: an internal, to deal with the risks that the organization takes to run the project for the client; and an external, with the client, to understand the client's risks.

When the project ends, another workshop occurs to discuss the general results of the project in relation to risks. At this meeting, the lessons learned are recorded for future use.

Although the process of risk management in the company is very well defined, as well as for the formal procedures regarding roles and responsibilities, it is observed that the projects do not fully implement PRM, and the process of monitoring and control is the most deficient. Generally, projects do not provide the resources for PRM, and when it is implemented, it is not integrated with other project management areas.

The risk area has a global responsible and several regional leaders are subordinated to him. Each country in the region has several risk facilitators and risk champions. Risk facilitators may lead risk workshops. These professionals are not responsible full-time for risks, but they are volunteers if there is a need to conduct a workshop, or answer any questions. That is, they always accumulate more than one function. To be a risk facilitator, the professional needs to have an internal training on the model of project management of the company specific to risk management. Risk champions may be risk facilitators, but a generic risk champion will always be the first contact for issues related to risk, and it is not necessary to have specific training to take this position.

This model is still compatible with the matrix structure, but has some limitations. Since these professionals are part-time, sometimes they may not be available to perform the risk function. Moreover, sometimes they may not have the appropriate knowledge on the project management or risks. And sometimes the result of the risk analysis may present partiality, as the professional can be influenced by his superior, or by the project manager, biasing the risk analysis. In certain projects, full-time professionals might be allocated to specific projects to perform risk activities.

However, in Brazil it is different. Rather than assume the decentralization model, there is a team of professionals who perform only risk activities. The team is composed by five people, who can work in various proposals or projects simultaneously, optimizing costs.

What justifies the adoption of the centralized model is because most contracts in Brazil are lump sum, which presents higher risk to the contractor than reimbursable contracts. In other countries, because reimbursable contracts are more common, the company has not adopted a centralized structure.

Thus, in the case of the decentralized model PRM can eventually become a task of the project manager, but in the centralized model, supported or fully performed by a risk professional.

4.2 Risk management process relevance

Table1 shows the descriptive statistics of the survey.

Table 1 – Descriptive statistics of risk management process importance

	Responses	Mean	Mode	Median	Deviation	Max.	Min.
Communication and consultation	23	3,26	3,00	3,00	1,29	5,00	1,00
Establish the context	23	3,13	4,00	4,00	1,14	5,00	1,00
Risk Identification	23	3,35	4,00	4,00	1,11	5,00	1,00
Qualitative Analysis	23	3,26	4,00	4,00	1,05	5,00	1,00
Quantitative Analysis	23	2,74	4,00	3,00	1,25	4,00	1,00
Risk Treatment	23	3,26	4,00	3,00	1,25	5,00	1,00
Monitor and Review	23	3,22	3,00	3,00	1,24	5,00	1,00

Considering all the processes, the best results were found for risk identification and qualitative risk analysis. Those are the processes usually executed during a risk workshop. However, a few considered that risk facilitators identify “too many risks”. Actually, risk identification and analysis are critical to calculate contingency reserve, which is added to the selling price. For this reason, most managers show some resistance to identify risks or are too “optimistic”. This also explains why quantitative risk analysis has the lowest mean. On quantitative risk analysis, it is calculated the earned risk value, which is the contingency reserve. On one side, the company wants to mitigate its risk, but on the other, the project manager wants to win the bid for the project, by lowering the price.

It is interesting to notice that except for quantitative risk analysis, the processes regarded as less important are communication and consultation, establishing the context and monitor and review. Communication and consultation, and establishing the context are processes that do not have many objective techniques available, and requires some soft skills. As for monitor and review, it shows that the team and the project manager are not fully engaged with risk management, and for them, it is a waste of time and increase of unnecessary costs.

4.3 Risk management process and project characteristics

The project characteristics in this study refer to risk classification, contract type, scope and technological complexity.

The company classifies the project’s risk into four categories. Since projects are classified internally according to their risk level, it was expected that the higher the risk, the greater the importance of PRM. However, the results of the Mood’s test showed no relation between the two variables. The survey only suggested that riskier projects have smaller variance in the importance of risk management. The phenomenon can be explained because in A+ projects formal risk management is mandatory, whilst for others it

is not. Thus, a B project, for instance, may have formal risk management while another one may not.

