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DIRECTIONS FOR BUILDING AN APPROACH TO INNOVATIVE SOFTWARE PROJECT MANAGEMENT

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In recent decades, organizations have structured its activities around projects. We have become a driven-projects society. The research and practice in project management area have evolved as a response to this. Among other benefits, successful projects allow reducing costs and increasing profits as well as improving quality and customer satisfaction. Innovation is one of the keys to success in organization. However, due to the high level of uncertainty and complexity, the threats identified by innovation in a project day-to-day are real. A large number of project management approaches do not consider the impact that innovations have on projects, contributing to high rate of project failure. In a typical software development environment it is not different. Based on this, the objective of this research in progress is to contribute to project success by proposing an approach to guide project managers and team members about the management of innovative software projects, fostering innovation and avoiding it to be stifled. The research method used in this work is based on the principles of evidence-based software engineering. During the first research phase, exploratory literature research in the innovation management in software projects was carried out as well as a systematic review of the impact factors in innovative software project management. At this research stage, the necessary elements to construct the initial approach have been identified. The results of this research contribute to the project management field, defining an approach to the innovative software project management, and helping project managers to realize the opportunities to promote innovation and manage it.

Keywords: innovation. Software project management.innovation in projects, anagement.innovative software projects.

1. Introduction

The new millennium has brought a deep and rapid transformation in society and consequently the economy. A new competitive scenario was established, being influenced by the rapid pace of technological change, as well as by economic globalization and geopolitical redefinition. Thereby, organizations know that to survive the competition in the business environment they must learn and generate knowledge. This reality is no longer restricted to conference proceedings; it is already news in business magazines (Marinho et al., 2015; Rebechini and Carvalho , 2003).

Organizations have experienced a transformation process in order to gain competitive advantage and market position, generating profound changes in the way the activities are organized, trying to create rapid and effective responses to market needs. An action set represent these responses, such as increased investment in research; the creation of new working relationships (outsourcing); the growth of collaboration between organizations (alliances), among others. For organizations, these changes reflect their capability and agility in taking advantage of opportunities, respecting their limitations (Rebechini and Carvalho , 2003; Dimaggio, 2009).

Stay competitive in this scenario means that organizations need to be able to adapt, adopt new strategies and provide continuously new products and services, new products and services. In this sense, the organization of activities in projects has grown in importance, especially if aligned with the organization's business strategies (Marinho et al., 2015; Stadnick, 2007). Rebechini and Carvalho (2003), discuss that investing in the adoption of technical and tools to project management, has been a major strategic concerns organizations. Similarly, Marinho (2015) indicates that organizations should strengthen management practices within their projects, whether single or multi-function, lead to a more formal and centralized control.

Considering the scenario presented, the need for innovation has become a decisive factor for the strategic success of organizations, supporting the long-term competitiveness (Kotler, 2000; Kaplan and Norton, 2004). Innovation and projects aimed at innovation development, being them a new product, process or service, should be on the executive agenda, along with the understanding of the business environment changes and the action plan needed to respond to, or to influence, these changes (Marinho, 2015). Deakins and Dillon (2005) argue that the key to success in this scenario is via high quality and innovative solutions.

For organizations who want to overcome their competitors, innovation is vital to bring new solutions satisfying the needs of individuals and society (Rodríguez-García et al., 2014). Bolton and Thompson (2005) agree that only by innovation and strategic change is possible to survive in this environment, outperforming its competitors.

Considering the above, it is necessary to deepen the understanding of innovation and projects, its scope and relevance, as well as the interconnection between them to thrive in this competitive environment.

Thus, the term innovation means a new way to do something. Schumpeter (1934)

defines innovation (economic) as the introduction of a new production method or manner of handling a commodity commercially. Galbraith (1982) discusses the distinction between invention and innovation. He defines innovation as the process of applying a new idea to create a new process or product. Cleland (2002) argues about Strategic Context of Projects and define innovation as the creation of something that does not currently exist. Similarly, Tidd and Bessant (2009) discuss that "*innovation is all about finding new ways to do things and to obtain strategic advantage – so there will be room for new ways of gaining and retaining advantage*".

However, these definitions just focus on something extremely new. Not taking into consideration modest changes that generate competitiveness. The types of innovation can be defined on various dimensions, for example: *"radical versus incremental, product versus process, exploratory versus exploitable, fundamental versus peripheral, short term versus long-term development, disruptive versus nondisruptive, and low cost versus high cost"* (Paletz, 2012).

Smith and Tushman (2002) argue that some organizations have the capacity to change the basis of competition, through incremental innovations as well as innovations that alter industry standards. Alike, Fagerberg (2006) explore, in his guide innovation, that innovation has been classified according to how profound they are compared with the existing configuration, between incremental and radical. Figure 1.1 shows the innovation classification into incremental and radical.

