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## THE DIMENSIONS OF IT PORTFOLIO MANAGEMENT (ITPM): AN ANALYSIS INVOLVING IT MANAGERS IN BRAZILIAN COMPANIES

**Pietro Cunha Dolci**  
**Antônio Carlos Gastaud Maçada**  
Federal University of Rio Grande do Sul, Brazil

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### ABSTRACT

The aim of this study is to explore and validate the dimensions of IT Portfolio Management (ITPM) in Brazilian companies, based on three different models. Five case studies were carried out in Brazilian companies that invest more than nine million reais per year in IT. Eight top IT executives from those organizations who had knowledge of the dimensions of ITPM were interviewed. Items were modified and new items included within the dimensions, while examples of equipment or systems applicable to each of the four dimensions were also identified. Research that helps managers to better understand and structure their IT investments by using the dimensions of ITPM is important to assist in the management of such resources.

**Keywords:** IT Portfolio Management, Dimensions of ITPM, IT Managers, Brazilian companies

### 1. INTRODUCTION

IT managers have used various methods and techniques for evaluating IT investments, ranging from simple formulas to complex computational methods or techniques that combine qualitative and quantitative analysis (Gunasekaran, Ngai and Mcgaughey, 2006). However, Burke and Shaw (2008) show there are many studies in the literature on Information Systems (IS) that assume that IT investments are made in isolation. Weill and Olson (1989) have highlighted the importance of separating the different types of IT investments in various organizations and arranging them in such a way as to facilitate their management.

Verhoef (2008) suggests that IT Portfolio Management (ITPM), considered an important research topic in IT area (Burke and Shaw, 2008), is one way in which organizations can manage IT from an investment perspective, maintaining it aligned

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Endereço para correspondência/*Address for correspondence*

*Pietro Cunha Dolci*, Information Systems Doctoral Student, Federal University of Rio Grande do Sul  
School of Management PPGA/UFRGS Phone: 55 51 9168-7247/ <http://sites.google.com/site/pietrodolci/>  
E-mail: pcdolci@gmail.com

*Antônio Carlos Gastaud Maçada*, Associate Professor, Federal University of Rio Grande do Sul  
School of Management, PPGA/UFRGS Phone: 55 [51 3308-3536](tel:555133083536) / E-mail: [acgmacada@ea.ufrgs.br](mailto:acgmacada@ea.ufrgs.br)

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with a continuous focus on business. ITPM, for Weill and Broadbent (1998), Aral and Weill (2004, 2007) and Weill and Aral (2006), guides IT executives to separate and classify IT investments into four different dimensions: infrastructure, transactional, informational and strategic, i.e., the portfolio of IT investments in each organization must be planned and managed according to the original concept of financial investment portfolios.

Although the concept has only recently begun to be widely discussed in IT research (Cho and Shaw, 2009), the term portfolio was created by Markovitz (1952) and began to be used in the IT field in 1981 (Mcfarlan, 1981). As with the investments made in a financial portfolio, IT investments can be divided and classified according to the benefits they provide and the strategies that companies want to implement and the objectives they want to achieve, which would thus constitute an IT portfolio.

The dimensions of ITPM are determined and structured by the perception of the company executive when deciding what percentage of the intended investments will be allocated to each of the management objectives. Since executives in different companies perceive their technology differently (Thomas and Mcdaniel, 1990), it is necessary to clearly determine the dimensions and the items of which they are composed. Thus, the guiding question of this study is: How are the dimensions of the ITPM technique seen by Brazilian companies?

In order to answer this question the following goal was established: to explore and validate the dimensions of ITPM in Brazilian companies, based on the models from Weill and Broadbent (1998); Aral and Weill (2004), and Weill and Aral (2006). The model proposed by these authors was chosen because the other models or frameworks in the IT literature on ITPM take a more general view of the term portfolio without identifying what is conceptualized as a portfolio. In these studies, ITPM is only addressed as part of a wider managerial context or the management of IT investments as a whole without focusing on its particular elements.

To achieve the proposed objective, five case studies were conducted (a pilot study, and four case studies) in large Brazilian companies in which the annual IT budget is high (more than R\$ 9 million per year) and that have hundreds of users. Eight IT managers with knowledge of the concepts and dimensions of ITPM were interviewed.

The paper is structured as follows: section 2 presents the concepts of IT portfolio management (ITPM) and the evolution of the dimensions of ITPM as well as the key concepts involved (section 2.1); Section 3 describes the research method; Section 4 presents the pilot case study, while in section 5, the data from the different cases are analyzed, and finally, section 6 presents the main findings of the research, its contributions, limitations and some ideas for further research.

## **2. INFORMATION TECHNOLOGY PORTFOLIO MANAGEMENT (ITPM)**

ITPM provides a means to monitor and manage all IT investments in an organization so that benefits, costs and risks of individual investments can be evaluated in order to determine whether or not they are contributing significantly to organizational performance (Schniederjans, Hamakiand Schniederjans, 2004). According Maizlish and

Handler (2005), the ITPM technique is a framework and a tool that results in a positive correlation between the amount invested in IT and increased productivity. In contrast, for Verhoef (2008) ITPM focuses on the problem of managing the values of IT investments for the business. Furthermore, ITPM provides a holistic view of total IT investments and helps in the future of these expenditures (Symons, *et al.*, 2005).

In addition, ITPM is required when the resources within the company are limited and the manager is not free to make any kind of IT investment that he believes would bring more benefits to the organization (Gliedman, 2002; Gliedman, Leaver and Sedov, 2010), which is the situation in all businesses. These limitations or restrictions may be related to finance, personnel, system resources and/or business challenges.

