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Agile Project Management and Innovative Product Development: benefits and challenges of two companies from São Carlos Tech-Pole, Brazil

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ABSTRACT

A project management (PM) theory entitled “Agile Project Management – APM” has emerged as an alternative to deal with the challenges of applying traditional models and approaches to non-traditional, innovative and complex product development environments. This paper examines the benefits and challenges of two APM implementations. The research was carried out at two technology-based companies of São Carlos Technology Pole, Brazil, within single and multi-project environments. It comprised an extensive literature review followed by an action research methodology. Research results were evaluated using descriptive statistic analysis supported by questionnaire application, interviews and document investigation. From the theoretical standpoint, this paper starts a new discussion about the challenges and benefits of applying APM methodologies, practices and tools to innovative product development environments. In addition, it presents relevant evidence requiring further investigation about the correlation regarding the adoption of APM practices as an alternative to traditional project management practices in innovative NPD environments.

Keywords: APM; Innovative New Product Development; Technology-based Companies.

1 Introduction

According to Salomo, Weise and Gemünden (2007), although new product development (NPD) is widely recognized as a potential source of competitive advantage, and has been through constant evolution (Brown and Eisenhardt, 1995; Griffin, 1997; Barczak, Griffin and Kahn, 2009) companies are still struggling to find efficient and effective management techniques and tools to meet the requirements of dynamic and turbulent business environments. This may be attested by the growing literature that criticizes the indiscriminate use of traditional models and approaches in non-traditional product development environments (Iansiti, 1995; Baccarini, 1996; Dawson and Dawson, 1998; Williams, 1999; Maylor, 2001; Chin, 2004; Highsmith, 2004; Augustine, 2005; Shenhar and Dvir, 2007; Perminova, Gustafsson and Wikström, 2008).

This criticism has brought about an alternative approach, known as Agile Project Management (APM), to deal with the challenge of applying flexible and simple project management practices to NPD processes (Conforto and Amaral, 2009). In this sense, Cooper (2008) has demonstrated the importance of considering alternative theories such as “lean and agile” approaches to innovative product development environments. This

discussion has gained more relevance since 2001, when an agile manifesto for software development was signed.

Along these lines, Boehm and Turner (2004) discuss the importance of balancing agility with discipline in non-traditional NPD environments. Despite the evolution of NPD and PM literature, there is a lack of research investigating the benefits and challenges of combining traditional PM practices with new approaches, such as APM, when applied to innovative product development environments. Although some authors, such as Mafakheri, Nasiri, Mousavi (2008) and Qumer, Henderson-Sellers (2008), have already started investigating the agility level of agile methods and projects in the area of software development, it is necessary to explore other areas, such as New Product Development.

This paper examines the benefits and challenges of the implementation of an agile project management method entitled IVPM2 (Iterative and Visual Project Management Method). The research was carried out at two technology-based companies (Heydebreck, Klofsten and Maier, 2000; Grinstein and Goldman, 2006) of São Carlos Technology Pole, Brazil, within single and multi-project environments. The IVPM2 was assessed using descriptive statistic analysis supported by questionnaire application, interviews and document investigation.

2 Agile Project Management (APM)

The development of innovative products demands a flexible and interactive PM process. According to Steffens, Martinsuo, and Artto (2007), projects of this type are seldom carried out as originally planned. For that reason, Shenhar and Dvir (2007) believe that they fail if managed with traditional management tools and methods.

In order to respond to this issue, new approaches – characterized as “flexible” and “agile”, in particular APM – have been conceived, especially in the area of software development after the signing of the agile manifesto in 2001 (Beck, et al., 2001). This

paper adopts APM, which is defined as grounded on a set of principles aiming at making project management models simple, flexible, and iterative. APM seeks to adapt existing PM practices to implementations in dynamic NPD environments, i.e., projects with specificities shaped by innovation and high levels of uncertainty and complexity (Conforto, 2009).

At any rate, criticism about traditional PM models and techniques should be seen with prudence, as there are no scientific studies comparing both approaches that show that APM is more advantageous regarding innovative products. In summary, it is fundamental to investigate the application of APM, its benefits and advantages. It should also be noticed that APM authors describe practices and application examples relating to isolated projects, mostly in the software area. Hence, they do not take into account the impact of these techniques on the planning and control of projects of products involving hardware and software developed at technology-based companies in multiple-project and innovation environments, as is the case in question.

3 Managing innovative product development projects

Authors that favor APM (Highsmith, 2004; Chin, 2004; Cohn, 2005) recommend this approach for projects that involve uncertainties, innovation, and are inserted in dynamic business environments, where traditional PM techniques cannot achieve the flexibility level needed to absorb project changes. The adopted management approach should meet the needs of projects involving constant change and complex situations, in which development speediness is crucial to business success. According to Wysocki and McGary (2007), new product development projects and R&D projects are good examples to which to apply more objective and less bureaucratic approaches. In this context, Wysocki (2007) acknowledges that project development and management should be based

on an exploratory approach (using cycles and iterations) due to the nature of projects, which demands differentiated management approaches.