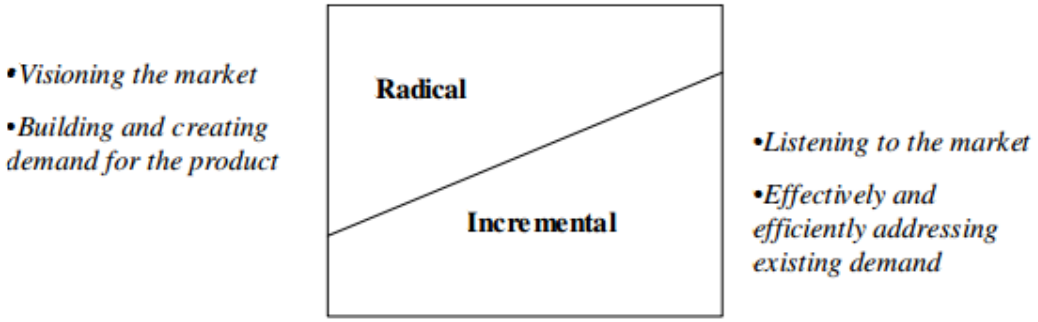

Figure 1.1: Two types of innovation
Source: Stadnick (2007)

Tidd and Bessant (2009), suggest that radical innovation (*"new to the world"*) is rare and most often it occurs incrementally (*"the cumulative gains in efficiency are often much greater over time than those which come from occasional radical changes"*).

The Organization for Economic Co-operation and Development (OECD) has proposed innovation indicators in order to define, improve and standardize the methods of collecting and disseminating information on innovation. The OECD has developed a series of manuals called "*Frascati manuals*" that define and standardize the methods of collection and analysis of key innovation indicators currently used in economic research (Scarpelli and Kannebley, 2013; Tigre, 2014).

However, the approach adopted by the OECD based on criteria relating the R&D projects, generating a number of limitations when it comes to innovation in another context. To address these gaps, they have increasingly used innovation indicators defined

by the Oslo Manual (Scarpelli and Kannebley, 2013);(Oslo Manual, 2005). Researches based on these indicators are considered more consistent with the understanding of innovation as a broad and complex process, exceeding the initial focus, centered on R&D data and patent (Scarpelli and Kannebley, 2013). The Oslo Manual (2005) defines: what is meant by innovation; the different ways in which an organization can innovate; ways to quantitatively measure innovation through input and output; several new levels of innovation; and several questions about the sources, effects, obstacles and innovative ways.

Considering the wider scope to the concepts of innovation, the Oslo Manual (2005) defines innovation as a new or significantly improved product (good or service) or process or a new marketing method or a new organizational method in business practices (managerial method) (Autor, 2015).

Filippov and Mooi (2010) discuss the relevance of project management, innovation, and technology in the organization change, growth, and profitability. Also, they point out that "*It is unsurprising that development of innovation is often run as a project*". However, argue that innovation projects differ from conventional projects and therefore, we should use a specific approach for managing them: "*Thus, there is a need to examine the Innovation Project Management (IPM) as a distinctive area of managing innovation in projects, using the tools and methods of the project management*".

Therefore, based on Oslo Manual's wider innovation definition, Innovative Software Project Management (ISPM) is the term used to define this research scope, which investigate the software project management when there is innovation in product, process, technology or organizational method (Autor, 2015).

The significant growth of the project management discipline in recent decades, both in academia and in practice, produced an increase in the supply of models of reference proposed by professional associations in pursuit of greater efficiency and effectiveness in carrying out projects of various types and nature. However, studies show that despite these efforts, project success rates are still far from a satisfactory level (The Standish Group, 2011; Gartner, 2008).

In this context Moura (2011) proposed The Software Project Framework (SPF). A set of new dimensions to software project management is defined as one of the elements of SPF. Innovation is one of SPF's dimensions (Moura, 2011).

In SPF, innovation is reported as a dimension which software project managers must observe for improving projects' implementation. According to Moura (2011), innovation means a new way of doing something, affecting the way of thinking, develop products, define and improve processes and adapt organizations to make them more competitive. Based on the direction given by the SPF, this work is going to improve knowledge of innovation phenomenon in software projects. In addition, directions for building an approach to manage innovation in software projects are going to be explained.

Besides the introductory section, this paper is structured as follows: Section 2 presents a theoretical background; Section 3 discusses the research method; Section 4 presents the systematic review on ISPM; Section 5 discusses the strategic orientations for ISPM and finally Section 6 contains the conclusion.

2. Theoretical Background

This section aims to present concepts related to the research, there are going to be presented innovation, project management, software project management, innovation project and impact factors identified in an exploratory literature review.

2.1. Innovation

The innovation literature has been concerned with creating typologies, in order to facilitate the understanding of the innovation characteristics, its classification and consequently helping to direct appropriate actions for its management. The types of innovation can be defined on various dimensions, for example: “radical versus incremental, product versus process, exploratory versus exploitable, fundamental versus peripheral, short term versus long-term development, disruptive versus nondisruptive, and low cost versus high cost” (Paletz, 2012).

