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IT investment management based on Information Technology Portfolio Management (ITPM): a study in Brazilian companies

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Abstract

The objective of this research is to analyze some Brazilian companies' use of ITPM technique as an aid to their IT investments management. It was carried out in five case studies in different Brazilian companies from several economic sectors which were using the technique or were in the initial implementation phase. Eight interviews were conducted. The persons interviewed were high-level executives working in the IT department in the studied companies. Different levels of ITPM use was found regarding IT investment management (planning, control and evaluation). It was observed, in the analyzed cases, that ITPM is used most frequently in IT investment planning, which is the process most discussed and used in analyzed companies. The ITPM technique is used more frequently in Company 2 than in the other cases because the organization of the IT area in the company is structured according to ITPM dimensions. The technique has received little attention in IT research and ITPM research is still very limited in the information systems literature, a possible reflection of its academic importance. To highlight its practical use, ITPM has been considered a useful and accessible tool which aid IT executives in better managing and justifying investments in technology.

Keywords

IT investment management, ITPM, Brazilian companies, Case studies.

1. Introduction

Information technology (IT) is viewed as a useful tool for achieving competitive advantage (Weill & Broadbent 1998; Chang, Chang & Wang 2011). This motivated companies to invest more in technology – acquiring systems, installing databases, and using the internet and electronic commerce in their business. Gunasekaran, Ngai and Mcgaughey (2006) points out that IT managers have used several methods and techniques to evaluate IT investments,

ranging from simple computational formulas to complex techniques that combine quantitative and qualitative analyses.

One of these techniques is IT Portfolio Management (ITPM), which has been identified by companies as one of the alternatives for identifying, analyzing and managing IT investments. ITPM is one method that organizations can use to manage IT from an investment perspective, aligned with a continuous focus on business (Peter & Verhoef 2008). Moreover, according to Burke and Shaw (2008), ITPM is an important research issue in the IT field; however, the concept has only recently begun to be widely discussed in IT research (Cho & Shaw 2009).

More specifically, the magazine InformationWeek in Brazil published a ranking of the most innovative companies; the fact that ITPM was one of the categories used in ranking them points to its importance as a theme today. But as Kumar, Ajjan and Niu (2008) pointed out, few studies exist in the IT literature about the use of this technique in companies. Besides, it is considered an underdeveloped concept.

To summarize, high IT investment costs need to be justified and ITPM is a valid technique to assist with this, but studies examining this technique are lacking. In response to these findings, the following question was elaborated: How does the use of ITPM help companies to manage their IT investments? The objective of this research is to analyze some Brazilian companies' use of ITPM as an aid to their management of IT investments.

The analysis of ITPM use in the companies broke down IT investment into three sub-processes: *planning*, *control* and *evaluation*. It was carried out in five case studies (a pilot study and other four cases) in different Brazilian companies from several economic sectors which were using the technique or were in the initial implementation phase.

2. IT Investment Management

It is necessary to improve the understanding of the IT investment management process realized by companies, taking into account costs and benefits, both short-term and long-term (Gunasekaran et al. 2006). Moreover, the high level of uncertainty associated with IT use by companies confirms, by implication, the great importance of the IT investment management process (Irani & Love 2002). Several studies were carried out as to the effect of IT investment in companies (Brynjolfsson & Hitt 1998, Mahmood & Szewczak 1998; Dimovski & Skerlavaj 2009). Some authors believe that IT doesn't provide competitive advantage but simply prevents falling behind the competition, being just another organizational cost (Carr 2003; Tiernan & Peppard 2004). However, other research points out that IT investment pays for itself and brings different benefits along with competitive advantage to companies (Melville, Kraemer & Gurbaxani 2004; Chang, et al. 2011); so it is necessary to analyze the management of these investments. One way to analyze the IT investment process, divided into three phases, is presented Stewart (2008) and adapted in this research (Figure 1): planning, control and evaluation.

According to Figure 1, the first phase, focuses on analyzing how the investments to be made by the company, based on its objectives and needs, are defined, prioritized and selected. This provides a detailed analysis of the investments with regard to costs, return and risks. The control phase, means monitoring and tracking investments with regard to costs, schedule and designed performance. The use of management tools can help IT and business executives to better manage the investments. Finally, the evaluation phase involves pre- and post-

implementation review and, where necessary, making adjustments. It is important to verify if the investments achieved the objectives initially proposed and if they are fulfilling all the investment requirements.

