ERP: AN INVESTIGATION INTO THE DECISION BETWEEN BUYING COMMERCIAL PACKAGE AND DEVELOPING INTERNALLY

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ABSTRACT

The contemporary scenario demands from the organizations a greater concern in terms of making the management of their activities more effective, in order to increase their competitiveness through cost reduction and operational efficiency. In this sense, the systems of enterprise management (ERP) appear as a solution to this conjuncture. Typically, an ERP is procured in the form of a ready package; however, some companies choose to develop it internally, influenced by the complexity of implementing these market software solutions. Thus, the objective of this work is to analyze the characteristics of a commercial ERP and a locally developed ERP, drawing a comparison between these two approaches to understand the best solution to help processes in large companies. The methodology used was the exploratory qualitative research, through a case study in a large company of the industrial sector of heavy equipment, which promoted the implementation of ERP in both ways throughout its existence. It has been found that adopting the internally developed system is easier and better meets the requirements of the company. However, the managers of the organization considered that the commercial ERP is more beneficial, due to the possibility of greater integration between the subsidiaries and the other companies of the supply chain, a relevant point in the company strategy.

Keywords: ERP, Enterprise Resource Planning, Internal Development, Shelf Software, System Package.

1. INTRODUCTION

In a competitive environment, companies are constantly looking for new technologies to improve the planning and management of their processes and activities, aiming to achieve higher levels of performance that guarantee competitive advantages over the main competitors.

In this sense, in the last decades, many companies have opted for the integrated systems of management, also known as ERP (Enterprise Resource Planning), that allow the management and optimization of business processes, integrating the various functional areas of the organization in a single database and providing information in real time (Laudon *et* Laudon, 2011, Yan *et al.*, 2008).

Therefore, when deciding to use an ERP, the first activity is to choose a system that fits the needs of the company. The search can begin with commercial (shelf) software, develo-

ped with vendor experience and feedback from many companies, or by the option of locally developing their own ERP.

In this line of reasoning, the present study has the objective of analyzing the characteristics of these two types of ERP system, that is, commercial and internally developed, drawing a comparison between them in order to understand what the best solution for a large company is. The research strategy used was the case study of a large Brazilian industrial sector organization.

The motivation of the article is related to the fact that commercial ERPs have demonstrated numerous difficulties in their implementations, such as low adherence of standard ERP processes to the company, customization complexity, high consulting and training costs, constant changes, among many others (Cánez *et al.*, 2000, Hung *et* Low, 2008,

Menon, 2016, Tarn *et al.*, 2002, Souza *et* Zwicker, 2000). In this context, the acquisition of such software on the shelf becomes questioned. However, there is very little discussion in the literature as to which approach is best for conducting business. These obstacles and dissatisfactions reveal the importance of the study in order to help companies better understand these two approaches and decide for the best system for their needs.

The article is organized into five sections, beginning with this introductory section. Section 2 presents the theoretical foundations, addressing the ERP theme. Section 3 discusses the methodology used in the research. The case study and analysis are described in section 4. Finally, section 5 contains the final considerations, limitations and recommendations for future studies. This study is followed by a list of references used in the study.

2. THE HISTORY OF ERP IN ORGANIZATIONS

This section presents the theories that serve as the basis for this work. Here the concepts of ERP, its history, advantages and disadvantages, problems occurred in the implementation are examined and the differences between a commercial and an internally developed ERP, the need to customize the commercial ERP and the adequacy between the company's processes and ERP functionalities are discussed.

2.1 Concepts

Organizations use information to maximize productivity gains, and this fact poses the problem of information integration as one of the most debated issues in the context of Information Systems (SI) (Lee *et al.*, 2003). This is mainly because there are many tools isolated in their diverse technical environments, leading in most cases to the duplicity of information and different results in the different areas of the company, since they are not integrated (Alshawi *et al.*, 2004, Davenport 2000, Muscatello *et* Chen, 2008).

Thus, the main problems of data fragmentation available in organizations are related to the difficulties in obtaining consolidated information and the inconsistency of redundant data stored in more than one system. In this sense, ERP systems appear as a solution to such problems, aggregating, in a single integrated system, the various business processes that support the organizations (Pang, 2001).

In turn, it can be noted in the literature that an ERP system has many definitions, and there is no universally accepted meaning. Although definitions vary from technical view to holistic business perspective, the concepts do not contain significant variations (Shiang-Yen *et al.*, 2011). Fundamen-

tally, Yan *et al.* (2008) visualize the ERP system from four perspectives, as shown in Table 1.