Therefore, PM application and theoretical evolution are on another level, in which the so-called traditional techniques and methods are being disputed, in particular when they are applied to companies that develop projects involving innovation and high levels of complexity and dynamics. According to Collyer and Warren (2008), dynamics is one of many project dimensions and its importance derives from its meaning. As regards a given project, it represents the high level of uncertainty and change in the project environment, impacted by factors such as innovation and influenced by constant changes in scope. The author claims that its importance increases exponentially since it is common in projects involving new technologies or innovative product development projects.

In dynamic business environments, organizations need to cope with many challenges and risks. These challenges require flexibility and responsibility, especially in the development of new technologies and introduction of new products (Iansiti, 1995). In this context, projects are seldom carried out as planned, as suggested by Steffens, Martinsuo, and Artto (2007). According to Shenhar and Dvir (2007), projects managed traditionally do not succeed because of the standards and approaches adopted in the management of projects with distinct characteristics.

This singularity does not apply to environments in which technology-based companies operate. In many fields, managing a project implies dealing with external and internal influences, such as business environment-related restrictions and challenges, market uncertainties, technological limitations, and the search for innovation (Nobelius, 2004). New product projects involving a high degree of innovation are usually more difficult to manage. These projects are influenced by many uncertainties from several

sources, including a complex interaction among planning, execution and control (Oorschot, Bertrand and Rutte, 2005).

A recent study by Buganza, Dell’Era, and Verganti (2009) concluded that it is very challenging to manage product innovation in turbulent environments with a high level of uncertainty and complexity. Some authors, such as Cooper (2008), Smith (2007), Highsmith (2004), and Chin (2004), propose alternatives to the management of innovative projects. However, the above authors do not present empirical data that attest to the benefits and challenges of applying techniques and tools based on new theories, such as Lean (Leach, 2005), Agile (Highsmith, 2004), and Flexible Product Development (Smith, 2007).

In thesis, all criticism to the indiscriminate application of PM techniques and methods to diverse types of projects, demands investigation. This criticism has been a point of debate since the 1980’s, in particular concerning innovation projects (Clark and Fujimoto, 1991). Few studies have proposed methods and techniques for the management of projects of innovative and complex products, with the exception of Andersen (1996), Chin (2004), Highsmith (2004), and Cohn (2005). However, these studies are incomplete as they present neither empirical data that attest to the benefits from their application nor detailed employment and reimplementation procedures. This has been recently brought to light by the study of Sauser, Reilly and Shenhar (2009), which emphasizes the need for further research in this field.

4 IVPM2 Description

This study was carried out based on an agile project management methodology implementation. The method was entitled as IVPM2 (Iterative and Visual Product Management Method). It was developed by means of an action research design (Coughlan and Coughlan, 2002, 2009). Many sources were used to define the IVPM2 framework and

its boundaries (Pugh, 1996; Cooper, 2001, 2008; Highsmith, 2004; Chin, 2004; Smith, 2007; Boehm and Turner, 2004; Augustine, 2005; Cohn, 2006; Amaral and Rozenfeld, 2007; Shenhar and Dvir, 2007; PMI, 2008). As the method has been previously described (Conforto and Amaral, 2008, 2009), the objective of this section is to provide an overview of its components and implementation process. IVP2 comprises five features and a seven-stage iterative cycle based on APM principles. Its features are:

- (1) PPDM – Phase and Project Deliverable Model;
- (2) PPCW – Project Planning and Controlling Whiteboard;
- (3) WAPW – Weekly Activity Planning Whiteboard;
- (4) PMS – PM Software, in this case DotProject (see <http://www.dotproject.net/>);
- (5) SPIS – Simplified Performance Indicator System.

The seven-stage cycle functions as an iterative development cycle; each project can have as many iterations as necessary depending on its needs and characteristics. Figure 1 illustrates the seven-stage cycle as well as the five IVP2 features.

Once a new project begins, the iteration cycle starts by defining project phases and deliverables, guided by PPDM (Stage 1). Then, the project manager and team members together place deliverables on a whiteboard (PPCW) using sticky notes (Stage 2). At the next stage (Stage 3), the deliverables placed on PPCW are registered by a PM software program (in this case it was adopted DotProject). The software plays an important role in IVP2 as it is used to document and create a history file of the project, which will provide performance indicators for the iterative development plan.