The IT literature contains several different ITPM models or frameworks (Maizlishand Handler, 2005; Zheng, 2007), though most take a more general view of portfolio and fail to clearly define what is meant by a portfolio, while others focus on selecting the IT portfolio (Cho, 2009), or on general rules to be applied when planning an IT portfolio (Karhade, Shaw and Subramanyam, 2009). In these studies, the topic was addressed within the wider managerial context or that of the management of IT investments as a whole without focusing on the specifics of each one, which would allow further exploration of the topic 'IT portfolio' and its dimensions.

Thus, we chose the model originally proposed by Weill and Broadbent (1998), and studied by Weill and Aral (2004), and Weill and Aral (2006), where IT investments are classified and structured into four different dimensions allowing a better view of IT investments. Papers that explore these dimensions and put them within their respective contexts (national in this case) can be used to provide a better understanding of each dimension. The following are the main concepts, their developments, and the authors of the dimensions of ITPM.

## 2.1 The Dimensions of ITPM

The concept of portfolio has its origins in the seminal article *Portfolio Selection* (Markowitz, 1952), which can be considered the birth of Modern Portfolio Theory. It was the first to consider the desire for investment diversification (Rubinstein, 2002). The concept of portfolio is used in several areas of knowledge such as mathematics, health and administration. In the latter, there is, for example, the use of advertising in the sense of the company product portfolio which means the number of products that the company has to sell to end customers (Kotler and Armstrong, 1993). Another use of the term relates to portfolios of new products in development, which are composed of projects that result in new items that can be traded (Kumar, Ajjanand Niu, 2008).

This theory is also used in the IT field. As with financial investments, investments in IT in companies can be conceived not as a financial portfolio, but as an IT portfolio that contains investments with different management objectives, from operational to strategic (Weill and Broadbent, 1998; Schniederjans, and Hamaker and Schniederjans, 2004; Maizlishand Handler, 2005; Cho and Shaw, 2009).

The first author to explore the theme of portfolio in IT was Warren McFarlan (1981), who focused on IT portfolio in terms of the managing the risks involved in IT projects. Subsequently, Turner and Lucas (1985) pointed out the importance of this approach when analyzing IT investments, though they did not use the term IT portfolio management. However, the work of Turner and Lucas (1985) can be considered the first

to present the dimensions for the management of IT investments and was useful in the preliminary research into ITPM.

In their work, these authors separated IT investments according to the organizational goals they would help achieve, and described them as: (i) Operational, divided into production, logistics, supplies, buying and selling, general accounting, payroll and personnel; (ii) Managerial Control: divided into budget, general ledger, assets and depreciation, financial statement, project tracking, sales analysis and profit analysis; and (iii) Strategic Planning: consisting of the corporative database, economic analysis tools, technological forecasting, new product evaluation, acquisition and mergers analysis, competitor analysis and market analysis.

These managerial objectives were specified, derived and extended from Turner and Lucas's (1985) research by Weill (1992) and came to be referred to as: (i) Transactional IT, (ii) Strategic IT, and (iii) Informational IT. The managerial objectives or dimensions created form the basis and focus of interest for the present research. Note that in the evolution of research, the nomenclature changed, with the operational part becoming Transactional IT, managerial control Informational IT and strategic planning IT Strategy. From this point on, the terminology used will be the latter, presented here.

These dimensions were completed in the research of Mirani and Lederer (1998), where strategic dimension changes the organization's products or the way the organization competes by providing benefits such as competitive advantage, alignment, and customer relations; Informational IT provides information and communication infrastructure for the organization, with benefits in terms of access, quality and flexibility of information and, according to the authors, Transactional IT supports operations management and helps cut costs, benefiting the efficiency of communications, systems development and business.

A fourth dimension, IT infrastructure, was included later, and has been studied by several authors (Broadbent and Weill, 1997; Broadbent, Weill, and Neo, 1999; Broadbent, Weill, and ST Clair, 1999; Weill, Subramaniand Broadbent, 2002). Initial research defines IT infrastructure by the IT components, the human part, the shared IT services. It includes, furthermore, the way enterprises connect, share and structure information and the deployment of IT by the company. It represents the basis for the ITPM that is shared throughout the enterprise in the form of reliable services, and is usually coordinated by the IT group which includes technical and managerial expertise.

Following the identification of the origins of each dimension, IT investments are presented as an IT portfolio with four dimensions (Weill and Broadbent, 1998). According to Weill and Broadbent (1998); Aral and Weill (2004), and Weill and Aral (2006) the dimensions and their items can be defined, characterized, and composed as described below.

IT infrastructure is the basis of the portfolio, since it is the basis for the IT capabilities that, in turn, include the technical and managerial expertise required to provide a reliable service. Investments are shared with IT services used by several applications: servers, networks, laptops and customer database. They provide benefits such as business integration, business flexibility and business agility, reducing the cost of IT in the business units and reducing the cost of IT over time and with standardization.

Within the IT portfolio, the next level is transactional IT; it processes and automates the repetitive and basic transactions of enterprises. The goal is to cut costs by substituting labor with capital, or work with larger volumes of transactions with greater speed and at a lower unit cost, or increase productivity. Transactional systems are built and dependent on a reliable capacity of the infrastructure.

At the top of the IT portfolio there are the uses of IT investments for strategic and informational processes which rely on and are supported by the IT infrastructure and transactional processes. Usually these two should be in accordance with the needs of companies before investments are made in strategic and informational IT processes.

The other IT portfolio level is informational, which provides information for the management and control of the company. Typically, it supports management control, decision making, planning, communication and accounting. Investments in this dimension provide information for purposes such as accounting, reporting, compliance and analysis. It provides benefits such as increased controls, better intelligence, better integration, better quality of information and information cycle time within the smaller company.