Business Process Perspective	Technical/Technological Perspective
ERP system as an instrument that allows companies to manage and optimize business processes from interoperational or interorganizational integration.	ERP system as a real-time, configurable interactive software package that includes multiple modules (or applications) to support the function of information processing throughout the company from a single database and a uniform operating platform.
Communication Perspective	**Functionality Perspective**
ERP system as an information system that integrates all information flows and allows access to information in real time, used throughout the company.	ERP system as an integrated set of programs that automates various business processes.

Table 1 - Definitions of ERP systems from the four perspectives.
Source: Adapted from Yan *et al.* (2008).

It is also possible to note that there is a wide variety of definitions that relate the different aspects of the system, such as that proposed by Vlachopoulou *et* Manthou (2006), which define ERP as company-wide systems that automate all business processes and replace the legacy systems[1]. Thus, ERP software integrates all departments and functions of a company into a single system and runs on a common database, making it easy to share information and to communicate between departments.

According to Laudon *et* Laudon (2011), ERP is a management system that integrates all areas of the organization, so that they can be coordinated and share information. The integrated management system is, therefore, a set of systems that aims to aggregate and establish information relationships among all areas of a company.

Thus, ERPs are used to integrate business processes in manufacturing, production, finance, accounting, sales, marketing and human resources into a single system (Laudon *et* Laudon, 2011).

In this line of reasoning, ERP are packages of process applications that support the standard business processes, providing business visibility through information that is con-

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1 Legacy systems are software systems over 10 years old, which many organizations still depend on. These systems are usually slow, run on old or obsolete hardware, and spend an excessive amount of money on their maintenance. However, these systems support critical business processes that create profit for organizations (Shaief, 2011).

solidated and integrated into a database for different areas of the organization in real time (Decoster, 2008).

To illustrate the definitions exposed so far, Figure 1 shows the working architecture of an ERP system, based on the view of Davenport (1998). The author states that at the core of an ERP system is a database that receives and delivers data to applications that support the activities of a company. Thanks to the use of a central database, the flow of information becomes drastically more agile.

Figure 1 - Typical operating structure of an ERP system.
Source: Adapted from Davenport (1998).

In addition to the concepts presented, there are other important characteristics related to ERP systems, which, according to Turban *et al.* (2008), are: modularity, scope, uniformity and standardization of information, customization capacity, incorporation of best practices, information quality, functional opening, and guaranteed solution evolution. Souza (2000) also adds the following characteristics to the ERP systems:

- Functionalities: refer to the services available in ERP systems, having different characteristics and possibilities of use. The modules include a vast set of functionalities and can typically be acquired and implemented separately in the system. ERP systems are structured in modules to enable companies to implement only the components they need;

- Parametrization: it is the process of adapting the functionalities of an ERP system to a certain company from the definition of the values of several parameters. The configuration is represented by the total set of system parameters (after its definition), encompassing the set of operating options of the ERP system;

- Customization: corresponds to the modification of an ERP system to adapt it to specific business situations, not possible to be reproduced, using only the pre-existing parameters in the system;

- Location: corresponds to the adaptation of the ERP systems developed in one country for use in another, in order to adapt it to local commercial laws and procedures, such as taxes, specific legislation, among others;

- Version update: understands the process from which the software vendor provides increases in system functionality or the correction of problems and errors.

2.2 Brief history

ERP systems originated from the controls exercised in the manufacture of products. In the 1960s, in search of better control in the manufacture of a product, some industries began to use a bill of materials that contained the description and quantity of materials to be used, which was popularly known at the time as Bill of Material (BOM). At the beginning of the 1970s, there was an evolution in this list to contemplate material requirements planning. There was, therefore, the emergence of Material Requirements Planning (MRP), which could already predict not only the materials to be used in manufacturing and their respective quantities, but also the time in which these quantities should be used (Corrêa *et al.*, 1997).

Subsequently, in the 1980s, the Manufacturing Resources Planning II (MRP II) system emerged. In addition to the control that the MRP carried out, the MRP II dealt with production capacity planning and financial aspects, such as budgeting and costing of production. Despite the advance of this last system over the previous ones, the integration between the information and data of the several departments of the company, at that moment, was still not possible (Anthony *et* Govindarajan, 2002).

In the early 1990s, the integration of MRP II with other specialist systems into a single database was consolidated. The solution offered was expanded beyond the boundaries of the manufacturing sector, encompassing other sectors of the enterprise. In this way, they were baptized as ERP (Enterprise Resource Planning). These systems began to perform all the tasks that MRP II performed, but with the benefit of integrating all sectors of the company (Corrêa *et al.*, 1997).