This dichotomous distinction is the simplest way to classify innovation, but is still widely used. Fagerberg (2006) explore, in his guide innovation, that innovation has been classified according to how profound they are compared with the existing configuration, between incremental and radical. Tidd and Bessant (2009), suggest that radical innovation (“new to the world”) is rare and most often it occurs incrementally (“the cumulative gains in efficiency are often much greater over time than those which come from occasional radical changes”).

Based on the classical distinction between incremental and radical, some authors have proposed more flexible classifications, including intermediate stages and more dimensions. Wheelwright and Clark (1992) have made a distinction between incremental or derivative, next generation or platform and radical or breakthrough, considering changes in product and process. In the same way, Kleinschmidt and Cooper (1991) proposed three types of innovation in products: low, moderately and high.

Although there is a wide variety of classification for innovation, considering multiple dimensions and levels, in the context of this research were used the classic distinction between incremental and radical innovations to guide the proposed approach.

2.2. Project Management

The key to success for an organization's survival in the new competitive scenario is the ability to provide rapid and effective responses to market needs, taking advantage of opportunities and respecting their limitations (Deakins and Dillon, 2005). Organizing work in projects has been a growing phenomenon in our society. Organizations and individuals are organizing around projects. We have become a society driven projects. Research and practice in the field of project management (PM) have evolved as a response to this fact (Moura, 2011).

Project management is a managerial approach and the first uses of modern project management terms and techniques began being applied in about 1955. A project is a temporary endeavor undertaken to create a unique product, service, or result (Morris and Pinto, 2004; PMI, 2013).

The significant growth of project management area in recent decades, both in academia as a professional, produced an increase in the supply of models of reference proposed by professional associations in pursuit of greater efficiency and effectiveness in carrying out projects of various types and nature. Among the various associations and their project management bodies of knowledge, should be highlighted (Hewagamage and Hewagamage, 2011); (Iakovleva, 2014);(Ghosh et al., 2012):

- The International Association of Project Management (IPMA)
- The Project Management Institute (PMI)
- The Association for Project Management (APM)
- PRojects IN Controlled Environments version 2 (PRINCE2)
- The Project Management Association of Japan (PMAJ)

As shown previously, the various associations have tried to develop a comprehensive standard to suit all types of projects through their models and bodies of knowledge. However, Dvir et al. (1998) argue that a universal theory of project management applicable to all types of projects, adopted by some managers, it may be a major cause of problems in projects, due to the fundamental differences between projects. Similarly, Shenhar (2001) proposes, in his article *"One Size Does Not Fit All Projects",* that all projects not share a universal set of management characteristics, and must take into account the specific needs of the project and the organization.

A research network initiative called Rethinking Project Management: Developing a New Research Agenda (RPM), highlighted the need to enrich and extend the project management field, connecting it to the challenges of contemporary project management practice (Cicmil et al., 2006; Atkinson, Crawford and Ward, 2006; Winter et al., 2006).

In this context of project management rethink and agreeing with Dvir et al. (1998) and Shenhar (2001), this research aims to enrich and extend the project management field, through the analysis and understanding how project management can be applied in an innovative software project.

2.3. Software Project Management

The software has played an important role for organizations and society in general. Thus, the software development process needs to be better understood due to difficulties in delivering software in accordance with requested. Sawyer and Guinan (1998) show that about 40 percent of US corporate capital expenditures are directed to the software and that the great failure rate in the software underscores the difficulty in its development.

According to Ruhe and Wohlin (2014), software is the direct result of the cognitive processes of individuals involved in working on innovative team. During a software development project, a learning process is carried out, in which knowledge is acquired and the information is generated. Dealing with people and conflicts, team building, knowledge sharing, and communication are the determinants of good project management.

Hewagamage and Hewagamage (2011) stressed that software is intangible products and that most failures are caused due to human error in management or technical work undertaken by the relevant members of the project. Thus many studies have been specially conducted to improve the software project management, reducing the failure rates.

Afridi (2012) argues that "*The software development processes involve various kinds of activities. These activities involve innovative solutions applications to managing technical and managerial stages"*. Pattit and Wilemon (2005) report how critical is the successfully managing software development projects to organizations.

As pointed out in this Section, the importance of software development has increased in recent decades and an appropriate software project management is essential to reduce the high failure rate of these projects. This research aims to propose an approach to manage software projects where innovation is present.

2.4. Innovative Project

The need for innovation has become a decisive factor for the strategic success of organizations, supporting the long-term competitiveness (Kotler, 2000; Kaplan and Norton, 2004). Innovation and projects aimed at innovation development should be on the executive agenda, along with the understanding of the business environment changes and the action plan needed to respond to, or to influence, these changes (Marinho, 2015).