After being fed into DotProject (Stage 3), the deliverables, in some cases, have to be decomposed into work packages, activities, or even tasks by means of WAPW (Stage 4). Project team members carry out the work packages associated to one or more PPCW-defined deliverables, and once the activity or task is completed they insert information

regarding the percentage of completion and time spent at DotProject (Stage 5). At Stage 6, DotProject generates simplified performance reports and provides an overview of the project progress using the information about task and activity completion. At the end of the iteration the project team and project manager use the information to take actions in order to start a new iteration (Stage 7).

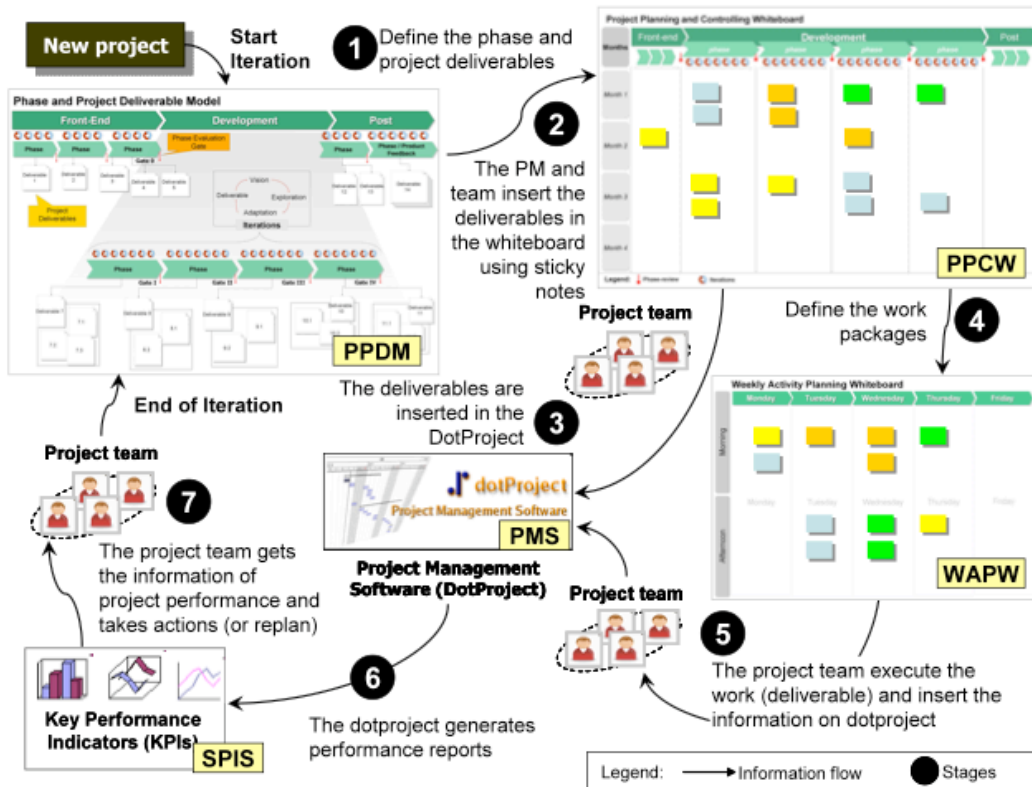


Figure 1. Framework of the implemented method (IVPM2), combining NPD concepts to APM principles. Source: Conforto and Amaral (2008, 2009)

Although IVPM2 focuses on the planning of deliverables, it does not exclude the need for defining tasks or activities when necessary. The information and details about deliverables are inserted in PMS as well as activity and task completion information. This is followed by information on completion related to tasks and activities; the planning does not include task or activity information such as Gantt charts. The duration of iterations depends on the type of project, its phases, complexity, novelty, and degree of uncertainty.

5 Research methodology

The research methodology adopted comprised three phases: (1) extensive literature review combined with action research (Coughlan and Coghlan, 2002, 2009); (2) implementation of the method under investigation at two technology-based companies of São Carlos Tech-Pole, Brazil; (3) evaluation of the method. This paper focuses only in the evaluation phase. It considers the implementation of an APM method, i.e., IVPM2 (Iterative and Visual PM Method), described in previous publications (Conforto and Amaral, 2008, 2009). The companies participating in this study – hereinafter referred as “Company A” and “Company B” – are two distinct environments of projects with differing characteristics themselves.

Company A develops technological solutions by integrating hardware and software into robotics to meet the needs of research centers, universities, and security, energy, and entertainment companies. Founded in 2003 by scientists, it is constituted by 25 collaborators: doctors, masters, and graduates in computer engineering, mechatronics, mechanical engineering, and physics. It is partners with research institutes and universities in projects that last from 6 to 48 months. There, IVPM2 was implemented in a pilot project with estimated duration of two years, with high levels of complexity and innovation according to the typology proposed by Clark and Fujimoto (1991). Moreover, the project environment can be described as a single-project environment, with a dedicated development team of six people, which included the project manager and company director, who played the role of technology director.