2.3. Implementation issues

Implementing an ERP in an organization is typically a complex process that involves hiring specialized consulting, mobilizing functional teams, allocating physical space, scheduling, planning hardware acquisition, and negotiating with all vendors involved. In many cases, the implementa-

tion projects are divided into five stages: Process Analysis, Solution Design, Solution Construction (configuration), Integrated Testing, and implementation (go-live). These projects last, for the most part, from 6 to 24 months and are considered critical, since they involve substantial investments, significant timeframes, as well as the choice of the most appropriate system and stakeholder engagement with the tool (Colangelo Filho, 2001).

Among the difficulties encountered in an ERP adoption project, it is possible to highlight the profound changes in terms of business processes, the complexity of customization tasks, the high cost related to consulting and training activities, constant changes and version management (McNally *et* Griffin, 2004, Menon, 2016, Souza *et* Zwicker, 2000, Tarn *et al.*, 2002). Even after implementation, the system continues to evolve continuously to reflect company processes, and many changes can be considered as new implementations (Davenport, 1998).

According to Turban *et al.* (2004), one of the biggest problems in the ERP implementation is its complexity. So, there are cases where companies need to change their business processes to fit the ERP.

In order to prove this difficulty, Themistocleous *et al.* (2001) studied the causes of failure to use ERP systems in the USA, UK, Germany, France, Canada, Japan and India. It was found that 66% of the interviewees understood that the overflow of the budget, as well as delays in terms of completing the project (58%) were the most important factors for dissatisfaction with the project. Moreover, conflicts with both system vendors (42%) and project consultants (30%), and internal conflicts (34%) also proved to be important. The resistance to change on the part of the employees (42%) is pointed out as another cause of failure in the implementation of these systems.

According to Sumner (1999), the causes of failure to implement ERP systems can be grouped into 12 categories: people (teams working on the project), specifications (insufficient), objectives (lack of), techniques (Data and software analysis failures), communication (lack of communication with users), organization (structure, lack of leadership), technological (hardware/software), complexity, resistance to change, methodological, planning and human resources.

While the use of ERP has a number of advantages, its implementation can be very risky, and if companies do not pay attention to their needs and limitations, they can make their process more complex. It is also worth noting that often companies have to buy the entire system package, although they only need parts or software modules. For this reason, the ERP solution may not be attractive to all companies (Turban *et al.*, 2004).

Tobie *et al.* (2016) carried out a study with 36 articles on the implementation of ERP systems, in order to highlight the lessons learned by companies that implemented these types of systems and to recommend some best practices that can help companies to avoid the same problems in future implementations. Among the main difficulties and recommendations suggested by the study, the following stand out: (a) develop a good implementation strategy, as suggested by Akeel *et* Wynn (2015), who emphasize the importance of higher levels of the company that are closer to project management and that key users are involved; (b) have a good business case in the adoption phase; (c) choose the ERP that best fits the needs of the company; (d) educate and train users; (e) have a good knowledge management (information shared between project members and ERP consultants) and; (f) pay attention to culture, since good practices of ERP often require a greater adaptation of the company to the system.

In this same line of reasoning, in order to increase the likelihood of achieving the benefits arising from the implementation of an ERP system, Gleison *et* Ildeberto (2016) drew up a proposal for a conceptual framework, which aims to improve the assessment of the value generated by such systems. The model proposal focuses not only on improvements to the operational areas, but it also covers strategic perspectives of companies (information technology, competitiveness, business and organizational perspectives) in order to maximize the benefits of implementation. Therefore, this evaluation model can be a relevant tool that companies can consider in their ERP adoption analysis process, in order to anticipate and reduce the impacts of their implementation.

2.4 Advantages and disadvantages

Implementing an ERP system can involve profound changes in the structure, business processes, and even the culture of an organization. On the other hand, the benefits of these types of systems are numerous and can bring important contributions to increase the competitiveness of companies (Davenport, 2000, Hayman, 2000, Ilfinedo *et* Nahar, 2006, Scheer *et* Habermann, 2000, Sumner, 1999).