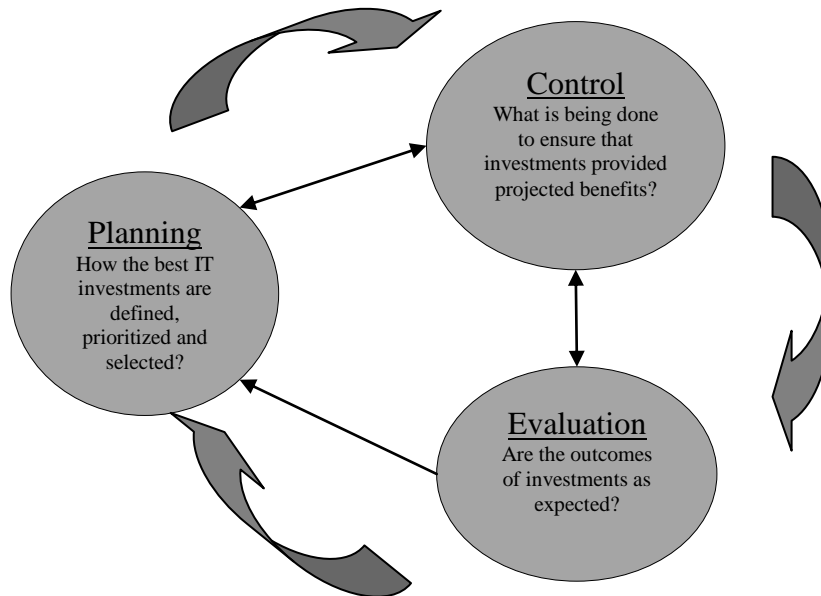


Figure 1: IT investment management
Source: (Stewart 2008)

According to Irani (2002), ITPM could be understood as an analysis and evaluation technique. It should include involvement, analysis and definition by stakeholder, evaluation of risks associated with different investment strategies, and understanding of the scope and impact of IT infrastructure development. Furthermore, Datz (2003) argues that ITPM can be applied in the planning, control and evaluation comprising the IT investment management process, which is the subject of the next section.

3. Information Technology Management Portfolio (ITPM)

Jeffery and Leliveld (2004) define ITPM technique in terms of managing IT as a portfolio of assets similar to a financial portfolio and striving to improve the performance of the portfolio by balancing risk and return. In addition, ITPM is related to the attainment of IT investment synergy, where this synergy affects IT portfolio return and risk (Tu & Shaw 2011).

According to Maizlish and Handler (2005) the eight general stages for IT portfolio building are: (i) game plan, (ii) planning, (iii) creating, (iv) assessing, (v) balancing, (vi) communicating, (vii) governance and organization, and (viii) assessing execution. Cho and Shaw (2009) point out that in building an IT portfolio, realizing the strategic value or strategic alignment of IT is one of the most critical factors determining the success of the portfolio, but

many IT managers have difficulty achieving this in practice. Thus, ITPM application assists companies in IT investments, enabling them to: (1) maximize the value of IT investments while minimizing the risk, (2) provide increased visibility and evaluation into IT spending; (3) improve communication and alignment between IT and business leaders; (4) provide increased transparency into IT decision-making; (5) reduce costs, improve control and facilitate agility; and (6) allow planners to schedule resources more efficiently, helping to prioritize the investments (Datz 2003; Symons et al. 2005).

Moreover, the application of ITPM to the planning, control and evaluation steps of the IT investment management process (Stewart 2008) helps reduce the number of redundant investments. Further, it is necessary because it enables analysis of the biggest IT investment with regard to business objectives (Datz 2003). In executing this task, taking into account the stages for IT portfolio building (Maizlish & Handler 2005), companies can structure the IT portfolio using the four dimensions proposed by Weill and Broadbent (1998) and later studied for example by Aral and Weill (2007): infrastructure, transactional, informational and strategic.

IT infrastructure is the foundation of all IT investments and is the basis for IT capacities. Investments in this dimension are the shared IT services used by multiple applications. In the transactional dimension, the systems process and/or automate repetitive and basic business processes. The investments in informational dimensions provide aids to business management and control, supporting decision making, planning, communication and accountability. And the last dimension, strategic, are used to gain competitive advantage by supporting entry into new markets or by helping to develop new products, services or business processes.