In contrast to company A, at the company B, the IVPM2 was simultaneously implemented in seven projects, with estimated duration of 3-18 months and different levels of complexity and innovation. Its project teams, considered in this study – a total of 13 people, which included team members, project coordinators and the company director –

were not dedicated to the projects under investigation. It is a multiple-project environment, i.e., its characteristics are distinct from those of Company A. Company B is a service enterprise specialized in industrial design, fast prototyping, development of virtual models and prototypes of products for high-technology companies. It also develops projects in association with universities, research institutes, and high-technology enterprise incubators.

In both companies, it was applied a questionnaire comprising 23 questions to identify IVP2 benefits to the project management process. Six people in Company A and 13 people in Company B answered the questionnaire. All research participants, in both companies, answered questions about IVP2 by means of a Likert scale: (5) totally agree; (4) agree; (3) indifferent; (2) disagree; (1) totally disagree. The interviews were carried out individually with each project team member, coordinators, and directors of the companies under investigation. Table 1 shows the questions used in the interviews:

Table 1. Questionnaire related to IVP2 benefits for the companies

Code	Question
Q1	Contributed to delivering value to customer.
Q2	Contributed to management by iterative cycles and partial deliverables.
Q3	Contributed to improving general project results.
Q4	Contributed to improving absorption of changes in project.
Q5	Contributed to composing self-organized and self-directed teams.
Q6	Contributed to improving communication with customer.
Q7	Favored participative decision-making.
Q8	Contributed to visual management of project.
Q9	Time spent on management activities using IVP2 is brief.
Q10	Contributed to improving accuracy of project information.
Q11	IVP2 implementation does not demand investment in advanced resources and tools.
Q12	IVP2 enabled better standardization of project documents.
Q13	Retrieving and reusing project information became simpler and faster.
Q14	Contributed to team's commitment to goals and results.
Q15	Favored simple and fast project planning.
Q16	Contributed to speeding project re-planning.
Q17	Enabled monitoring project progress.
Q18	Contributed to aligning project results with company strategies.
Q19	Contributed to development of leadership aspects.
Q20	Contributed to development of a single PM language.
Q21	Conflict and contention within project team diminished after IVP2 implementation.
Q22	Conflict and argument with customers diminished after IVP2 implementation.
Q23	Integration of visual techniques into PM software contributed to improving project progress monitoring.

6 Results and evaluation

Figure 1 shows a compilation of question results from both companies. A comparison of the data helps to elucidate why IVPM2 was useful to just one of the companies with regard to some aspects, why both companies were benefited in relation to other aspects, and why data diverged as a function of specificities of each project environment. The graph was obtained by summing the grades given by respondents that “totally agreed” or “agreed” with the criterion in question. The cut-off grade was defined as a percentage of 75% of respondents that totally agreed or agreed to the question. A grade higher than or equal to 75% means that the criterion is true, thus beneficial to the company PM process.

Out of 23 criteria evaluated, 15 converged as regards IVPM2 benefits in both companies, i.e., they were given grades equal to or higher than 75%, as shown in Figure 1. Among them, Q2 and Q4 should be highlighted, which means that IVPM2 contributed to the management by iterative cycles and partial deliverables and to a greater absorption of project changes. On the other hand, IVPM2 did not contribute to reducing contention among project team members and arguments with customers. This result may be partly explained by the increased interaction among project team members as well as with customers due to IVPM2 characteristics, i.e., use of visual project planning and control devices and frequent meetings with customers.