In order to verify these benefits, Davenport (2000) conducted a study with 200 Chief Executive Officers of companies that had installed business management systems. This study revealed the main reasons that led companies to invest in an ERP system, as shown in Figure 2.
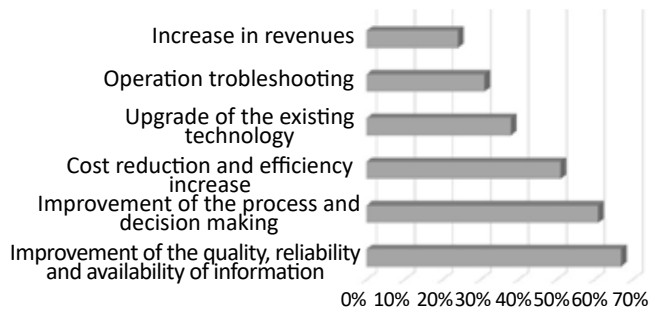
Figure 2 - Expected benefits of implementing an ERP System.
Source: Adapted from Davenport (2000).

Analyzing the data presented by the study, it is verified that approximately two-thirds of the executives surveyed consider the quality of the information available by ERP to be fundamental. Another important benefit was the improvement in terms of the decision process, with 61% of the responses, which is related to the companies' need to have a system that integrates the information into a single database and, consequently, enables a better decision-making decision process. The item cost reduction and efficiency increase (51%) is also important and is mainly related to the operational benefits of the automation of processes offered by Information Technology (IT) (Shang *et* Seddon, 2002).

In the perspective of Albertão (2001), the benefits of using an ERP are:

- Use of a common database - flexibility;

- Elimination of the use of manual interfaces - cost savings;

- Improvement of information flow within the organization - efficiency;

- Improvement in the quality and consistency of the reports, allowing a better comparison of data;

- Improvement in the decision-making process;

- Elimination of redundancy of activities;

- Reduction of all lead times and response times to the market;

- Reduced inventory by providing more accurate information and better data management;

- Offering multi-language and multi-enterprise platforms (for global companies) in more robust systems;

- Better response time from the system;

- Specialization.

Shang et Seddon (2002) classify the benefits of a five--dimensional ERP system. In the operational dimension (1) are the benefits obtained by automation and rationalization of daily routine activities, reducing or nullifying human intervention. It delivers cost savings, reduced time cycles, increased productivity and improved customer service. On the other hand, the managerial dimension (2) encompasses the benefits achieved by centralizing information in a single database with analytical data capacity, which allows for better planning and support of management and decision-making activities. The fact that the ERP system provides information in real time allows a better and more adequate control of all the activities and departments of the organization. With regard to the strategic dimension (3), the benefits resulting from the internal and external integration capabilities of ERP systems stand out. Organizations benefit from integrating the entire value chain, bringing together all business partners, enabling alliances to be created and thus increasing productivity, reducing costs and increasing innovation. In the organizational dimension (4) are the benefits resulting from the internal integration of all processes, based on the harmonization of all interdepartmental activities. ERP systems provide an improvement in terms of organizational communication, which facilitates a common view of the company and greater employee motivation. Finally, the technological dimension (5) covers the benefits obtained as a result of the integrated and standardized architecture of ERP systems, as well as reducing the maintenance costs of legacy systems, reducing maintenance costs for isolated applications and allowing greater flexibility to introduce future applications.

Despite the aforementioned benefits and the great recognition and acceptance of ERP systems in organizations, some criticisms have been directed at this type of system, both from a technical perspective and from a business perspective (Davenport, 2000).

In this sense, Caldas *et* Wood Jr. (2000) point out that commercial ERP systems involve a broad process of organizational transformation, with impacts on the management model, organizational structure, management style and, mainly, people. To support this idea, Souza *et* Zwicker (2000) argue that it must be remembered that the use of an integrated system may imply changes in the organization, either in terms of the operational efficiency of the processes being carried out or in relation to the organizational structure itself.

2.5. Commercial ERP versus Internal Development

While many companies choose commercial ERP solutions in the form of ready-made packages, one can identify advantages in terms of building them in-house. Thus, executives need to evaluate the pros and cons and decide whether to buy or create their own system. The following is a comparison between the decision to buy a commercial ERP package and develop it internally.

In this line of reasoning, Cánez *et al.* (2000) suggest that less strategic applications should be purchased, while more strategic applications should be built. Corroborating this view, Hung et Low (2008) argues that developing it internally is more advantageous than buying it when the system is related to the company's strategic activities.

With respect to costs, such as implementation costs and to keep the system running, it can be ensured that, in the option of purchasing a shelf system, investments are relevant to organizations (McNally *et* Griffin, 2004). Therefore, although commercial package costs are lower compared to internal development, they will be increased by the hidden costs of system implementation, support, and maintenance (Rosen, 2001).