Finally, on the same level as informational IT, there is strategic IT, in which the objectives are slightly different from other parts of the portfolio. Such investments are made in order to gain competitive advantage or, more generally, to position the company in the market by increasing sales or market share. The deployment of the Automate Teller Machine (ATM) was a case of successful strategic use of IT in the 1980s. Citibank, a pioneer in the large-scale use of ATMs in New York, changed the banks forever. For Citibank, this strategy was brilliant. The impact on the market forced other banks to respond quickly and begin to build ATM networks at a high cost.

Figure 1 shows the hierarchically structured model (Weill and Broadbent, 1998; Aral and Weill, 2004; Weill and Aral, 2006) with the IT investments divided as in a portfolio, composed of the dimensions and their items: infrastructure, transactional, informational and strategic, while the last published paper on the subject, in 2007, is identified (Aral and Weill, 2007). This model was the reference for the exploration and analysis of the ITPM dimensions in this research. Table 1 provides a summary of all the authors who have studied some of the managerial objectives or dimensions investigated in this study.

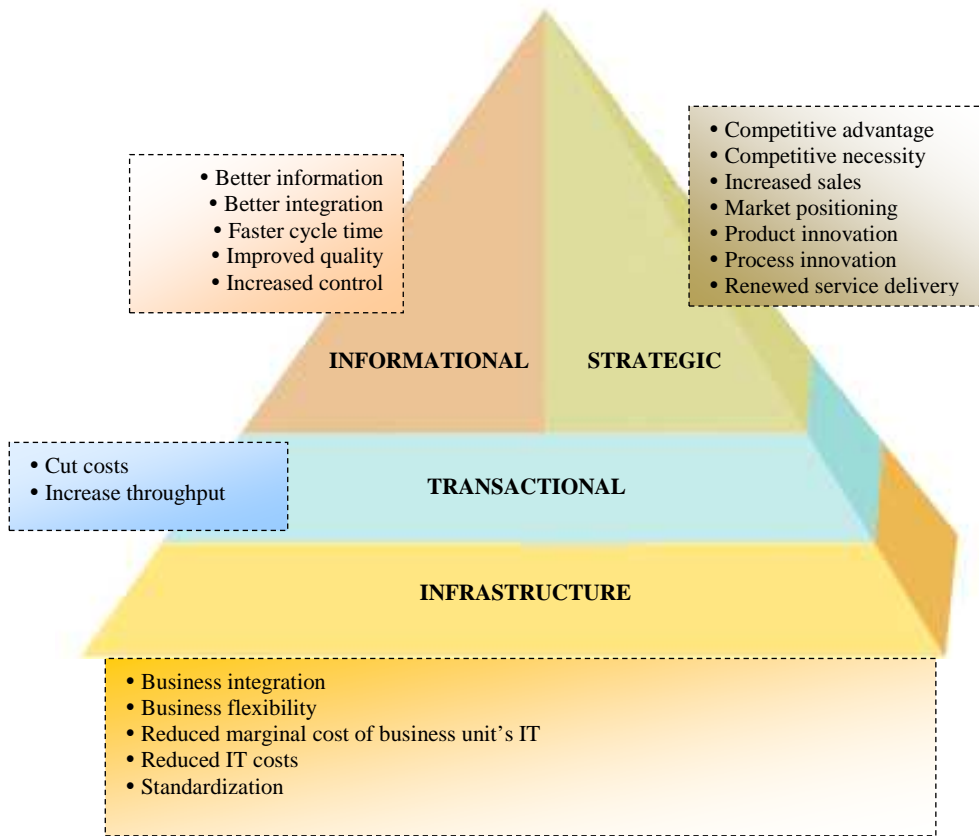


Figure 1 – The Dimensions of IT Portfolio Management

Source: Weill and Broadbent, 1998; Aral and Weill, 2004; Weill and Aral, 2006.

| DIMENSIONS     | AUTHOR (YEAR)           |              |                            |                           |                            |                                 |                                      |                                       |                       |                       |                       |
|----------------|-------------------------|--------------|----------------------------|---------------------------|----------------------------|---------------------------------|--------------------------------------|---------------------------------------|-----------------------|-----------------------|-----------------------|
|                | Turner and Lucas (1985) | Weill (1992) | Broadbent and Weill (1997) | Mirani and Lederer (1998) | Weill and Broadbent (1998) | Broadbent, Weill and Neo (1999) | Broadbent, Weill and St Clair (1999) | Weill, Subramani and Broadbent (2002) | Aral and Weill (2004) | Weill and Aral (2006) | Aral and Weill (2007) |
| Infrastructure |                         |              | X                          |                           | X                          | X                               | X                                    | X                                     | X                     | X                     | X                     |
| Operational    | X                       |              |                            |                           |                            |                                 |                                      |                                       |                       |                       |                       |
| Transactional  |                         | X            |                            | X                         | X                          |                                 |                                      |                                       | X                     | X                     | X                     |
| Managerial     | X                       |              |                            |                           |                            |                                 |                                      |                                       |                       |                       |                       |
| Informational  |                         | X            |                            | X                         | X                          |                                 |                                      |                                       | X                     | X                     | X                     |
| Strategic      | X                       | X            |                            | X                         | X                          |                                 |                                      |                                       | X                     | X                     | X                     |

Table 1 – Research into the dimensions of ITPM Source: Elaborated by the authors

### 3. RESEARCH METHOD

This qualitative and exploratory research is based on five different case studies. A qualitative approach is most suitable since it seeks to describe the complexity of a situation and provide an in-depth analysis of the interaction between the variables (Richardson et al, 1999), which is the case with the analysis of the dimensions of ITPM and the identification the items composing them.