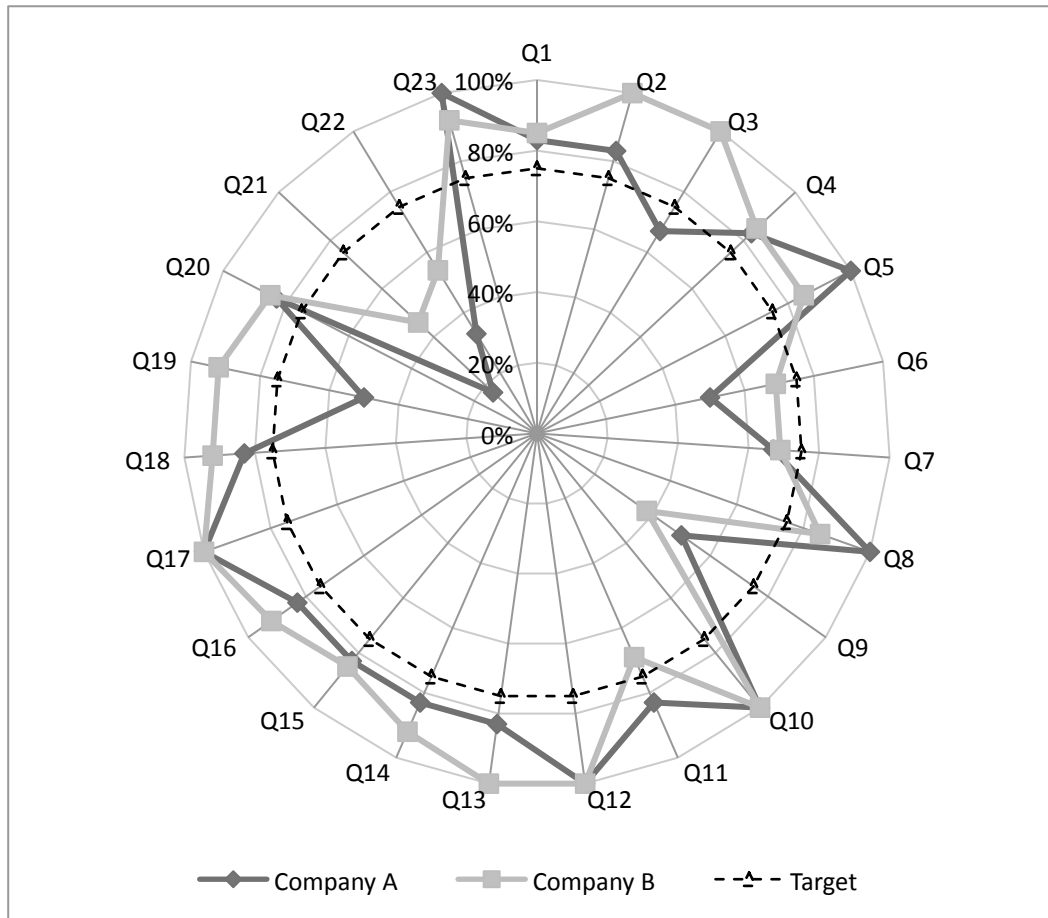


Figure 1. IVPM2 evaluation – Questions 1 to 23

IVPM2 visual devices also contributed to the management by iterative cycles and partial deliverables as shown by Q8. The visual management of projects by means of IVPM2 components allowed greater interaction and communication among project team members. This result had a direct impact on the assessment of Q17, i.e., monitoring of project progress by means of software combination with visual devices and APM principles, as well as the guidance provided by the product development process. Among the questions with positive answers by both companies, emphasis should be placed on Q12, Q15, and Q20, related to minimum document and product development process standardization, which contribute to the creation of a single language and provide a simple and speedy way of planning projects, mainly due to IVPM2 visual aspects assessed in Q8. The standardization of the product development process, by means of PPDM, and the PM language also contributed to increasing the quality and accuracy of project information

(Q10). Another relevant aspect was the team's commitment to results and goals as assessed in Q14, essential to participative decision-making and the development of self-management and self-discipline, as per Q5.

Question 23, which explores the contribution of combining visual techniques with PM software to improve project progress monitoring, stands out among the questions that received grades equal to or higher than 75%. This is a significant aspect to the advancement of APM theory and its application to multiple-project environments, such as the case of Company B. The literature on APM implementation in the development of innovative products is not very extensive. Therefore, understanding the application of software in conjunction with agile practices is of great importance. Although APM theorists do not mention the need for adopting software programs, the results of this study indicate its importance, particularly in multiple-project management in order to speed up, organize, and aid the registration and retrieval of project information, thus enabling better management of information generated during project execution.

The companies in question indicate only five criteria below the cut-off grade: Q6, Q7, Q9, Q21, and Q22. Among the PM aspects that did not benefit from IVPM2 are: communication with customer (Q6); participative decision-making (Q7); time spent in management activities (Q9); conflict among team members (Q21) as well as with costumers (Q22). With respect to Q9, the average time spent increased after IVPM2 implementation. This is evidenced by Q24, Q25, and Q26, as shown in Figure 2 and Figure 3. Despite IVPM2 making use of simple tools and allowing for collaborative PM, in which all members participate in planning and controlling their own deliverables and activities, many respondents mentioned the prospect of using IVPM2 in conjunction with a PM office (PMI, 2008) so as to reduce their participation and time spent in management activities.

Yet, this is contrary to the principle of members' active and collaborative participation advocated by APM literature.

On the other hand, some aspects diverged when the results obtained in both companies are compared. The question related to improving project results (Q3) did not get a good grade in Company A, whereas all of Company B respondents claimed that their project results improved after IVPM2 implementation, thus reducing project delays. Conversely, Company B respondents did not agree on Q11, i.e., investment in resources and tools to use IVPM2. The last divergent criterion among the companies concerned leadership (Q19), to which, according to Company A, IVPM2 did not contribute. In contrast, IVPM2 users from Company B evaluated it favorably.