It is important to note that complex systems, such as ERP, can generally benefit from the knowledge embedded in the packages (Nelson *et al.*, 1996). Nevertheless, very large systems, generally used in large organizations, may require more resources to keep them running, compared to the cost of internal solutions (Fowler, 2004).

Another important factor is that the more specific the requirements, the greater the tendency to develop it internally (Fowler, 2004). This is due to the fact that customizing a package to meet these specific needs involves risks. In addition, because of practical reasons related to system maintenance, package providers may not allow customization (Rosen, 2001). Therefore, an alternative to customization would be the organizational change in order to tailor the company's processes to the package (Rosen, 2001, McManus, 2003).

Moreover, with respect to risks, the use of commercial packages can avoid several types of complications, such as risks of project completion, cost and budget risk, control risk and performance risk (Davis, 1988). On the other hand, purchasing an ERP presents supplier risks associated with documentation, implementation, support and maintenance and other long-term issues, such as vendor viability (Rosen, 2001).

In Mallory's view (2017), many companies spend too much time and money trying to replace their current systems with a commercial ERP; however, improving them may be the most effective and affordable option. As a solution to this difficult decision, the author recommends that companies evaluate their existing internal systems before deciding to purchase a shelf ERP. As for internal systems, the author suggests evaluating the possibility of implementing new features available in later versions, adding other modules that they do not already have, purchasing third-party products that can be integrated with their software to solve specific business problems, or hiring someone to customize the system to meet the specific needs of their business.

2.6 Need for Customization of Commercial ERP

In order to make its use more flexible in a larger number of companies from different segments, the ERP systems developed by specialized suppliers were created in the form of a generic solution that can be customized to a certain degree. The customization is the modification of a system so that it can adapt to a certain business situation impossible to be reproduced by preexisting parameters. Through this procedure, it is possible to meet any needs of the company (Gomes *et* Vanalle, 2001).

Thus, most ERP market software packages rarely meet the specific needs and existing processes of organizations. ERP misadjustments arise from specific business, industry, or country needs that do not match the ERP package resources. Table 2 summarizes the sources of ERP misadjustments in Soh *et al.* (2000).

Misadjustment Source	Description
Specific business need	Differences in organizational structure, products and processes, management practices
Specific industry need	Industry/sector regulation, standard practices
Specific country need	Unique regulatory or social practices in every nation or culture

Picture 2 - Sources of ERP Misadjustment problems.
Source: Adapted from Soh *et al.* (2000).

Because of these misadjustments, companies can tailor their business processes to the model of ERP systems they have acquired to reduce the level of customization and use systems more efficiently. Thus, the main objective, which is to make the companies more competitive, is compromised by the effort to make the systems work

(Olsen *et* Saetre, 2007). In other words, the capabilities of a commercial ERP package limit the design of business processes. By acquiring the system, the company is accepting a set of limitations to the business practices that it can perform. Gattiker *et* Goodhue (2004) illustrated the limitations of ERP systems in business practices, as shown in Figure 3.
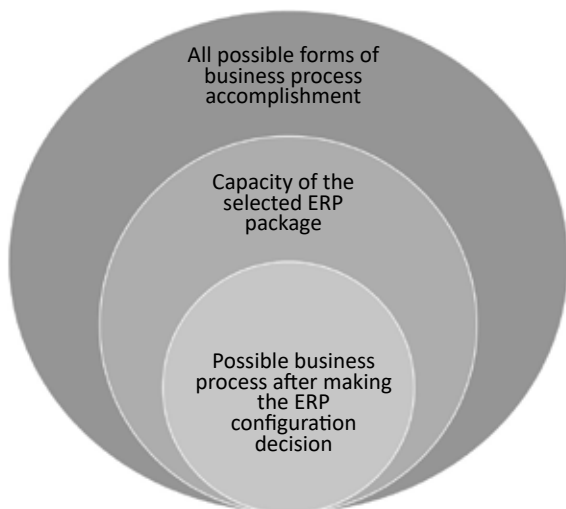

Figure 3 - Limitations of ERP systems imposed on business process options.
Source: Adapted from Gattiker *et* Goodhue (2004).

Therefore, the limitations of commercially available ERP systems typically require companies to tailor the software to the reality of their business. However, the longer the customization is performed, the more the system approaches the internal application development model (Gomes *et* Vanalle, 2001, Souza, 2000).

2.7 Suitability between Enterprise Processes and ERP Functionalities

The literature suggests that in a process for implementing an ERP system, one should use the reengineering approach of Hammer *et* Champy (1994), that is, it starts from a blank sheet and tries to adapt the system to the process of the company (Ogura *et* Marins, 2003).