4. Research Method

This research is qualitative and exploratory; it was carried out as a case study of five different companies. A qualitative approach is suitable for this research because it seeks to describe the complexity of a situation, understand dynamic processes and analyze variable interaction (Richardson et al. 1999), all of which pertain to ITPM use in some Brazilian organizations.

The units of analysis in this study were companies beginning to use or using ITPM techniques to assist the planning, control and evaluation of IT investments. The persons interviewed were high-level executives working in the IT department in the studied companies (e.g. Chief Information Office, Chief Information Manager, IT Director, IT Infrastructure Supervisor). These IT managers had knowledge of the framework and showed a lot of interest in the topic as well as the relation between academic research and their companies. Factors taken into account included characteristics of the respondents regarding the time they spent working in the IT area, time as employees of the company, and knowledge of ITPM. This last factor was further broken down into knowledge acquired (a) in courses at the Massachusetts Institute of Technology (MIT) in the United States with the authors of the model used in this research; (b) through lectures conducted in Brazil; and (c) through papers and books from the cited authors. The companies studied also spent a huge amount on IT, more than 5 million dollars per year and had an IT budget between 0.6% and 1% of revenue.

From the literature review the case study protocol was elaborated and validated in a pilot case study. The protocol contained all information necessary to guide the researchers in collecting the data (Yin 2003) and was used for this purpose. After the pilot case study, following

refinement of the research instrument, case studies were carried out in companies that met the requirements of this study: (i) big companies with high IT investments, and (ii) companies starting to use or already using ITPM. The identification of the companies and contact with the companies and managers were conducted with the help of a CIO with knowledge of the executives and their cognizance of ITPM. Other sources of evidence included the semi-structured interviews in addition to secondary evidence provided in document form such as investment sheets, corporate websites, and other relevant documentation released for research respecting the information security policy of the organizations. All interviews were recorded and later transcribed. The cases, sectors, respondents and the duration of the interviews are summarized in Table 1.

Case	Sector	Respondent	Working in IT / current company	Duration of interview
Pilot	Many	IT corporate manager of the group	- 24 years / 8 months.	1 hour and 20 minutes.
1	Petrochemical industry	Chief Information Manager - one of the top 40 CIOs in the Brazil.	- 25 years / 1,5 years	2 hour and 30 minutes
		IT Infrastructure Supervisor	- 22 years / 1 year	
2	Financial Services	managing and IT director - one of the top 40 CIOs in the Brazil.	- 25 years / 8 years.	1 hour and 40 minutes
		IT specialist	- 26 years/ 4 meses.	
3	Steel	IT management and planning executive	- 9 years / 6 years	1 hour and 45 minutes
4	Automotive	CIO - - one of the top 40 CIOs in the Brazil	- 25 years / 7 years.	2 hours
		IT Coordinator Project Management Office	- 15 years / 3,5 years.	

Table 1. Cases, sectors, respondents and duration of the interviews

The study used content analysis, which consists of discovering the core of meanings that comprise the communication and observing the presence and frequency of terms that can mean something to the chosen analytical objective (Bardin 1977). Categories were determined based on the (units) core meanings, which were separated into three categories: final (planning, control and evaluation) that had already been set, intermediate (items in each dimension – for example, definition, prioritization, tools and process) and initial (definitions, characteristics, examples and how ITPM is related), that had emerged from the analysis itself; which some examples are presented in each case separately.

The pilot case study was conducted in a business group in south of Brazil, which ranks among the 120 largest shareholders in Brazil, according to its website. The organizations of this group have operations in the agricultural, food and commercial sectors. The company was making efforts to use ITPM techniques to assist in IT investments. Information about its ITPM implementation was obtained through an interview with the IT group corporate manager, who had prior experience with the technique. This pilot case study allowed for adjustments in the data collection instrument, such as changes in the questions to improve clarity and changes to the order of some questions. This instrument, validated in this pilot case study, was then changed and reviewed prior to use in the other cases presented in the next section.

5. Information Technology Management Portfolio (ITPM)

This section presents the analysis of four case studies carried out in this research. These cases were analyzed separately, the goal being to clarify how IT investments are managed and how the ITPM technique is used in this process. The analyzed companies are starting to use the technique or have already begun its implementation. Each case features a description of how (according to the respondents' answers) the ITPM technique is applied in regard to IT investment planning, control and evaluation.