Interviews were held with the chief IT executives from the companies that had recently begun to use or were already using the ITPM technique in their information technology investments. The IT managers already have some degree of understanding of the approach and were very interested in the subject and the interaction between universities and companies. The interviews, which were taped and transcribed, lasted one hour and thirty minutes on average and the companies were visited twice, on average.

Some characteristics of the respondents were taken into account, such as the length of time working with information systems, the length of time at the current company and knowledge of the dimensions of ITPM. The respondents were found to have acquired their knowledge of the dimensions of ITPM in several ways: (i) courses at the Massachusetts Institute of Technology (MIT), U.S., with an author of the model being used, (ii) lectures held in Brazil, and (iii) access to scientific and trade articles written by those authors.

Another important feature of this research is that companies are expected to have a large annual IT budget, which, in the case of the analyzed companies, was more than R\$9 million (Brazilian currency) per year and also have hundreds of users. Table 2 shows a summary of the information from each company (sector, IT investments and ratings of importance of the company in the national scenario) and on the respondents (position, length of time in IT / time working at the current company).

| Case  | Sector                 | Respondents  | IT Investments  | Classification  |
|-------|------------------------|--|---|---|
| Pilot | Various                | - Corporative IT Manager of the group (24 years / 8 months)  | - forecast for 2008 to spend fifteen million reais on technology.   | - one of the largest groups in the State in terms of liquid assets.<br>- among the largest 120 Brazilian holding companies. |
| 1     | Petro-chemical Company | - <i>Chief Information Manager (CIM)</i> (25 years / 1.5 years)<br>- Considered one of the top 40 CIOs in the country.<br>- <i>IT Infrastructure Supervisor.</i> (22 years / 1 year) | - over R\$ 9 million;<br>- IT budget between 0.6% and 1% of revenue | - 100 largest groups in Brazil.- 100 largest publicly traded companies in Brazil - 25 largest companies in Southern Region  |

|   |                    |   |  |   |
|---|--------------------|---|--|---|
| 2 | Financial Services | <ul style="list-style-type: none"> <li>- Managing Director and IT Director (25 years / 8 years)</li> <li>- Considered one of top 40 CIOs in the country.</li> <li>- Specialist in IT at the company (26 years/ 4 months)</li> </ul> | <ul style="list-style-type: none"> <li>- area budget between 2.1% and 3% of revenue.</li> </ul>                        | <ul style="list-style-type: none"> <li>- among the 55 most proactive companies in Brazil</li> </ul>   |
| 3 | Steel              | <ul style="list-style-type: none"> <li>- Planning Director and IT Management (9 years / 6 years)</li> </ul>   | <ul style="list-style-type: none"> <li>- 14% of the investments from 2008 to 2010 will be designated for IT</li> </ul> | <ul style="list-style-type: none"> <li>- 10 largest business groups in the country - 10 largest publicly traded companies in the country.</li> <li>- 10 largest organizations in the Southern Region</li> </ul> |
| 4 | Automotive         | <ul style="list-style-type: none"> <li>- CIO (25 years / 7 years)</li> <li>- Considered one of the top 40 CIOs in the country.</li> <li>- IT <i>Coordinator Project Management Office</i> (PMO) (15 years / 3.5 years)</li> </ul>   | <ul style="list-style-type: none"> <li>- budget of 1.1% to 1.5% of the company revenue.</li> </ul>                     | <ul style="list-style-type: none"> <li>- largest car manufacturers in the world and among the 10 largest companies in the country .- most innovative in IT in the country</li> </ul>                            |

Table 2 – Summary of the company and respondent information.

Source: Valor Econômico, 2008; Revista Exame, 2008; Computerworld, 2008.

The theoretical research in the previous step was used as the basis of the case study protocol, which is designed to guide the researcher when collecting data for a case study (Yin, 2005). In a case study, the protocol plays an important role in ensuring reliability, since it provides information so that the research, when repeated under the same conditions, obtains the same results (Riege, 2003; Yin, 2005). Thus, the protocol used in the case study was developed taking into account the dimensions originally proposed by Weill and Broadbent (1998), and subsequently studied by Weill and Aral (2004), and Weill and Aral (2006).

When analyzing the responses, content analysis was used, which consists of discovering the core meanings within the communication whose presence or frequency of appearance may have some meaning for the chosen objective of analysis (Bardin, 1977). Categories were determined based on the (units) core meanings, which were separated into three categories: final (four dimensions), intermediate (items in each dimension) and initial (definitions and examples), which are presented in each case separately. The main objectives of the analysis were: (i) to validate each dimension with its respective items, (ii) to explore their definitions and contextualize the examples, and



(iii) to find new dimensions or items. Some examples of the categories found in each of the case studies are presented.

A pilot case study was prepared (presented in Section 4) with the purpose of enhancing the external and internal validity of the study (YIN, 2005). After which, the other four case studies were made (section 5). The cases were analyzed separately, then compared and consolidated to determine the final model with the ITPM dimensions.

#### **4. PILOT CASE STUDY**

The Pilot Case Study was conducted in one of the largest business groups in the State of Rio Grande do Sul, in which the Corporate IT Manager of the group was interviewed (Table 2). The company was taking steps towards using the ITPM technique to help with IT investments. A personal interview conducted with the IT manager lasted approximately one hour and thirty minutes. In relation to the concepts of ITPM he had attended a lecture, given by Peter Weill himself, on the theme of IT portfolio management. In addition the respondent had read some articles and the fundamental book on IT portfolio by Weill and Broadbent (1998).