As a consequence, the adequacy of the system to the particularities of the company has, in general, a high cost, because it involves hiring many hours of specialized consultants for the necessary modifications. Many companies do not have sufficient resources to handle this cost and eventually adapt their processes to the system. On the other hand, this adaptation brings even greater impacts to users who, in addition to having to learn how to operate the system, need to relearn how to perform their tasks within the software (Mendes *et* Escrivão Filho, 2002).

Following the same line of reasoning, Gomes et Vanalle (2001) and Souza (2000) point out that the larger the number of customizations made to adapt an ERP system to customer needs, the more the system moves away from the ERP system model and more it approaches to the internal application development model. The implicit rule is therefore to adapt the company to the ERP system, avoiding customizations. According to Martin *et* McClure (1983), any necessary changes must come from the package vendor.

3. METHODOLOGY

The present research is of qualitative character and it adopted, as research strategy, the single case study in a large company of the industrial sector. According to Yin (2010), a case study is a way of doing empirical research that investigates contemporary phenomena within the real-life context, in situations where the boundaries between phenomenon and context are not clearly established. Therefore, the case study is an appropriate procedure and will be used as a delineation of the field research of this article.

A qualitative study was chosen due to the fact that this type of study is appropriate when the objective is to explore subjects in a defined environment to gather data-rich perspectives (Yin, 2015), and to allow the interviewees to freely discuss their perceptions in terms of the subject studied (Merriam *et* Tisdall, 2015). The quantitative study was not adopted because it would not have allowed a complete discussion of the subjects, but would present options for the subjects to be chosen (Merriam *et* Tisdall, 2015).

The scope of the study consists of identifying the characteristics of an ERP system developed internally and of a shelf ERP, and analyzing which option is more advantageous for a large company. Thus, the research tries to answer the following question: is the implementation of an internally developed ERP system more beneficial than the implementation of a commercial ERP system in large companies?

This research is exploratory, with the purpose of explaining and providing greater understanding of a given problem. In this type of research, the researcher seeks greater knowledge about the subject under study (Gil, 2006).

For a better understanding of the case studied, it was decided to use semi-structured interviews as a method of data collection. Among the various research tools used, the interview is one of the most important. This is

because, besides being directed to the specific objectives of the researcher, it produces the deepening and the richness of the information that is expected of the methodology (Yin, 2010). In the semi-structured interviews, although there is a set of previously defined questions, the interviewer is not restricted to them, giving the interviewee the freedom to talk about the proposed topic and lead the conversation (Marconi *et* Lakatos, 2008).

The research was carried out in two stages. In the first one, interviews were conducted with two IT managers, who participated directly in the implementations and support of the internally developed ERP, one of which also participated in the implementation of the commercial ERP. The interviews took place in-house. In the second stage, the data collected for the two ERPs were compared. The interview period in the company was from July to August 2014.

In this work, for strategic and confidential reasons, the organizations and participants that have served the case studies will not be identified. However, it is emphasized that no information relevant to the study will be omitted.

The company selection criterion used in this study considered the fact that it is a multinational company, with high revenues, IT investments aligned with the organizational strategy and convenience, due to the authors' ability to access the data.

4. CASE STUDY

In this section, the presentation of the company and the case study carried out in it is made. It also promotes a discussion of the results and a comparative analysis, evidencing the characteristics of the ERP system built by the corporation itself and installed in its units, and of its successor, the SAP commercial ERP.

4.1 Company Characterization

The research was conducted in a US multinational industrial sector with sales and revenues around US$ 60 billion and leading the world supply in the heavy equipment sector. The Brazilian unit of the company, hereinafter referred to as the Alpha Company is headquartered in the countryside of the state of São Paulo and has 5,000 employees. It also has dealers that serve the Brazilian and international market. Most of its production, about 80%, is exported to 120 different countries.

4.2 Commercial ERP versus Internally Developed ERP

Prior to the strategic decision to migrate to SAP's commercial ERP, the Brazilian unit experimented two locally developed ERP systems.

The first was built in the 1980s and, although initially satisfying the company's processes, in the mid-1990s the system presented two main issues. First, the software system was becoming obsolete as the company grew, technologies and the market evolved; thus, the need for a current system that met the new reality of the organization was evident. Secondly, the system in question was not prepared for the turn of the year 2000, the so--called "Millennium Bug". This second problem was the motivating factor that propelled the Brazilian unit to seek a quick solution, in order to replace its local ERP that would cease to function at the turn of the decade.