5.1 Case Study 1

The first analyzed company is in the petrochemical industry sector. This organization was beginning to use the technique as well as ITPM concepts to improve its investments in technology. Four interviews were conducted with the Chief Information Manager and the IT Infrastructure Supervisor, each of these lasting on average one hour and a half. In addition to the interviews, the researchers were informed about IT investment in the company by means of various data sources, including a document called CEP (Capital Expense Proposal) as well as information and examples which helped in the ITPM analysis.

The content analysis of transcriptions of interviews yielded 21 initial categories (e.g. First source of IT investments, Difference between IT investment and IT expense) 8 intermediate categories (e.g. Investments approval, Evaluations before investments) and 3 final categories (e.g. Planning).

Planning was defined on the basis of three basic sources: dynamic nature, technological opportunities perceived by the IT area personnel, and technology brought to the IT team by users in other businesses. The ITPM technique is beginning to be used to improve IT investment visibility and help the company in its IT investment planning. With respect to control, there is a committee which meets regularly to monitor IT spending using CEP to control investments. ITPM dimensions have been used to define different IT investments and enable greater control and better alignment between IT objectives and organizational objectives. Moreover, there are evaluations of investments, using information contained in CEP, which can be accessed at any time to verify if the investments met proposed goals.

5.2 Case Study 2

The second company analyzed is in the financial service sector, which the respondents were the IT director, as well as the IT specialist. The ITPM technique has been used in the company, where the IT area, including the classification of its expenses and investments, are structured according to ITPM's four dimensions. IT infrastructure retains its usual nomenclature; however, the transactional dimension is called "solution", the informational dimension is referred to as "information management," and the strategic aspect is called "executive and strategic".

Due to company policy, the only data sources that could be analyzed in this case were the interviews themselves, though some additional informational items such as reports and documents about IT investments were viewed during the conversations, and these were used to further illustrate the case and complement the interviews. The content analysis of the interview transcripts identified 21 initial categories (e.g. Structuring of the IT sector according to ITPM dimensions, Use the ITPM to follow-up the investments), 5 intermediate categories (IT investments definition, Existence of IT committee) and 3 final categories (e.g. Control).

The planning of IT investments in the company is accomplished as a part of the organizational strategic planning process. Because of the special characteristics of the financial market, IT planning must be flexible in order to meet business demand and to be able to classify IT investments and expenses quickly. For this reason, the company takes into consideration the IT portfolio structure. The ITPM technique is used in conjunction with information about each dimension to assist in IT planning; the whole of the IT area is organized and divided according to the ITPM dimensions, as already mentioned. There is no specific IT investment budget; rather, IT needs are anticipated within the budgets for other areas. The structuring of the IT sector according to ITPM dimensions also helps the company to better control the investments it makes, and the use of ITPM assists in monitoring these investments. Final evaluations of IT investments are still not made in a formal way, but the organization has undertaken initiatives to fill this gap. The ITPM technique was pointed out as a way to help the managers to accomplish this task.

5.3 Case Study 3

The third case study was conducted in a business group located in the south of Brazil, belonging to the steel sector. An interview was with the IT management and planning executive, who is beginning to apply the concepts of ITPM to IT investment management. According to the respondent, the ITPM technique is known of within the company but still not widely used.

The additional documents presented during the interview could not be published due to the company's information security policy; instead, the respondent simply referenced some examples, using and letting them be seen within the interview. The content analysis of the interview transcriptions identified 18 initial categories (e.g. Information sharing between IT and its costumers, IT committee composition), 7 intermediate categories (Tools to assist IT investment management, Tools to assist IT investment control) and 3 final categories (e.g. Evaluation).

Planning is elaborated according to the users' and areas' necessity as well as to the annual expenses and investments budget. Problems arising from the expansion of the organization were highlighted, and the use of ITPM was adduced as an aid to organizational integration with other companies. The technique is used first of all to generate a preliminary IT portfolio; it also facilitates an overview of the IT area, helps keep the organization's members aware of the different systems used in the organization and promotes an improvement in the alignment between IT strategy and organizational strategy. Moreover, the ITPM technique is used to assist in the monitoring of IT investments across the company, to ensure the use of the same systems throughout the organization, and to diminish the heterogeneity created by the expansion. There are no systematic evaluations of IT investments, and the ITPM is only beginning to be used as a method for evaluating IT investments.