In addition to the questionnaire comprising 23 questions about IVPM2 benefits to the companies' PM, other specific questions were asked in order to elicit the average time spent in management activities before and after IVPM2 implementation (Questions 24, 25, and 26), the level of motivation and adherence to the method (Question 27), and the factors that worked against the method (Question 28). Figure 2 shows the results of Questions 24, 25, and 26 for Company A with regard to the time spent in PM activities before and after IVPM2 implementation. Q25 and Q26 explore, separately, project planning and monitoring and control activities. Question 24 (Q24) shows the weekly average time spent in PM activities before IVPM2 implementation. For 30% of respondents, in average, PM activities took 30 to 60 minutes. The remaining answers fall between 1 and 2 hours or longer than 3 hours, pertaining to the group of project coordinators.

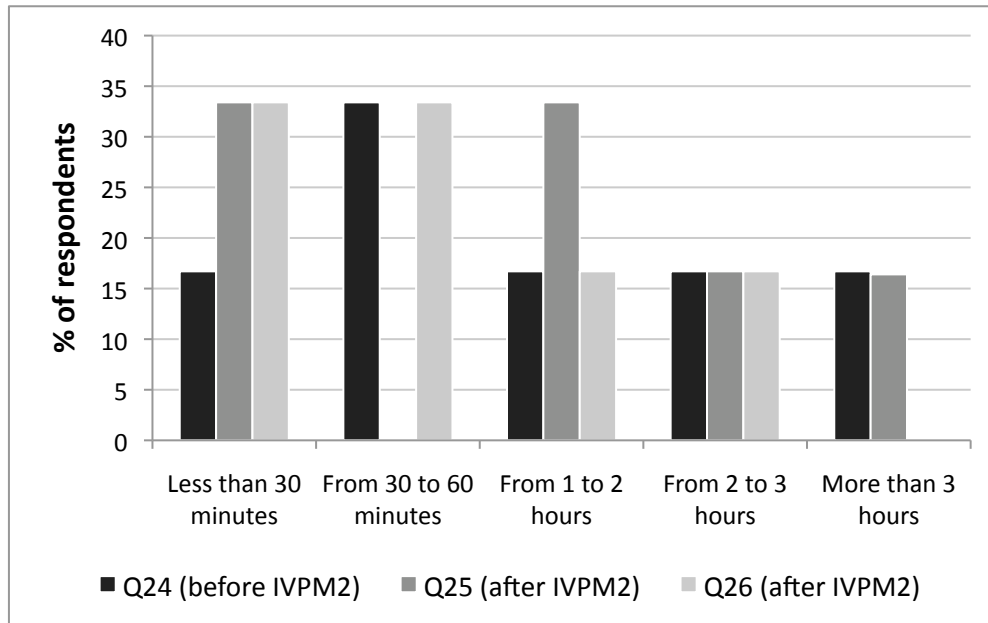


Figure 2. Question 24, 25 and 26 – time spent (weekly basis) in management activities before and after IVPM2 implementation – COMPANY A

Figure 3 shows the results of Q24, Q25, and Q26 for Company B. In the multiple-project environment found in Company B, it is possible to notice that more than 35% of respondents claimed to spend less than 30 minutes, and a little over 30% reported spending from 1 to 2 hours in PM activities that include planning and control of project activities and deliverables before IVPM2 implementation. After IVPM2 implementation in Company B the weekly time spent in planning activities increased, in particular for respondents that had spent less than 30 minutes. They began to spend more than 30 minutes, whereas some project coordinators and leaders started to invest more than 2 hours or even over 3 hours, as shown in the figure. These numbers were also impacted when the time spent in monitoring and control activities is analyzed. More than 35% responded that they now spent more than 30 minutes, with 15% of respondents indicating spending more than 2 hours. The same percentile of respondents started to devote more than 3 hours per week to project monitoring and control activities.