Since then, some ERP solutions have been studied, among which two were the commercial ERP of SAP and the ERP developed internally by the corporation, which was already installed in other organizational units.

These two systems were analyzed and compared in order to identify the one that would best suit the company. It was verified that SAP presented only 13% of adherence to the processes of the company, whereas the ERP developed internally by the corporation contemplated 80% of the processes. This factor was decisive for the choice of internal ERP at the time.

The stability of the version was also an important factor, since the internal ERP had been developed in the 1970's by the corporation and, when it was implemented in the Brazilian unit in 1998, it was already being used in more than 20 units for more than 20 years. Therefore, it was already a consolidated system, practically stable, and its implementation was relatively simple, since the problems were being minimized by the experience acquired during the previous implementations.

Even with the initial positive prognosis, there were several difficulties in terms of its implementation in the Brazilian branch. The biggest problem was the fact that the processes of the whole company, from the receipt to the shipment of finished products, carried out until now in a manual or little automated way, began to be made with the aid of the system. Thus, although the processes were not modified, people had to learn to perform them with the help of systems.

In addition, since these were computerized processes, several training sessions were required of all those involved, as well as the creation of extensive documentation

(user and system) on all systems and processes, in order to facilitate and Serve as a guide to both system users and IT analysts responsible for system support.

Another important point, motivated by the integration of processes and information, was the need to implement other satellite systems that were not part of the scope of internal ERP, such as a purchasing system.

On the other hand, besides the high adherence, it is possible to mention other advantages of the use of an internally developed ERP. For example, contrary to Sumner (1999) and Themistocleous *et al.* (2001) regarding the high resistance of the employees to the change to the new process, this obstacle was overcome as a consequence of the bigger problem that was the Millennium Bug, that is, people understood that it was necessary to change because they ran a risk of a generalized halt in current systems brought about by the turn of the millennium.

Another significant advantage was that the implementation occurred within the expected and without major problems, mainly due to the fact that there is a specialized team in the implementation. Thus, the implementation was supported by a corporate team with a great deal of knowledge and experience from the implementations occurred in previous organizational units. This internal team support was of fundamental importance as it made it possible to avoid and minimize many problems throughout the process.

Currently, the internal ERP is still in operation and has a corporate IT team of approximately 20 people dedicated exclusively to provide support to all the units where ERP runs, including Brazil. The corporation also has about 20 process specialists, divided by business areas, to support the factories that have the system installed. Remember that the current system is not online, that is, transactions and information recorded throughout the day are stored in a database and are processed and updated only at night.

In the Brazilian unit, as in other units, the system is stabilized and functioning properly, taking into account the requirements of the processes. However, there is a corporate initiative with the aim of replacing it with a commercial ERP. Among the main objectives of this substitution are the alignment with the organization's strategy of becoming a more profitable company and the creation of a unique language among all branches throughout the world. In total, there are 35 branch offices using the old ERP system developed internally, each with its own configurations and customizations, and for the business of the company, it is essential that the units talk to each other. Therefore, it is strategically imperative that the entire organization has a unique language.

Another reason that led the organization to start a project for the acquisition of a commercial ERP is the fact that the main companies and competitors use such systems. However, because the ERP does not meet 100% of the business processes, the complete solution for the Alpha Company consists of the ERP and other systems to supply the processes that are not contemplated by the commercial system. A corporate team was formed to implement SAP in all units and the strategy is to implement the solution in one or two branches each year, depending on their size and complexity.

The commercial ERP is in the initial phase of implementation project in the Brazilian branch. Note that it has already been implemented in six units of the organization in different countries, which are already using the system fully. The corporate team responsible for the project established an implementation model with features that were common to all units and was based on the principle that the business processes of these units should adapt to the ERP system, not vice versa. In view of this, the customizations were only allowed after analysis of the team, provided they were small and essential to the business. In practice, the US corporate team physically moved to the units in which the ERP was deployed to learn, along with the IT staff and key local users, the processes and to bridge the gap between the process and the system. These gaps were then analyzed by the corporate team to decide which solution to apply. Usually, the solution proposed by the team followed the line of change in the process and, in the last case, the customization of the system was allowed.

We can cite some difficulties encountered in most commercial system implementations already completed, such as the question of adapting local business processes to the system. It was noticed that each unit of the organization had its own practices and that many processes in the system were different from the current ones, which generated great need of analyzes and corrections. The complexity of the countries was also another great difficulty, that is, as the project was developed by an American company, the particularities of each country, such as fiscal and tax, were not taken into account.