5.4 Case Study 4

Case Study 4 was conducted in a company in the automotive sector. An interview was held with the CIO and the IT Coordinator – Project Management Office (PMO). Both respondents have knowledge of the technique and the concepts of ITPM, and the company has been using ITPM dimensions to assist in the IT investment process. The other documents presented in the interview could not be published because of the company's information security policy;

instead, the respondents simply referenced some examples and letting them be seen within the interview.

The content analysis of the interview transcripts identified 16 initial categories (e.g. IT investments defined by the global company, Satisfaction research), 7 intermediate categories (e.g. IT investments definition, Previous evaluation) and 2 final categories (e.g. Planning and Evaluation).

In regard to IT investment planning, these investments are determined by the company's global organization, and the Brazilian subsidiary communicates its needs and priorities to the global company, which then analyzes them and weighs them against the needs and priorities of the other subsidiaries. ITPM, referred to as TISI (Transactional, Infrastructure, Strategic and Informational), is used to assist with IT investment, management, justification and prioritization. No evidence was seen of elements of a formal control of IT investment. IT investment evaluation occurs in two phases – before and after technology acquisition – and the ITPM technique is not used to evaluate investments in either of these phases.

6. Discussion

It was observed in the analyzed cases that ITPM is used most frequently in IT investment planning, which is the process most discussed and used in the four companies. Some organizations are making robust use of the technique while others have begun initiatives and are still in initial stages of implementation. These findings corroborate the suggestion of Kumar et al. (2008) that the ITPM technique is beginning to be used by organizations.

It was noticed that the ITPM technique is used more substantively in Company 2 than in the other cases because the organization of the IT area in the company is structured according to ITPM dimensions. The planning of this organization is based on the four ITPM dimensions to provide greater flexibility for response to rapid changes in the market. Thus, it was highlighted that ITPM is a technique which allows CIOs to improve their knowledge of IT investment and expenditure. However, in the other cases it was observed that the ITPM process was used only in its early stages, in order to define the IT portfolio and thereby assist in investment management. Even in this initial phase, the respondents observed, ITPM is relatively accessible, which encourages its dissemination and utilization in organizations.

In terms of practical application, Case 3, identified the use of the ITPM technique from the beginning to generate a preliminary IT portfolio. It was identified in Case 4 that ITPM (or TISI, in the terminology of the respondents) is also used in an initial process to elaborate the portfolios of individual IT departments for contribution to a final portfolio, in which reviews and adjustments were realized. In Case 1, ITPM is also being used, initially, to define the IT portfolio according to technology investments and expenses.

In three companies (Cases 2, 3 and 4), it was noticed that ITPM is used to assist the IT investment prioritization, but it was pointed out that this process is still at an early stage. The studied organizations use other means to prioritize the investments, such as the business case. In Case 1, ITPM has still not been used to prioritize the investments because it is being used to define the ITPM dimensions and provide investment visibility. The ITPM is recognized as an indispensable communication tool that helps business executives better understand IT investment and, then, (Cameron 2009) better manage it.

Regarding IT investment control in the analyzed companies, it was found that there is no formal process, but this control is still part of the process within every company. ITPM was seen as having the potential to aid the organizations in better controlling their investments.

In Cases 2 and 3, market benchmarking was used as a reference for adjusting and improving the IT portfolio of the analyzed companies. However, few studies use this type of analysis and due to the difficulty of gathering company data, the parameter for analysis has been derived from American studies (Weill & Broadbent 1998; Aral & Weill 2007). These should be carefully analyzed because of contextual differences in the Brazilian instances. In Case 4, formal elements of IT investment control were not found; ITPM could help this company. In Case 1, ITPM dimensions have been used to classify the IT investments, allowing an analysis of IT resources expenditures within the company. It can therefore be said that this technique enables better control and better alignment between IT and organizational objectives (Datz 2003; Symons et al. 2005).