The dimensions and items illustrated in Figure 1 were used as a reference and starting point. The questions encompassed how the respondent defines each dimension, if the items initially stipulated constitute part of each dimension and if there is any other that could be included.

Based on the content analysis, 51 initial categories were identified (e.g., definition of IT infrastructure; Type of control, Types of investments in IT to cut costs; Type of IT investments to gain competitive advantage), 23 intermediate categories (e.g., Definition and importance of IT infrastructure; Better information, Integration of information, Increased sales) and the four final categories (infrastructure, transactional, informational and strategic).

From this categorization, the definitions and examples of each of the dimensions were established, as shown below. The company investments in infrastructure are intended to support the flow of information and include related services. Examples are: servers, computers, printers, laptops, and the staff and technical teams to support the systems. The transactional dimension includes investments that facilitate the existence of the relationship of the company as a whole and the parts involved, examples being: systems responsible for day-to-day business and the exchange of data between users. The informational dimension includes investments in systems and management practices that allow data to be transformed into information and help in decision making, BI (Business Intelligence) for example. And the strategic dimension includes all investments that are aligned with the generation of profit.

All the items were confirmed by the respondent, with some modifications. The first item is the relocation of “integrating information,” which originally belonged to the informational dimension, to the transactional dimension. This is supported by the following transcript of the interviewee’s answer: “the information is grouped at the transactional level and arrives at the informational level already grouped [...] it’s a transactional function [...] Today, I can’t see the information not being integrated at the transactional level”. Another suggested modification was the inclusion of an item within

the strategic dimension. The new item would be “motivational”, where companies are also investing in IT technology in order to stand out and motivate their professionals. It also makes the company more attractive to future professionals, which affects the organization strategically. According to the respondent: “A company that invests in technology, by providing opportunities, training courses and which is modern in comparison to its competitors, has a strategic advantage.”

The pilot case study, which made it possible to validate the case study protocol, led to the revision of some questions and some changes were made: relocation of some questions; changes to the text of some questions to facilitate better understanding and the elimination of some questions. Additionally, this initial study provided the first issues that will later be compared and consolidated with other cases examined below.

## **5. DATA ANALYSIS**

This section presents the analysis of the four case studies included in this research. The cases are analyzed separately, showing the definitions of all the dimensions and their items, both in accordance with the concepts and model presented in section 2. The dimensions and items illustrated in the initial model (Figure 1) were used as a reference and starting point for analysis and exploration. The questions encompassed how the respondent defines each dimension if the items initially stipulated constitute part of each dimension and if there is any other that could be included.

### **5.1 CASE 1**

The first case study was conducted in a large petrochemical company, from which the Chief Information Manager (CIM) and - IT Infrastructure Supervisor were interviewed (Table 2). The former attended a course at MIT, given by one of the authors of the dimensions of ITPM, where he obtained access to the basic concepts about ITPM and its dimensions, which motivated him to apply the technique in the company, and relay information on the subject to other members of his team. Four interviews were held (one with the CIM, one with the IT Infrastructure Supervisor and two with both), each of which an hour and a half, on average.

Content analysis of interview transcripts led to the identification of 62 initial categories (for example, The individual in charge of investments in infrastructure is not from outside of IT; The informational level groups data from the transactional level and generates information; Cut costs is reducing costs; Software to assist in product innovation), 26 intermediate categories (for example, Gain agility; Gain more and better quality information; Data integration; Gain competitiveness) and the four final categories (infrastructure, transactional, informational and strategic).

Based on this categorization, the definitions and examples of each of the dimensions were established, as shown below. The infrastructure investments are made at the base of the company and provide support to other dimensions. Generally, investments in infrastructure services are greater than those in the assets themselves. According to respondents, the examples are: hardware, servers, desktops, notebooks, printers, basic software (operating systems, control software and network administration), database, routers, cabling, providers and the costs of link. The

transactional dimension refers to spending on systems used in everyday business, applications that sustain the business transactions; it sustains the common daily processes of the company, examples are the integrated systems (especially ERP) project software, and communication, purchasing systems. The informational dimension refers to all the investment in IT made at the management layer to generate information to assist in decision making, e.g., BI, expert systems, auditing systems, and short and long term planning systems. The strategic dimension refers to investments intended to provide the company with greater competitiveness, sustainability, market position and different partnerships. In addition, they are all the investments that assist in strategic planning, which are aligned with overall organizational strategy and geared more towards the market. The respondent cited as examples of this dimension: the pier management system, e-procurement and foreign trade systems.

Some modifications were found by analyzing the interview data provided by the respondents. Content analysis revealed a change in the IT infrastructure dimension in this case, where the item “business flexibility” from the original model was changed to “business agility”. Agility is achieved when IT enables the use of technological resources in different ways, for example, the use of the database with easy and complete access. This change, according to respondents, is relevant because agility is to respond to market changes flexibly and more quickly, thus it incorporates proposed initial definition. Furthermore, in this dimension, the respondents pointed out that the items “reducing IT costs” and “reducing marginal cost of business unit’s IT” could be unified.

We identified some changes in the transactional dimension. The first is the change in the item “cut costs”, which should be treated as “reducing costs”, since according to the respondents: “There are the bad costs and the good costs [...] cost cutting involves removing what is not achieved [...] there are costs that are necessary for us to do things faster.”

Therefore, all IT investments help “reduce costs”, primarily through the reduction or improvement of the labor force. The second change is the inclusion of the item “optimizing process”, which according to the CIO means “more than lower costs, it implies more quality and more control.”