Tucker (2001) argues that creating tangible value for the customer, improving processes, and building new opportunities are the result of a successful innovation. To ensure that the organization achieves its objectives is necessary to implement an innovation process based on a set of tasks and procedures (Rodríguez-García et al., 2014).

Blindenbach-Driessen and Van Den Ende (2010) argue that "*innovation projects are different from business projects, because the newly developed product or service is applicable for a range of customers. It is not a specific solution that suits the demands of one customer only*".

According to Dodevska and Mihic (2014), innovation projects are not structured and their future is uncertain. The project manager faces the challenge of managing the chaos, achieve the project team agreement, predict the future in unpredictable environment, and manage the risk of innovation projects.

According to the Oslo Manual (2005), innovation activities vary greatly between organizations. Some organizations are engaged in well-defined innovation projects, such as the development and introduction of a new product or service, while others primarily make continuous improvements to their products, services, processes, and operations. Both types of organizations can be innovative: "*an innovation can consist of the implementation of a single significant change, or of a series of smaller incremental changes that together constitute a significant change*".

Considering the types of innovation, usually referenced in the literature - radical and incremental, it is common to associate Tech, R&D or NPD with the radical type. And associate with the incremental type, adjustments or changes something existing as product, service and processes (Iakovleva, 2014);(Dvir and Shenhar, 2012).

Carvalho (2009) indicates that there is a growing interest of organizations for the recognition of different types of innovation projects, in order to identify the appropriate approach to enable innovation project with distinct characteristics.

Considering the presented in this section, this research proposes an approach that recognizes the different types of innovative projects and supports the project managers to deal with innovative projects, fostering innovation and avoiding stifles it.

In this context, when the project manager faces a radical innovation projects, he or she should worry about all activities related to innovation already "known", that is, he or she already know of the existence of innovations in the project and he or she have to try to mitigate their risks and uncertainties. However, in non-radical projects, the project manager must be attentive to foster innovation; enabling it to appear and mostly avoiding stifle it by the processes and activities. This care can produce an incremental innovation that otherwise would not be achieved.

2.5. Impact Factor

Projects are unique, they differ in size, purpose and complexity, therefore, the criteria for measuring success varies from project to project. The traditional measure for assessing the success of the projects is related to the "triple constraint": cost, time and quality / scope. However, the project success criterion goes beyond these aspects. Most often, the success criteria are determined subjectively by stakeholders. There is a clear distinction between the success of PM and project success (Sanjuan and Froese, 2013; Papke-Shields, Beise and Quan, 2010; Mir and Pinnington, 2014).

Critical success factor (CSF) is an essential element for a project to achieve its mission. It is a critical factor or activity necessary to ensure the success of a project (Fortune and White, 2006; Mir and Pinnington, 2014; Sanjuan and Froese, 2013);[024].

In this research an exploratory review was carried out and identified some categories of factors that affect project management and consequently the innovative project success, which are: tools, techniques, processes, practices, organizational capabilities and IT assets.

Some authors organized the CSF in groups to facilitate the analysis and a better understand of their relationship. In same way, the factors were organized in three groups: Management Instruments, Approaches, and Organizational Factors; as depicted in Figure 2.1.

As a result of exploratory review, some tools and techniques were identified: Assigned project sponsor, Change request, Contract documents, Gantt chart, Kickoff meeting, Milestone planning, Progress report, Project management software for task scheduling, Requirements analysis, Scope statement, Database for cost estimating, Stakeholder analysis, Database of historical data, Database of lessons learned, Database of risks, Team development plan, Work authorization, Value analysis, Medium-term post evaluation, and Project mission statement (D'Alvano and Hidalgo, 2012; Besner and Hobbs, 2008; Besner and Hobbs, 2006).

In terms of processes and practices, were identified: Challenge the customer, Deliver value early, Create a Resilient Team, Prepare for the Unknown, Train the Sponsor, Focus the Team on Business Value, Plan for post-delivery, Adaptively Re-Plan, Use Meetings to Focus Attention, Encourage dissent, Empower and delegate, and Part time to

innovation (e.g. FedEx™ Day and 20% Time) (Reich, Sauer and Wee, 2008; Moe et al., 2012; Papke-Shields, Beise and Quan, 2010; Bakar et al., 2011).