The processes of qualitative analysis and risk treatment presented the higher level of importance in the A+ category, considering the parameters of mean, mode and median. However, in the A category, the most important category was risk identification, and in the B category it was monitor and review. It is important to note that for projects within the B category, all processes presented mode 1.0, suggesting that the respondents do not seriously consider the risk management. Furthermore, except by the process of monitor and review, all other processes have mean and median bellow 3.0.

It is expected that as risk increases, its management would be tighter. Thus, according to the contract type, risk management would be considered more or less important. However, the research has not shown this situation. Actually, it reveals that contract type does not significantly influence on how risk management is perceived in the project. This does not mean that a relation between contract type and risk does not exist, but that for this case, the contract type is not a determinant factor to decide whether risk will be important or not.

The company also classifies the projects in major, minor and miscellaneous, according to its size, through the combination of scope and contract value. Considering all processes, in general, risk management has the greatest importance in major projects. According to the Mood's test, there is difference in major and minor projects risk management. Analyzing each process individually, risk identification was the only process with significant differences, with a confidence level of 90% i.e., risk identifications has a greater importance in major projects than in minor projects. The median for major contracts is high, while for minor projects is moderate.

This is because usually major projects are also A+ in risk classification, and formal risk management is required. Formal risk management is not mandatory on minor projects, but it depends on the perceived importance of risk management on that project. Consequently, because not all projects have mandatory risk management, the importance of risk management in minor project varies more than in major projects.

Analyzing the scope factor alone, it was identified three major scopes in which the company is experienced. It was expected that risk management in EPCM projects would have higher importance than in other scopes, but statistically no significant difference was observed. In EPCM projects, risk management relevance varies between moderate and high, while in some engineering projects, relevance is low. The greater variation in engineering projects is because not all engineering projects have the same complexity.

Regarding the project complexity, in this case, projects are classified as "business as usual" and "non-business as usual". However, the Mood's test for this factor has not shown any significant difference.

The Mood's test for contract type revealed that this factor does not significantly influence on how the project team manage risks, for all the processes.

4.4 Risk management process and project success

In the analyzed projects, success is independent of risk management importance. Data in the Table 3 suggest that when the project resulted in failure, risk management processes have been considered very important, except by the process of monitor and review. Those results seem contradictory, but can be explained by the fact that when risk management was implemented, the projects were already in advanced progress, and sometimes with a result worse than the expected. Thus, PRM in those cases is implemented not only to manage risks but also to solve problems inherited from the past. Because of this poor performance, the project team saw risk management as more important.

Table 3 – Risk management process importance and project result

		Mean	Mode	Median	Deviation	Max.	Min.
Failure	**P-Communication**	3,45	2,00	4,00	1,29	5,00	2,00
	P-Context	3,45	4,00	4,00	0,93	5,00	2,00
	P-Identification	3,64	4,00	4,00	0,92	5,00	2,00
	P-Qualitative	3,36	4,00	4,00	1,03	5,00	2,00
	P-Quantitative	3,09	4,00	3,00	1,04	4,00	1,00
	P-Treatment	3,64	5,00	4,00	1,29	5,00	2,00
	P-Monitor	3,18	2,00	3,00	1,33	5,00	2,00
	General	3,42	4,35	3,25	0,99	4,80	2,00
Success	**P-Communication**	3,08	3,00	3,00	1,31	5,00	1,00
	P-Context	2,83	4,00	3,00	1,27	4,00	1,00
	P-Identification	3,08	4,00	4,00	1,24	4,00	1,00
	P-Qualitative	3,17	4,00	3,50	1,11	4,00	1,00
	P-Quantitative	2,42	1,00	2,50	1,38	4,00	1,00
	P-Treatment	2,92	4,00	3,00	1,16	4,00	1,00
	P-Monitor	3,25	4,00	3,50	1,22	5,00	1,00
	General	3,05	4,00	3,18	1,04	4,00	1,00

Table 4 displays the correlation between each process and five success dimensions. When analyzing schedule dimension, there is a positive correlation between monitoring process and success. Establishing the context contributes to the success, as it helps to understand where the project will be held, who the stakeholders are, their behavior and the success factors, contributing to identify project risks.