One of the observations from this study is that IT investment evaluation has not been accomplished in a formal way in the cases analyzed, but initiatives have been advanced to close this gap. In Cases 2 and 4, ITPM was used as a means to perform evaluations of IT investments, providing greater visibility for these investments (Datz 2003; Maizlish & Handler 2005). Portfolio structuring is used to support business strategies and plans, providing a consolidated source of information about investments in IT (Over 2009).

In Case 3, the ITPM is used to supplement IT investment monitoring. Moreover, structuring ITPM dimensions enables a greater understanding of IT investments and allows evaluation as to whether these investments are in agreement with expectations and proposals. In Case 1, ITPM has still not been used to evaluate IT investments; instead, technology investments are evaluated by means of formal documents created within the company for each new investment in IT area. The documents contain different sorts of financial and technical information, and ITPM could be included to help the managers to better evaluate IT investment and expenditures. Table 2 presents major considerations about ITPM and the IT management process in the four analyzed cases.

7. Final Remarks

The goal of this research, to analyze the use of ITPM as a help to the IT investment management of some Brazilian companies, was accomplished using case studies. This study helps to better comprehend the use of ITPM to better manage the IT investments of companies in terms of planning, control, and the evaluation process.

The ITPM technique has been identified as a new but little studied way to aid IT executives in better managing and justifying the investments in technology. Despite this, the technique has received little attention in IT research (Kumar et al. 2008) and ITPM research is still very limited in the information systems literature (Tu & Shaw 2011). Moreover, to highlight its practical use, ITPM has been considered a useful and accessible tool which provide increased visibility and evaluation into IT spending; improve communication and alignment between IT and business leaders; provide increased transparency into IT decision-making; and allow planners to schedule resources more efficiently (Datz 2003; Symons et al. 2005).

Moreover, ITPM was developed as one of the Brazilian *Information Week Magazine's* assessment categories for diagnosing the useful innovations in IT; this illustrates the

importance of this technique and its utility in companies. Thus, this research can help companies to better manage their IT investments using the ITPM technique.

The main limitations of this research are that: 1) the use of case studies does not allow the generalization of research to the population of companies, but rather the exploration and deepening of the theme, and 2) a variety of sectors were used in the analysis because there are few companies that use ITPM to assist in their IT investments. This allows the researcher to consider the application of ITPM in different economic sectors. Finally, possibilities for future research include: analyzing ITPM in companies in the same sector to observe the differences and similarities; and quantitatively analyzing the use of ITPM in Brazilian companies to detect how this tool is being used in the country.

	IT Investments Planning	IT Investments Control	IT Investments Evaluation TI
Case 1	ITPM is being used, initially, to define the IT portfolio according to technology investments and expenses. Because of this, it was not still used for the prioritization of investments, but to provide greater visibility of investments.	ITPM dimensions have been used to classify the IT investments, allowing an analysis of IT resources expenditures within the company, enabling a better control. This technique assists to identify where the resources are being allocated.	ITPM has still not been used to evaluate IT investments; instead, technology investments are evaluated by means of formal documents created within the company for each new investment in IT area.
Case 2	ITPM is used more amply in Company 2 than in the other cases, which there are dimensions analysis, Portfolio structuring using the dimensions, The IT sector is structured according to ITPM dimensions. ITPM use to prioritize the investments and improve the understanding of IT expenses and investments.	IT portfolio benchmarking was used as a reference for adjusting and improving the control on IT portfolio.	There are not formal IT investments evaluations and ITPM has been pointed out close this gap. ITPM was indicated as a means to perform an evaluation of IT investments, providing greater visibility and better understanding for these investments.
Case 3	ITPM process was used only in its early stages, in order to define the IT portfolio using the ITPM dimension to elaborate an annual IT investment plan. ITPM use to prioritize IT investments, but in the initial phase.	IT portfolio benchmarking was used as a reference for adjusting and improving the control on IT portfolio.	There are not formal IT investments evaluations and ITPM is beginning to use to supplement IT investment monitoring.
Case 4	ITPM use to structuring dimensions to assist in IT investment planning and prioritization. Initial process to elaborate the portfolios of individual IT departments for contribution to a final portfolio.	IT was not found formal elements of control of TI investments and ITPM can help in this process.	There are not formal IT investments evaluations and ITPM has been pointed out close this gap. This technique was indicated as a means to perform an evaluation of IT investments, providing greater visibility and better understanding for these investments.

Table 2. ITPM and planning, control and evaluation in the analyzed cases

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