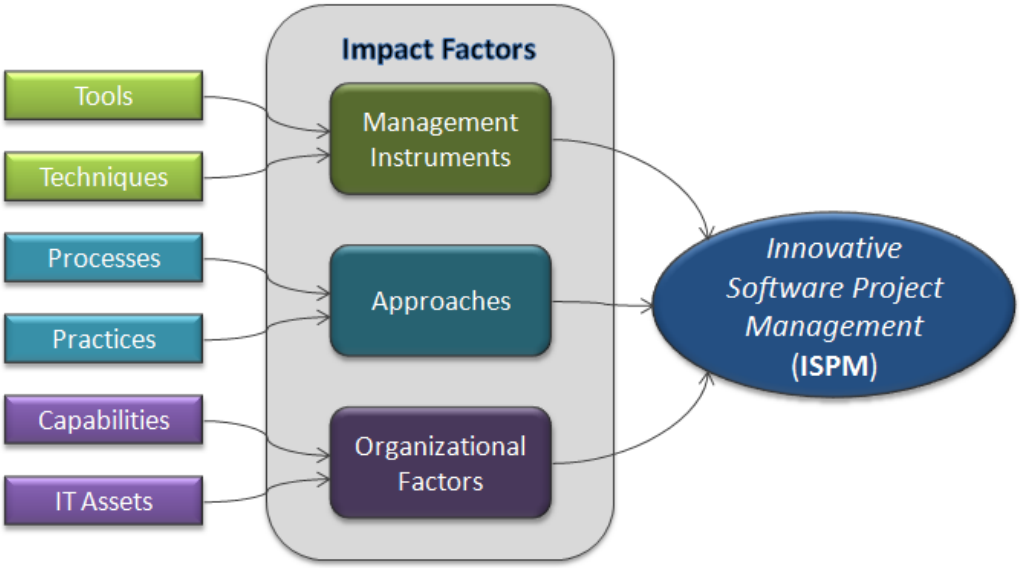

Figure 2.1: Impact Factors to ISPM
Source: The author

Five classes of organizational capabilities were identified, as showed below (Davies and Brady, 2007; Anderson et al., 2005; Abraham and Bonacordi, 2010; Zilber, 2005; Moe et al., 2012; Simon, 2006):

- Motivation: Recognition program, Creative stimulants, Encouragement of initiatives, Supportive climate, Job challenge, Meaningful tasks, Tolerance for mistakes, Employee perception of change, Trust to be heard, and Belief to have an impact;
- Autonomy: Open communication, Agile decision making, Job design for teamwork, Multifunctional teams, Inter-functional coordination, and Openness;
- Knowledge: Continuous Training and education of staff, Availability of communication channels for information dissemination, Systems for data base, data transfer and documentation, Knowledge sharing, Knowledge diffusion, Variety of knowledge sources, Attention to innovative ideas, Freely expression of ideas, and Instant assessment of innovative ideas
- Capital: Reward system for innovative ideas, Resource provision for innovative ideas, Diversification on employee skill, Employee skill level, and Cross-functional teams responsible for innovation;
- System: Engaging support from the organization's leadership, Defining success criteria and measurable success indicators, Degree of bureaucracy, Degree of hierarchy, Risk taking culture , Entrepreneurial culture, Flexibility, and Decentralization.

In terms of IT assets, were identified (Aral and Weill, 2007; Ross, Beath and Goodhue, 1996; Tarafdar and Gordon, 2007; Stoel and Muhanna, 2009):

- Infrastructure: Foundation of shared IT services. Provide flexible base for future business;

- Transactional: Automate processes, cut costs increase volume per unit cost;
- Informational: Provide information for managing, accounting, reporting, planning, analysis, and data mining;
- Strategic: Support entry into a new market, provide a new service, enable a new product;
- Relationship: IT and business unit management share the risk and responsibility for the effective application of IT.

Therefore, we investigated which are the main impact factors related to Innovative Software Project Management (ISPM), aiming to understand how these factors can affect and contribute to the improvement and success of software projects (Autor, 2015).

3. Research Method

This section presents the research method used in this work. The methodology aims to show the way forward by the researcher, helping him / her to reflect and making more reliable research results. The research method used in this work is based on the Experimental Software Engineering principles which is based in conducting primary and secondary studies in different investigation stages

Nowadays, many studies have been conducted using Evidence-Based Paradigm. Originated in the medical domain, it is defined as a systematic process to discover, evaluate and apply findings of research in decision-making. As in other areas, Kitchenham, Dyba and Jorgensen (2004) discuss the application of this paradigm in software engineering - Evidence-based Software Engineering (EBSE).

Evidence-based Software Engineering aims to:

> *"to provide the means by which current best evidence from research can be integrated with practical experience and human values in the decision making process regarding the development and maintenance of software." (Kitchenham, Dyba and Jorgensen, 2004)*

The first step to start a scientific research is getting to know its main concepts and possible information sources. This step evaluates whether a baseline already exists with the main area concepts which could be used as a starting point for the research. An exploratory literature review was performed with the aim of identifying the basic concepts and the main research sources in the domain area.

Having identified and known research area main concepts, the next activity is to obtain scientific evidence to allow the field maturity analysis of the area in question. One of the main methods used is a rigorous procedure called Systematic Literature Review (SLR) or in short form Systematic Review (Kitchenham, Dyba and Jorgensen, 2004; Budgen et al., 2006; Kitchenham, Budgen and Brereton, 2011).

A SLR provides ways to implement comprehensive and not biased literature reviews, making their results have scientific value as advocated by Travassos and Biolchini (2007). SLR aims to present a fair assessment of a research topic, using a reliable, accurate and auditable methodology (Kitchenham, 2007).