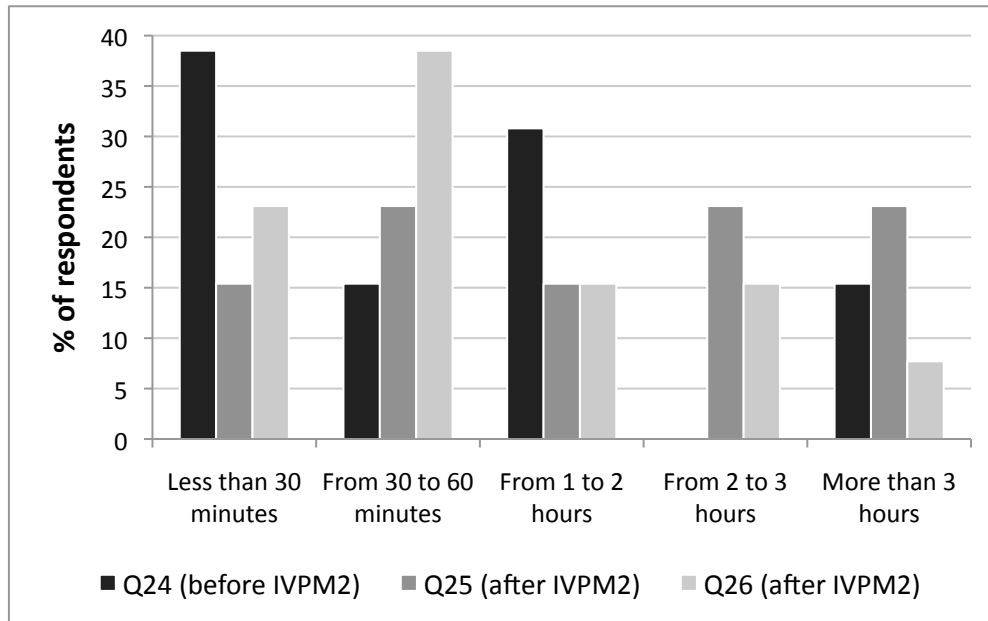


Figure 3. Question 24, 25 and 26 – time spent (week basis) in management activities before and after IVPM2 implementation – COMPANY B.

These data reinforce the evidence that IVPM2 demands that the team develop self-management and self-discipline skills, contributing to project team members' collective participation in planning and control activities by means of agile project management principle. This reflects the time allocated to these activities, both for team members and project managers and coordinators. On the other hand, it contributes to making management and decision-making processes more agile and flexible.

Question 27 dealt with the level of motivation and adherence to IVPM2 on the part of project teams. It may be noticed that the opinions in Company A were divided; half of the team claimed to be motivated and the other half unmotivated. Yet, in Company B, the responses favored motivation to use IVPM2 by 85%. This reinforces the need to evaluate the project environment before implementing an APM-based method for innovative NPD projects. It is necessary to identify the team members' profiles, types of projects, and above all the organizational culture so as to get the best results with APM-based methods.

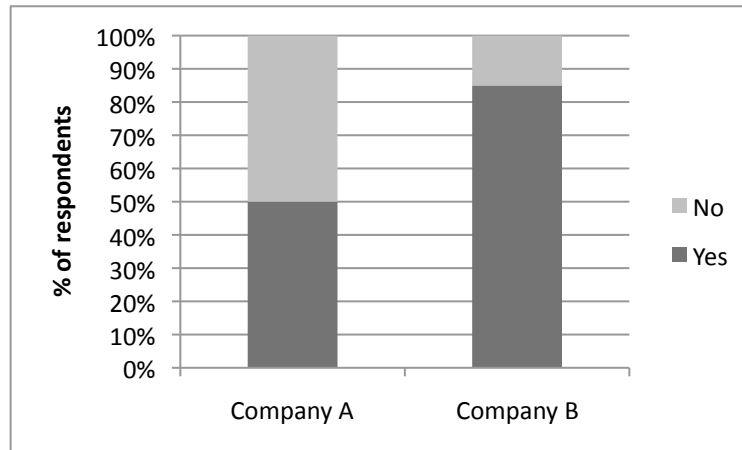


Figure 4. Question 27 – Comparison of level of adherence and motivation to use IVPM2 in both companies under study.

Figure 5 shows a summary of factors that had a negative impact due to IVPM2 implementation according to research participants. Among these factors, organizational culture (F1) stood out, followed by F2, F3, and F4, i.e., team’s resistance to adopting management techniques, available time to implement IVPM2, and absence of specific PM competencies, respectively.

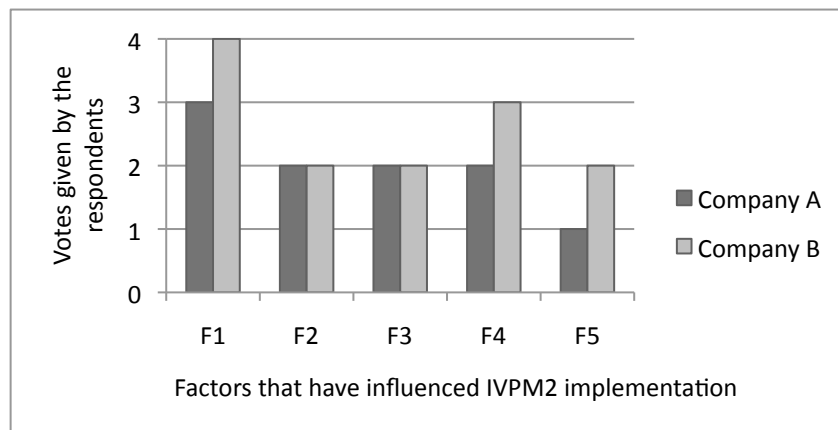


Figure 5. Factors that negatively influenced IVPM2 implementation

- Where:
- Factor 1 (F1): Organizational culture
 - Factor 2 (F2): Team’s resistance to adopting management techniques
 - Factor 3 (F3): Time to institutionalizing (implementation of method)
 - Factor 4 (F4): Absence of PM competencies
 - Factor 5 (F5): Adequacy of IVPM2 to all types of projects