According to respondents, the last modification is the insertion of the item “integrating data” because it is a function of transactional dimension to integrate data, which is then processed at the information level to become information to be used in decision making. An example of this integration is the use of secondary systems such as weight data collection systems that feed the ERP, which, in turn, provide information to executive information systems that enable access to information for business areas using a single central repository.

In the informational dimension, it was noted that the item “better information” found in the original model merged with the item “improved quality.” Thus, the first was replaced by “obtaining more information” because the use of management models such as the BI provides a greater quantity of easily accessed information to users, for example.

Finally, we identified two changes in the strategic dimension. Firstly, the item “increased sales” as originally proposed, was not confirmed by the respondents, as this is not a company’s strategy and, but, a primary objective. Secondly, the items “competitive advantage” and “competitive necessity” were replaced by “obtaining competitiveness” because, according to respondents: “In the strategic dimension, rather

than using the words competitive advantage and necessity, it is better to use obtain competitiveness because it encompasses the two and is more objective and easier to understand.”

## 5.2 CASE 2

The second company to be assessed was from the financial services sector, where we interviewed the IT and managing director and the company IT specialist (Table 2). ITPM was being used in the company whose IT department is structured in accordance with its four dimensions, to aid the classification of expenditures and investments in IT. Two interviews were held (one with the IT expert and one with both interviewees) which each lasted about an hour and half.

Content analysis of the transcripts from the interviews showed 55 initial categories (e.g. Videoconferencing helps reduce costs; data from transactional IT to informational IT; Speed and accuracy in decision-making; Online tool for order management), 25 intermediate categories (Definition and examples of IT infrastructure; Process optimization; Reducing the information cycle; Delivering renewed services) and four final categories (infrastructure, transactional, informational and strategic).

Based on this categorization, the definitions and examples of each of the dimensions were established, as shown below. The infrastructure is the technological basis that will be used by other systems and other ITPM dimensions within the organization e.g., equipment (network components, servers, desktops, laptops), systems (communication, electronic mail, operational, a data bank, antivirus, storage) and services (help desk, support, telephony and data links). The investments in the transactional dimension are related to the acquisition of software and systems to meet the daily transactions of the company, which include, according to the interviewees: integrated ERP systems, management systems and some specific areas of business such as payroll credit system, which handles all user information to release credit.

The informational dimension includes those systems that use a structured database provided by the transactional level in order to analyze and interpret data, so speeding up decision-making, and also helping make better decisions. Examples from the informational dimension are: purchases of software, access to BI cubes, consulting for improving the intelligence service, BI software installation, customization, software maintenance contract or any other service associated with the BI. And, according to the respondents, investments in the strategic dimension: “are intended to increase competitiveness, sales capacity or market share, and are associated with innovation, interaction and activities that provide differentiated value to the organization [...] they are all IT investments related to strategic objectives within the firm’s strategic planning.”

All items were confirmed by the respondent, and no modification was found to any of the items in any dimension. However, it is worth noting that the whole IT area is divided according to the four dimensions of ITPM: infrastructure, transactional (called solutions), informational (called information management) and strategic (called strategic and executive). Investments and use of BI were prevalent in the company, especially in the informational dimensions and is in line with other banks such as Unibanco, Banco do Brasil, Bradesco, among others (CIO, 2008).

### **5.3 CASE 3**

The third case study was conducted in a company within the steel industry, where the manager of IT planning and management was interviewed (Table 2). The interviewee is familiar with ITPM as he attended a course at MIT in 2008 and was in the initial stages of applying the ITPM concepts to the management of IT investments in the company. The interview lasted about two hours.

The content analysis of the transcripts from the interviews showed 43 initial categories (Infrastructure is a prerequisite for standardization, IT investment reduces transaction costs, Types of informational controls; IT resource added to adding service), 23 intermediate categories (Integrating the business; Increased productivity; Information quality; Market positioning) and four final categories (infrastructure, transactional, informational and strategic).

Based on this categorization, the definitions and examples of each of the dimensions were established, as shown below. The infrastructure investments are intended to support business applications, networks, data processing centers, communication systems, processing, storage and also the basic software for the company to operate safely, for example, antivirus programs. The transactional dimension includes investments in systems used to run the daily operations, for example, accounts payable, receivable, inventory control, warehouse, dispatch, billing, and also are the transactions associated with the operations and the process of producing and selling. The informational dimension refers to all IT spending which helps companies improve decision-making and that related to the extraction and analysis of data generated and collected from the transactional systems, which, according to the respondents, include BI, executive information systems and CRM. Finally, the strategic dimension includes investments that contribute to the company's strategic goals and are strongly associated with how the company positions itself in the market and the changes through which the company passes, in both the cultural and operational areas.

All the dimensions and items were confirmed by the respondents. A new item was included in the transactional dimension, "control of online data", since, according to the interviewee: "control of online data is a concern of the transactional level, by establishing a monitoring environment within the company's operations through the use of rules, consistency checks, fail-safe and fraud-proof processes, which can be provided by systems such as ERP."

### **5.4 CASE 4**

The fourth and final case study was conducted in an automotive company, where we interviewed the CIO and IT Project Management Coordinator were interviewed. Both respondents were familiar with the topic and concepts relating to ITPM technique. The company was using the ITPM dimensions to assist in technology investments. The interview lasted approximately two hours and one of the respondents, participating by teleconference, was not present during the full conversation.

Content analysis of the transcripts from the interviews showed 40 initial categories (Investments in IT infrastructure to reduce IT costs in business units; Investments transactional IT reduces costs; Information database; Definition of investments for

strategic purposes), 24 intermediate categories (Business standardization; Optimize processes, Information integration; Product innovation) and four final categories (infrastructure, transactional, informational and strategic).