Once the scientific evidence is obtained, the next step is to consolidate the knowledge, analyze all the evidences and identify necessary elements to build the initial approach to ISPM.

4. A Systematic Literature Review on ISPM

In this research, an exploratory review was carried out, as presented in Section 2.5. As a result, were identified some categories of factors that affect project management and consequently the innovative project success, which are: tools, techniques, processes, practices, organizational capabilities and IT assets; as depicted in Figure 2.1

Therefore, the main impact factors related to Innovative Software Project Management (ISPM) were investigated, in order to understand how these factors can affect and contribute to the improvement and success of software projects (Autor, 2015).

This section presents a systematic literature review of Innovative Software Project Management (ISPM), helping to identify the factors that affect the ISP and their management and how managers can prepare themselves for the challenges of their innovative projects (Autor, 2015).

4.1. Findings

Our findings show that the number of papers on innovation projects has been growing since the last decade, as well as the increased awareness of the challenges for the management of these projects. During the systematic review process some factors have been identified that affect the management and performance of innovation projects. Our research identified four tools and techniques that allow better planning and monitoring, helping to manage the initiatives to reduce uncertainty; or encourage innovation through a collaborative platform. We found evidence that an organic, flexible and informal structure of the organization enables the generation of ideas and innovative behavior, avoiding stifles the innovation. In terms of processes and practices, we have identified several models for innovation management, highlighting the agile approaches; as well as three processes and eleven practices that promote creativity, idea generation and collaboration to foster innovation in projects.

5. The Approach Elements

As a result of literature review analysis and considering the impact factors influence, this chapter presents the necessary elements to construct the initial approach of ISPM.

Considering the types of innovation, radical and incremental, it is common to associate the radical type as a real innovation, where the project manager should worry about all activities related to innovation already “known”, that is, project manager is already aware that innovation is present in the project and he or she have to try to mitigate their risks and uncertainties (Dvir and Shenhar, 2012; Kenny, 2003; Forsman, 2011).

However, in non-radical projects, we must be attentive to foster innovation; enabling it to appear and mostly avoiding stifle it by the processes and activities. This care

can produce an incremental innovation that before would not be achieved.

As previously shown, innovative projects have specific characteristics and needs to be managed differently from conventional projects for being successful. The adaptations needed to manage innovative projects should not be limited only to management of activities directly linked to innovation already "known". Just as important are activities that enable to foster innovation appear, avoiding stifle it.

At this research stage, the necessary elements to construct the initial approach have been identified. The types of innovation served as a reference to define the relationship between elements and analyze the impact factors influence on them.

A draft of the initial approach of this work was developed but has not yet defined a process, rules and restrictions to connect the elements. In this version, the elements are presented, describing their concepts and related impact factors. Thus, Figure 5.1 shows the initial approach and its elements.

Figure 5.1: Initial Approach Elements
Source: The author

The first approach element is Project Classification, where the type of project is identified and adaptation of the management style is presented, on Section 5.1; in Section 5.2 the concern about action to foster innovation is shown; in Section 5.3 it is exposed some activities to improve the project management when innovation is presented; Some attitudes to avoid stiffens it is discussed on Section 5.4. Finally, in sections 5.5 and 5.6 the management of uncertainties and risks is shown.

5.1. Project Classification

Through the use of typologies, classification and taxonomies, and analyzing the project characteristics, we can recognize and interpret the differences and similarities between innovation projects in order to adapt the project management approaches according to the needs of the project managers and the project peculiarities (Carvalho, 2009; Dvir et al., 1998).

One of the first typologies of innovation was proposed by Schumpeter (1934) and distinguishes radical versus incremental innovation. This typology is adopted in several studies and is still used today (Stadnick, 2007; Fagerberg, 2006; Smith and Tushman, 2002).

Several other typologies have been proposed, considering more than two levels of innovation as well as multiple dimensions. Among them, Dvir and Shenhar (2012) proposed the Unified Framework of Innovation, where the Diamond model (Shenhar and Dvir, 2007) was modified and could be applied for the analysis of innovations. The proposed model includes three dimensions: novelty, technology, and complexity, and innovations are characterized by a combination of their unique levels on each dimension. However, this framework is still based on the traditional dichotomy between incremental and radical.

The classification of projects has a direct relationship between project management approaches to be adopted. For projects with radical innovation, it is necessary specific cares since the need for innovation is already "known". Therefore, this project should be managed, taking into account the Innovative Projects element.

For projects with incremental innovation or "unknown", we should worry about fostering for innovation to flourish. In this case, the project manager should take into account the Foster Innovative element.

Regardless of the project classification, the project manager must ensure that innovation is not stifled by the procedures and processes of the organization. The Eliminating Barriers element has this concern.