Table 4 – Risk management and success dimensions

	Schedule	Budget	Customer	Team	Business
Communication	0,269	-0,085	0,012	-0,186	0,083
	0,214	0,699	0,957	0,394	0,707
Context	**0,36**	0,149	-0,253	**-0,458**	0,262
	0,091	0,497	0,244	**0,028**	0,228
Identification	0,077	0,084	-0,088	**-0,496**	0,275
	0,728	0,702	0,69	**0,016**	0,204
Qualitative	0,329	0,238	-0,098	-0,228	0,308
	0,126	0,275	0,657	0,296	0,153
Quantitative	0,008	-0,2	-0,344	**-0,579**	0,22
	0,97	0,36	0,108	**0,004**	0,314
Treatment	0,134	-0,052	-0,082	**-0,492**	0,259
	0,541	0,815	0,709	**0,017**	0,232
Monitoring	**0,647**	0,12	**-0,419**	-0,068	0,137
	0,001	0,586	**0,047**	0,759	0,532

However, the data shows no significant correlation between risk treatment and schedule success. As previously analyzed, risk management importance can be explained mostly by the quality of the risk workshops. Since the importance given to risk treatment is lower than to risk identification and qualitative analysis, risk treatment has no significant correlation with the schedule success.

Regarding client and team dimensions, there is a negative correlation between risk management processes and success. For the success of the team, this suggests that risk management does not contribute to the team learning as much as other technical aspects of the project. The most negative correlation value found was for the quantitative analysis. Actually, when the project is required to have a quantitative risk analysis, the team feels overworked, not only because of the time spent, but also due to the difficulty to get a consensus about risks and parameters.

4.3 Tools and techniques

We observed that among the existing tools and techniques, only a few are used.

For planning, the most used technique is planning meetings, although it is perceived as of moderate importance. Many techniques to identify risks exist, but the most used is brainstorming. Even so, it was evaluated as of moderate importance in the projects.

For qualitative analysis, both consequence and likelihood analysis are performed similarly. However, in the quantitative analysis, the most used technique is expected value, used to calculate contingency reserve. Complementarily, it can also be calculated using Monte Carlo's simulation. In other offices, the number is arbitrated. Simultaneously to the modeling technique, a sensitivity analysis can also be conducted. Although very powerful, these tools are rarely used.

To address the risk, the most used tool is acceptance, since almost all projects include contingency reserves for specific risks, followed by "mitigating the risk". Risks are rarely transferred or eliminated. On the other hand, for the opportunities, although there are treatments for them, they are not formalized in the risk management process.

For monitoring and review of the risks, the most used tool is risk reassessment. There is a procedure to review risks periodically in workshop sessions; nevertheless, people do not consider it very important. It reveals that people are unengaged to the risk management process. Although risk audit is used, the technique still has to be improved.

Almost all the used techniques are consolidated in a risk tool internally developed by the company. This software was originally developed by the head office in Australia, but in Brazil the tool was adapted to Brazilian needs.

Although risk identification was considered the most important process, the respondents indicated that the risk impact assessment were more important than risk identification tools. It is interesting to note that all tools have at least moderate importance, except quantitative analysis tools – most of them is of low relevance, showing that this is the least important process.

4.4 Factors that influence risk management

The last part of the survey reveals the cultural aspects of risk management and how the factors from the literature review affect their perception of the topic. The results showed that the following statements stood out: risk management adds value; risk management is seen as a core "competence"; risk management is "business as usual"; risk management protects the company's strategic goals; there is a clear identification of a person to implement risk response plans; it is important to have workshops focused on risks; contingency protects the project; contingency increases selling price and decreases competitiveness; and several risks are identified during the workshops.

On the other hand, the respondents disagreed with the following statements: all employees manage risks daily; and people are trained to deal with risks.

Although respondents believe risk management adds value to the projects, they are not very committed with it. Among the main factors that justify it is what Akintoye and MacLeod (1996) have identified: the lack of (financial) resources for risk management. Moreover, the usage of the risk management tools and techniques are moderate. Actually, most of the techniques listed in the questionnaire were unknown by the respondents, evidencing a gap in the knowledge of the tools and methodologies for managing risks.

Another interesting aspect is the performed trade-off when including contingency in the selling price. To protect the objectives of the project, it is necessary to have a contingency reserve, but it also increases the price, reducing competitiveness.

Risk management is also seen as an essential process and "business as usual". This perception may be explained by the strategy of implementing risk management top-down. For the same reason, people believe that risk management protects the objectives of the business.