Based on this categorization, the definitions and examples of each of the dimensions were established, as shown below. The IT infrastructure consists of all IT equipment, hardware, software, cabling, networking, telecom and security. The transactional dimension includes investments designed to cut costs in the organization and are related to the consolidation of infrastructure, since they are interrelated, as, for example, in integrated system like ERP. The informational dimension consists of IT investments related to the analysis, collaboration, improved methodologies and communication tools to create a more collaborative environment. According to the interviewees, examples of this dimension are CRM, tracking tools for project development, investment monitoring and reporting for planning and corrective actions. Finally, the strategic dimension is related to the investments made by the company in order to achieve organizational goals such as, for example, the new systems used by the authorized dealers that create a differential in sales.

All the dimensions and items were confirmed by the respondent. One aspect that emerged from the analysis was the emphasis given to the security issue as an important element of infrastructure. Moreover, it was stressed that investments in the transaction dimension should only be made once the infrastructure has been consolidated, corroborating the statement by Weill and Broadbent (1998) on this issue. Another outstanding point is the nomenclature used within the company, where ITPM is referred to as TISI (Transactional, Infrastructure, Strategic and Informational).

## **6. FINAL REMARKS**

The research objective of this study was to explore and validate the dimensions of ITPM in Brazilian companies based on models from Weill and Broadbent (1998); Aral and Weill (2004), and Weill and Aral (2006). The four dimensions (infrastructure, transactional, informational and strategic) were explored and validated in the five case studies carried out in large Brazilian companies with the CIOs, who had knowledge of the subject, providing the following final considerations regarding each one.

In the infrastructure dimension, the item “flexibility”, according to the analyzed cases, should be incorporated in “agility”, since it means flexibility with speed, which is consistent with the study from Mazutti, Maçada and Rivers (2005) which found that the same definition of agility. The “Business standardization” through infrastructure, according to the analyzed cases should be treated carefully, because the provision of uniform equipment and systems in the company avoids the possibility of differences in performance across the organization. However, some IT executives do not agree with this statement, because they consider the fact that the decision to standardize might affect the agility of the infrastructure. In contrast to the suggestion made in one of the cases of the case studies, the items “Reducing IT costs” and “Reducing marginal cost of business unit’s IT” should not be considered as a single item. They are distinct elements of the dimension, because there are investments in IT infrastructure that only benefit a single business unit and others that benefit the company as a whole, which is consistent with Weill and Broadbent (1998).

In transactional dimension, according to the cases examined in this study, two more items should be added "Optimizing process" and "Integrating data". The former has been incorporated into the final model, since it was identified that the transactional systems provide quality, operations control (identified in one case and included in this item), differentiation and speed to the processes. The latter was included because it found that the transactional systems help to integrate data that is transferred to the informational level. The inclusion of the item "information integration", mentioned in one case, was not corroborated in other cases, but the item was included in "data integration" because a relationship was identified between the transactional systems and data production. This finding is consistent with Laudon (2004), who states that the transactional ERP systems integrate all data and processes within an organization. The items "increasing productivity" and "reducing costs", found in the original model, were highlighted by CIOs in this company survey, as the most important in the transactional dimension. This finding is in agreement with several studies in the literature showing the concern of the researchers with IT investments, aiming to increase productivity (Mahmood and Mann, 2000; Torkzadeh, Koufteros and Doll, 2005) and reduce costs (Argyres, 1999; Dewett and Jones, 2001). Within the companies analyzed here, the systems used in this dimension are considered operating systems for the daily processes of the organization, ERP being the most popular system.

In the informational dimension the items "Improved quality" and "better information", found in the original model, were considered very similar by the interviewees. The former one was maintained, while the latter was changed to "Obtaining more information" because information systems provide more and better information. According to the CIOs of analyzed companies, Business Intelligence is the most widely used practice in this dimension. The information systems provide greater control of information due to the monitoring of access, higher quality of information with fewer errors and integration of the data originating from the transactional systems. BI transforms data into information, providing controlled access to those involved in the decision-making process and so contributing to the business intelligence (Tafner and Bernhardt, 2007).

The research revealed that for the IT managers, the strategic dimension is the most difficult to define due to its complexity and lack of definition on their part of what is strategic in the organization. The study from Lunardi, Maçada and Becker (2003), pointed out the difficulty of experienced by executives in managing and using IT in business strategy, which is considered a critical issue. This difficulty can be seen to have persisted over the years and requires deeper study of the problem IT executives have defining what is a strategic IT investment for their organization. The item "motivational" suggested in one case, though it was mentioned that, for example, the changing and acquiring new technologies motivates employees because of the opportunity to work remotely (Mamaghani, 2006), was not confirmed in the other cases. However, while motivating the employees was not found to be one of the main strategic objectives of IT investments, it can be stated that in some cases the acquisition of new IT is seen as the motivation behind and consequence of IT investments.

The items "competitive advantage" and "competitive necessity", from the original model, should be merged so as to form a new and single item called "obtaining competitiveness". The literature distinguishes these two items: competitive advantage can be defined as the implementation of a strategy that adds value, when no other competitor is simultaneously implementing the same strategy or another strategy that

produces equivalent benefits for the company and the market (Carneiro, Cavalcanti and Silva 1999), whereas competitive necessity is the obligation of companies to have some activities and practices that their competitors already have (Guelbert, 2004). Both definitions share the recognition that the competitive pressures or competitiveness lead companies to be more cost efficient, more stable and better able to respond to market dynamics (Feldens, 2005). It is noteworthy that the item “sales increases” was not suggested as a item of the strategic dimension by one company, though the authors decided to keep it, since the majority of respondents believe that IT investments can help in this activity, for example, new online tools for managing orders can result in higher revenues. Furthermore, the literature on IT confirms the indicator Return on Sales (ROS) as a measure of the financial impact of strategic investments in IT (Gunasekaran and Ngai, 2003). Finally, based on the information gathered and these considerations, the final model with the four ITPM dimensions and related items was determined (Figure 2).