5.2. Foster Innovation

Incremental innovation projects are associated with adjustments or changes something existing as product, service and processes; and the level of uncertainty and complexity is low compared with radical innovation projects. However, how suggested by Tidd and Bessant (2009), the innovation most often occurs incrementally: *"the cumulative gains in efficiency are often much greater over time than those which come from occasional radical changes"*.

To lead with incremental innovation projects or with projects where the existence of innovation is "unknown", the project manager must be aware of the tools, techniques and approaches needed to foster innovation. The project manager should foster the ideas generation and creativity as well as proper communication to enable collaboration and knowledge sharing (Afridi, 2012; Kishida, 2011; Schiavone and Villasalero, 2013;

Rodríguez-García et al., 2014; Davies and Brady, 2007).

The impact factors analysis indicated that the project manager should be concerned with project members to promote the ideas generation and creativity. To foster the human resource, leveraging the skills, expertise, and knowledge; some practices could be adopted as training, rewarding and following the technological developments, affecting directly the team motivation. In addition to the motivation, other aspects should be concerned to enable the ideas generation and creativity, it is the incentive to diversity and openness (Kishida, 2011; Pattit and Wilemon, 2005; Davies and Brady, 2007).

Some management instruments can be used to promote the ideas generation and creativity. Use of social media, as crowdsourcing, drives innovation through communication and collaboration, as well as by means of a semantically enhanced platform the innovation knowledge can be modeled through ontologies improving the management of open innovation (Afridi, 2012; Rodríguez-García et al., 2014).

In terms of approaches, we can mention the use of FedEx ™ Days and 20% Time as a way to give time and space for project members to explore and make mistakes, helping them to maintain their innovation capacity. Activities and incentives used to promote innovation require thought, planning, and development, since through these actions is that the types of innovations that are created (Moe et al., 2012).

The use of tools, practices, and approaches to foster innovation can act as a springboard to raise the level of innovation among projects, giving rise to innovation projects which did not exist before, as well as transforming incremental innovation projects in radical innovation projects.

As proposed in this section, incremental innovation projects are suitable for the Foster Innovation element. However, the use of tools, practices, and approaches presented in this element should encourage the “unknown” innovations to flourish also in radical innovation projects.

Even in a project with a low level of innovation, the project manager should pay attention in the project uncertainties. The Uncertainty Management element addresses this issue.

5.3. Innovative Project

Radical innovation projects are characterized by the high level of uncertainty and complexity. In this type of project, the existence of innovation is “known”. The project manager must be aware of the tools, techniques, and approaches needed to manage these features, enabling rapid adaptation of management as well as the identification of more knowledge and investment needs, to enable or not innovation.

Several approaches can be applied to the management of innovative projects, such as Helical, the IVPM2, and the Neo-realistic. However, the use of agile approaches has emerged as an effective method for projects in this context (Deakins and Dillon, 2005; Wu, Rose and Lyytinen, 2011; Kettunen and Laanti, 2005; Conforto and Amaral, 2010; Berggren, Järkvik and Söderlund, 2008). According to Spundak (2014), *“Agile project*

management approach is intended to the creative and innovative projects, for which it could be assumed that will be significantly changed during the course of the Project".

Intending to mitigate the risks inherent in this type of innovative projects, the project manager should use strategies to enable innovation. One strategy being used is the flexible use of Stage-Gate, in order to ensure the effectiveness of the investment (Van Oorschot et al., 2010).

Some tools and techniques can be used to reduce uncertainty and risks, improving the planning of these projects. Among other tools, we can mention: Fuzzy numbers and Risk Breakdown Matrix. Likewise, techniques: Careful and elongated up-front planning, Exploration of identified innovation-points, and Proper integration of innovation point sub-projects.

Even using the appropriate tools, techniques, and approaches, the uncertainty level of these projects remains high. Thus, the project manager should be able to handle the uncertainty management. The Uncertainty Management element addresses this issue.

5.4. Eliminating Barriers

Several authors, as Filippov and Mooi (2010) and Dodevska and Mihic (2014), have studied innovation projects (IP) and argue that they are a specific type of project and they cannot be managed the same way as conventional projects. As Keegan and Turner (2002) argue, "*A revision of traditional project management guidelines may be necessary given the potential of conventional approaches to managing (innovation) projects to stifle innovation*".

For successful innovation in the organization, some activities should be undertaken. One is to foster innovation by promoting the ideas generation, creativity and motivation of the team. However, organizational capabilities should be prepared to help these activities (Kishida, 2011; Schiavone and Villasalero, 2013; Davies and Brady, 2007).

The identification and elimination of barriers to idea generation and creativity in the organizational environment, makes it possible to use the Foster Innovation element. The actions to eliminate these barriers would help in designing a promising organizational environment to innovation (Bannerman, 2013; Paletz, 2012).