The results from both implementations show that despite companies displaying a lean and horizontal organizational structures, support from top administration and their own culture of not making use of specific PM techniques, appear to be the most important

negative influences when implementing an APM methodology. Highsmith (2004) emphasizes that the implementation of an agile method should be in alignment with the organization goals, such as: (1) continuous innovation; (2) product flexibility; (3) delivery of values in the shortest possible time; (4) adaptability of people and processes; (5) reliable results. It is unquestionable that processes and people's behaviors should change to meet the challenges posed by projects developed in dynamic business environments, such as the case of the companies under investigation. Nevertheless, this change of behavior takes time, as suggested by F3.

The results obtained in both companies as regards F4, especially in Company B, point to a controversial issue in APM theory, i.e., mastery of PM techniques and tools and the knowledge needed to manage a project. This paradigm pertains to the traditional PM theory; it presupposes that the project manager is an expert and authority in the field of project management. However, according to APM theory, the agile project team must be co-responsible for and an active participant in PM activities.

The study of Winter et al. (2006) accounts for this theory, which one of the hypothesis for the future of project management is related to the project team member role as a reflexive practitioner who works based on a continuous learning and development process to cope with complex project environments. Thus, the project manager – a position usually found in companies run according to the traditional theory, based on standards such as PMBOK (PMI, 2008) – should become a facilitator and a leader instead of just a manager, which the responsibility for managing the project should be shared with all team members.

6.1 Discussion and Managerial implications for NPD field

This study carried out at the two companies that implemented IVPM2, an APM based methodo, indicates that some functions of the PM software must be reevaluated in

order to make it useful to “all,” whose role of communication and interaction device is even greater than that of data analysis, which is little explored in APM literature. This may bring change to a paradigm constructed along decades of evolution in the field of project management applied to the development of innovative products. In addition, APM theorists seldom mention the role played by a software program. Due to the influence of authors such as Maylor (2001), who criticizes the role of software in project management, they either fail to mention the importance of adopting software programs or do so, but are vague, i.e., they just claim that these programs should be uncomplicated, while offering no further explanation.

In spite of combining simple visual solutions with a management software program, IVP2 users in both companies indicated the necessity and benefits of document standardization in the management process and using a product development model such as PPDM (Figure 1), even though the project environment is unstable and uncertain. Moreover, they emphasized the contribution of defining a product development process. Particularly in multiple-project environments, many aspects are benefitted by standardization and use of software in conjunction with visual techniques, e.g., communication, interaction, visual management, and capacity to take in changes during project execution.

APM authors have focused on teams working with a single project with co-located teams and high levels of interaction with customers. The unit of analysis is the project team and methods are customized to their needs; actually, there are authors that call them “agile project teams.” In this sense there is also the need to explore the application of these principles to global projects and virtual project teams.

The problem identified in APM theory – when applied to a multiple-project environment – was the difficulty in managing a set of projects, evidenced in Company B,

because the theory as it is leaves unanswered issues such as capacity planning and control and other areas of traditional PM theory, e.g., risk management (PMI, 2008). These results reinforce the need to investigate agile techniques to manage multiple projects and agile techniques that address issues such as capacity and resource allocation, and even PM managerial aspects both neglected in APM theory.

It is important to remark the relevance and positive contribution of IVP2 to both companies participating in this study. However, this study has limitations and restrictions, avoiding generalization. The results point to theoretical and practical contributions that may be useful to the field of PM, especially APM, and needs future studies in the field of operations management with a basis for their design. From the theoretical point of view, this paper can be seen as demanding further discussion about the correlation between NPD project performance and the agility of project management practices adopted by the companies under investigation.

7 Conclusions

This paper has identified that some PM practices related to APM theory, such as the use of whiteboards and sticky notes, cannot provide the same value and benefits when applied to different companies and projects, even if they have similar NPD projects, as regards as innovation and dynamism. Additionally, the analysis has demonstrated the importance of combining traditional PM practices with APM theory.

Both cases under investigation provided important evidences regarding the valuable integration of both theories when applied to innovative product projects. These empirical findings may be considered as a starting point for future research about the application of PM and APM theory to adapt and deploy more effective practices to innovative product development environments. Hence, the results advance the discussion about traditional

versus agile project management, by demonstrating that these theories do not conflict, but complement each other.

From the practitioner's standpoint, this paper contributes with empirical results and important evidence regarding the benefits and challenges of applying APM practices as an alternative to traditional PM practices. Practitioners can use these findings as an inspiration and guideline to develop and implement their own NPD and PM methodologies in association with APM theory.

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