Regarding the person responsible for implementing risk response plans, when asked who this person was there were only two answers given: the project manager or the corporate risk manager.

The company usually says that their employees are daily managing risks, and their stated goal is that all people are trained to deal with risks. However, it is possible to see that there is a gap between expectation and reality. A reason why people do not see themselves managing risks is the adoption of a centralized risk structure as, Kallman (2006) suggested.

Concerning communication about risk and its methodologies, most people said they are unable to tell whether the communication is effective or not because they did not know how this communication was done. This reveals that the communication about risk management is really rare.

At first sight, it seems that the company is really risk averse; however, the results of the survey showed that it is neither risk averse nor risk taker. They often take risks associated to clients and scope, but protect themselves including contingencies, for example.

4.5 Strengths, weaknesses and recommendations

From the findings, some strengths can be identified. First, the top-down engagement to implement risk management was essential to ensure that risk management process is in place at all levels. Nevertheless, Kerzner (2011) pointed to the importance of both top-down and bottom-up strategies, which means that risk management in the company has potential of improvement with a bottom-up strategy.

The adaptation of some process and tools to local reality is another positive aspect of the PRM in the company, because to ensure that the risk management is proper-

ly implemented it is necessary to understand the characteristics of the local market and culture. Ellingson (2009) pointed out that there is not a risk management approach suitable for all cultures or environments, which means that adaptations may be necessary. Considering the structure, the existence of a centralized risk department was positive: it optimizes resources and can support all projects.

Furthermore, the fact that risk management starts during the bid phase is positive as, by proactively managing risks, the likelihood of the risk may be reduced.

The weakness of the process suggests that the communication about risk management, its importance, values, process and tools is deficient. Not only there is a lack of general communication about risk, but also risk communication within the projects must be improved. Concerning the projects, it is seen that risk management is not applied in all projects, evidencing another gap. This usually happens in old projects, which have not included a budget for risk management.

There is also a gap in the understanding of the main office about the characteristics of its branch in Brazil. In addition to what Ellingson (2009) stated about adaptations, Zwikael and Ahn (2011) have also identified that there are differences in risk perception among different countries. Although some modifications were done in the company, there is still space for improvement. For instance, it was observed that risk classification does not influence how PRM is perceived, which means that maybe the criteria to classify the risk misfits for the company.

Within this context, some recommendations can be draw. Firstly, to increase the communication about PRM and its importance, employees should have more training. These trainings can be split in three parts with different focus: one more generic, for people in general; another a little more specific and related to project management in general; and finally one training focused totally on PRM, for those that wants to give support in PRM.

In the project context, to improve communication about PRM, it could be created some dashboards to report the results in a simpler way.

One more recommendation is to start considering the cost of managing risks in the project, and include it in the selling price.

5 FINAL CONSIDERATIONS

Given the objective of the paper to understand the pitfalls in project risk management implementation, the paper identified in the literature several factors that affect PRM implementation, confirmed by the action research. Initially, it was identified in the literature a wide range of tools and techniques to manage risks, and several cultural aspects related to it, which can be summarized in seeing the value of PRM.

This action research shows the pitfalls faced by companies that clone the same structure and methods recommended by the global corporation to the subsidiaries. PRM

may not be applied properly if the process is not adjusted to the local culture, considering risk appetite, and the organizational culture (Jorgensen, 2005). There is a risk when the project manager and the risk manager expectations are different, because one will see many risks, while the other will not. And also if the rest of the team is not trained in PRM, the implementation of the process will also be compromised. The study also reinforced the importance of the top-down engagement in implementing PRM (Kezner, 2011) and the gap between what is preached and what is actually done (Akintoye and Macleod, 1997).

It gives some insights about what should be considered in the decision-making of how to deal with risk management implementation, and may be useful in identifying the pitfalls in the implementation of risk management for other organizations.

The study also reinforced that there is not a one-size-fits-all management approach. There are cultural differences among countries and industries, and this must be considered when implementing PRM. Moreover, the applied methodology should avoid project categorization and the design of distinctive roadmaps for each key category identified.

Regarding this study, we must consider some limitations. The first issue is related to the exploratory research approach limited to one company and one country that affect the generalization of the research findings.

For future research, this pitfall should be investigated in a quantitative and confirmatory research approach, searching for generalization. Further studies could also relate the perception on risk management processes and the factors that influence PRM with the PRM maturity level.

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