To eliminate barriers to idea generation and creativity, the organization needs a style more organic, flexible, and informal to accommodate the innovation and task diversity, allowing the share of information and other scarce resources across functional areas, and provide mechanisms for decision making and conflict (Davies and Brady, 2007; Koc, 2000). The project-based organizational style could be adopted to address the needed flexibility to lead with innovative projects (Blindenbach-Driessen and Van Den Ende, 2010);[057];(Keegan and Turner, 2002; Koc, 2000; Filippov and Mooi, 2010).

According to Bannerman (Bannerman, 2013), the organizations must develop the "Dynamic Capability", the ability to build and leverage new capabilities. Thus, the author demonstrates that eliminating barriers in organizational capabilities, we can improve or create new organizational capabilities and thus obtaining better performance in an

environment: new, uncertain, and constantly changing; as the innovation projects.

As shown in this section, the barriers elimination to innovation is related to the organizational structure. Usually, the project manager has no influence to change it. However, knowledge of this element can enable the project manager to propose the necessary adjustments in the organization's environment or at least make it viable in the project environment. Thus, the project manager should take into account this element regardless of project type (radical or incremental).

5.5. Uncertainty Management

Innovative Project can be highly unpredictable, although the level of uncertainty will vary according to several factors. Software projects can be characterized as projects involving high level of uncertainty and that level of uncertainty has a relationship with the level of innovation of these projects (Autor, 2015; Moura, 2011).

Wu, Rose and Lyytinen (Wu, Rose and Lyytinen, 2011) argue that large and innovative projects have a high level of uncertainty and complexity, requiring an unbounded and non-linear risks management. Agreeing with this concept, Marinho (2015) proposed an approach to manage uncertainties in software projects and we suggest its use in our approach.

5.6. Risk Management

Innovation projects are a specific type of project, which is distinguished from conventional projects, mainly due to the high degree of uncertainty and risk, especially in the initial project phase, when it is necessary to define the project objectives. The risk management of innovation projects faces additional difficulties due to the plurality of risk sources for this type of project: management, technology and market (Dodevska and Mihic, 2014);[271].

Shenhar et al. (2004) argue that “the objective of risk management is not to eliminate risks, but to manage them across the project so as to avoid investing excessive resources in the solution of a given risk while neglecting others”. Innovation is about change and the project manager should be more open to change. Planning for change and developing a strategic approach to risk management means that project manager and the organization have more information at hand to make decisions when it comes to assessing potential risk versus potential value of innovation projects (Samson and Gloet, 2013).

In terms of tools and techniques, the project manager can use the Risk Breakdown Matrix to reduce uncertainty and risks, improving the planning of these projects (Dodevska and Mihic, 2014). However, with regard to the uncertainty management, once uncertainty is revealed, analytical techniques such as risk management can be used in project management (Marinho, 2015).

6. Conclusions and Next Steps

A large number of project management approaches do not consider the impact that innovations have on projects. Innovation is one of the keys to success in an organization,

however, the threats identified by innovation in a project day-to-day are real and expectations in a project are often high. An innovative software project has a high level of uncertainty and complexity, leading us to suggest that we need a specific approach to managing these threats. The use of management innovation in projects can be a determining factor in project success.

This work proposal was built on evidence-based software engineering and provides subsidies for the need to address innovation in software projects in order to reduce the negative impacts caused by uncertainties, risks, and complexity. It also contributes by defining an approach to innovative software project management (ISPM), fostering innovation and avoiding it to be stifled.

Initially, an exploratory literature review was performed aiming to present the concepts related to this work, to raise clarification points such as the understanding of innovation in the different knowledge areas, and how scholars address the innovation and innovation management concept. Thus, following evidence-based software engineering methodology and other steps, that are going to be described hereinafter, we began to answer the research questions.

A systematic literature review was conducted and presented. The systematic review research questions addressed: the identification of the factors that affect the ISP and their management such as tools, techniques, processes, practices, IT assets and organizational capabilities; and how managers can prepare themselves for the challenges of their innovative projects, fostering innovation and avoiding it to be stifled.

At this research stage, through the set step-by-step methodology, a draft of the proposed directions to an initial approach in this work was developed. The directions were elaborated based on findings of the exploratory review and the systematic review developed.

The draft of the initial approach, considering only the elements, impact factors, and their relationships, is an important step towards the creation of knowledge in the innovative software project management, and the move towards a comprehensive approach, considering the process definition, with rules and restrictions.

The results of this research contribute to software project management in two ways. First, the developing initial approach presents a way to manage innovation using the strategies and orientations that can support professionals and researchers in identifying relevant challenges and development of solutions for projects. Second, the research results provide the academic community a better understanding of the challenges of dealing with innovative software project management and therefore, show gaps in the area that can be good opportunities for future research.

The use of the initial approach helps the project manager to deal with innovation project, taking advantage of opportunities to foster innovation and avoid stifle it. Thus, the results of this research contribute to increasing innovation and consequently the organization's success.

Finally, to the researcher, this research enabled an academic maturity and subject

knowledge deepening. Studies during this search and the consequent acquired knowledge made possible interaction with other researchers of the area.

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