The following limitations to the research were identified (i) the use of case studies does not allow the results obtained from the research to be generalized, though it facilitates the exploration and deepening of the theme which was the aim of this research, and (ii) the inability to use the companies from the same industry for the analysis, which was due to the scarcity of companies familiar with the capacity of the ITPM technique to help IT investments, though this factor allowed the researcher to examine the dimensions in different economic sectors.

This research contributes towards both academic and business knowledge. The dimensions of ITPM were explored, defined and modified by Brazilian CIOs who are familiar with the subject and use it in their organizations. Moreover, some commercial research point to ITPM as a technique to assist CIOs in planning their investments (Symons et al, 2005). In addition, ITPM is considered one of the assessment categories for diagnosing the innovation of IT use prepared by InformationWeek magazine in Brazil (2008), which illustrates the importance of the technique and its current use in business. Research that helps managers to better understand and structure their IT investments is important.

Some suggestions for future research include (i) developing tools for analyzing the dimensions of ITPM quantitatively and measuring the correlation between the items in each dimension, and (ii) based on the results of this research, structuring the IT portfolio of different companies based on their investment accounts and building a database to assist in benchmarking Brazilian companies in relation to the percentage invested in each of the ITPM dimensions.



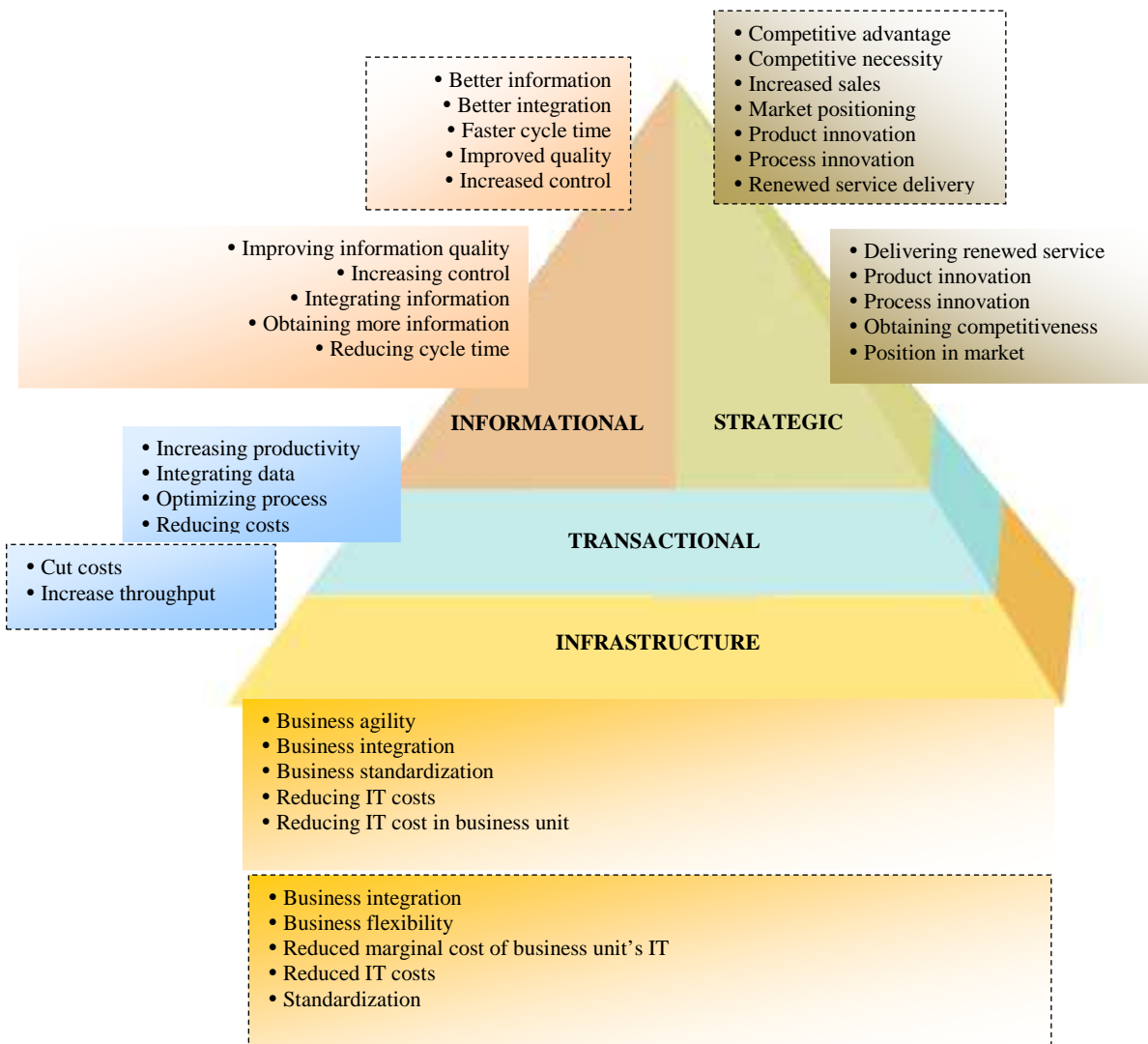


Figure 2 – Final model of the Dimensions of the IT Management Portfolio  
Source: Elaborated by the authors

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