Comparing the locally developed ERP, which has been operating in some units for more than 30 years, and the commercial ERP already fully implemented in other units of the company studied, the managers concluded that the internal ERP is more mature and therefore more stabilized and adherent to the company's current process. On the other hand, the commercial ERP is a project un-

der development by the corporation, and it is still very adaptable to arrive at an ideal standard model that can be easily implemented and that adheres to the processes of each branch.

Another disadvantage in terms of the commercial ERP raised by managers was the high cost of implementation and maintenance. For example, SAP ERP should be installed, by the initial design, in both large and small units. However, it's payback and benefits for the smaller units is still much discussed. In addition, it was found that people had a misconception that implementing business ERP in a company was easier than implementing internally developed ERP. In practice, commercial ERP was difficult to implement mainly because it required the adaptation of processes to the system and because of the complexity and operational differences of each unit, factors that make it difficult to create a standard ERP to be implemented more easily in all branches. On the other hand, as the internal ERP is a more mature and developed system focused on the company's processes and practices, it makes implementation easier.

However, despite the problems faced, most managers support the adoption of the commercial ERP because they understand that it will bring significant benefits to the corporation and its business units, such as the possibility of further integration of the supply chain (customers and suppliers) and also, by the use of a common language among the branches.

5. FINAL CONSIDERATIONS

The objective of this research was to analyze the characteristics of a commercial ERP and an ERP developed internally by the company itself, with the intention of verifying which one is the best solution for large organizations.

Through the results and analysis of the case study, it can be inferred that both have their positive and negative aspects, thus making this decision more strategic (Gleison *et* Ildeberto, 2016, Mallory, 2017). However, in the case of the company studied, managers understood that the best option is the commercial ERP, even with a process adherence rate well below the other option. It is worth noting that a low adherence rate can lead to some obstacles to implementation, as observed in the literature, such as complexity and the need to change business processes to fit the ERP (Sumner, 1999, Turban *et al.*, 2004) (Tobin *et al.*, 2001), and culture, since the best practices of ERP require a greater adaptation of the company to the system (Tobie *et al.*, 2016).

The main reason for the choice of shelf ERP is due to the fact that this is a system already consolidated in the market and, therefore, to facilitate the definition of a common language between its supply chain partners (suppliers and customers) and between the business units themselves. These benefits are in line with Albertão (2001), when he states that an ERP provides platforms with multi-languages and multi-companies (for global companies) in more robust systems, and with Shang *et* Seddon (2002), highlighting the advantages of internal and external integration of the ERP systems, enabling organizations to benefit from the integration of all business partners, thereby increasing productivity, reducing costs and increasing innovation.

The main advantage of the internally developed ERP evidenced in the study was the high adherence to the processes, since the company has the opportunity to create the system according to the particularities of its processes and strategy. On the other hand, the adherence of standard ERP processes to the company's processes is low, a fact that is in accordance with one of the main disadvantages of this type of system pointed out in the literature (Cánez *et al.*, 2000, Hung *et* Low, 2008).

Another major advantage of the internal ERP was the implementation within the expected period, since, according to the literature, the time of commercial ERP implementation is one of the main reasons for dissatisfaction with the project (Themistocleous *et al.*, 2001). The high cost of implementation and maintenance (McNally *et* Griffin, 2004, Souza *et* Zwicker, 2000), which, in many cases, may not justify the investment, as in the case of the smaller units, is also highlighted as a negative point of the commercial ERP and a concern of the company.

In spite of the notable disadvantages of commercial ERPs, it was chosen to be implemented in the company studied and the main reasons were to use the same system as the main competitors and to create a unique language within the supply chain. It is noted that the company evaluates as an important item the exchange of information and integration between the business units, as well as with suppliers and customers. It was understood that integration would be facilitated by using a commercial ERP, since the companies in the chain could either acquire the same system or be already prepared for such integration.

It is noteworthy that the present work consists of a single exploratory case study in a Brazilian company and, therefore, the results cannot be generalized to the other companies. However, the findings can provide general learning, since it can be considered a typical case because it is the implementation of an ERP system in a large Brazilian company.

As future research, it is suggested to conduct studies to better understand whether the adoption of a commercial ERP facilitates the integration between the partners of the supply chain. Another suggestion is to identify the characteristics of the satellite systems implemented together to meet some of the commercial ERP process needs, in order to determine which processes, need to be supplied with other systems and whether they should already be included in the ERP packages.

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