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IDENTIFYING CRITICAL SUCCESS FACTORS FOR THE IMPLEMENTATION OF ENTERPRISE RESOURCE PLANNING SYSTEMS IN PUBLIC EDUCATIONAL INSTITUTIONS

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ABSTRACT

The implementation of Enterprise Resource Planning (ERP) systems in Brazilian public educational institutions is considered critical and a time consuming process. Then this study aims to identify the Critical Success Factors (CSF) for the implementation of ERP systems in these organizations. A literature review, where 30 CSF used in scientific articles were identified, has been prepared. Based on found CSF, 20 were selected to compose a questionnaire constructed with the Likert scale and applied to 70 ERP systems specialists in educational institutions, in order to get the perception of the most CFS relevant during the pre-implementation, implementation and post-implementation phases. As a result of this field survey, a ranking of the degree classification “very important” for 20 CFS was drafted by percentage in the ERP lifecycle. This work intends to contribute with a comprehension in terms of what CFS needs to be observed during each phase of the ERP systems implementation in educational institutions.

Keywords: Critical Success Factors; Enterprise Resource Planning (ERP); Educational Institutions; Implementation.

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1. INTRODUCTION

As well as businesses and industries, educational institutions have been searching for IT (Information Technology) resources, and the ERP systems (Enterprise Resource Planning) have been increasingly used by these institutions (Alqashami *et* Mohammad, 2015).

As an IT application, the ERP system is considered one of the most important, as it enables organizations to connect and interact with their administrative units, allowing data management and internal procedures coordination. Educational institutions have sought the capabilities of the ERP system; however, many projects fail, go beyond the schedule or face budget constraints. The failure rate of ERP systems implementation in educational institutions is higher than in other sectors (Alqashami *et* Mohammad, 2015).

In addition, the ERP system implementation is a complex process and usually produces changes within the organization, whether involving changes in the roles and responsibilities of the people, or changes in relations between the company departments (Sun *et al*., 2015).

Ram *et al.* (2014) declare that both the academic literature as the commercial show that ERP systems implementation involves complexities, often resulting in failures and difficulties; however, the implementation of these systems has produced improvements as well as tangible and intangible benefits in organizations performance.

Several researchers, including Umble *et al.* (2003), Ehie *et* Madsen (2005), Finney *et* Corbett (2007) and Hart *et* Snaddon (2014), highlight the challenges and gaps in the successful implementation of ERP systems. The critical success factors (CSF), a management tool released by Bullen *et* Rockart (1981), emphasize the importance of knowing the key areas of the organization for the success of projects at the company.

This tool has been widely used and studied by researchers for implementating ERP systems, as presented by Bansal *et* Agarwal (2015), Kapur *et al.* (2014), *Ram et al.* (2014) and Beheshti *et al.* (2014), among others. Considering that the Critical Success Factors are regarded as key areas in the organization, when they are put into practice properly, these factors provide successful implementation of the ERP system and, in addition, considering the studies of Ashja *et al.* (2015) on the lifecycle of ERP, sorting it into three stages - pre-implementation, implementation and post-implementation, this research aims to identify the CSF that more affect success in these three phases of ERP systems in Brazilian public education institutions.

To achieve this goal, a questionnaire was prepared based on the literature review, where 20 CSF were evaluated by experts, in a Likert scale, focusing on the answers concerning the degree of importance "too high", in the perception of these respondents. As a result of this survey, a ranking of the 20 CSF was developed, showing the percentages for each CSF. The purpose of this ranking is to observe the CSF position as its relevance in the three phases of ERP implementation.

Finally, we highlight that this paper will refer to the term "implementation", both in generic form, thus covering all the complexity of ERP system within the organization, as defined by Sun *et al.* (2015), and specifically with respect to the second stage of the ERP life cycle, as proposed by Ashja *et al.* (2015): first phase, pre-implementation; second phase, implementation; and the third stage, post-implementation.

In addition to this introduction, this article is composed of the following sections: Section 2, which describes the concepts of ERP systems and their three stages of implementation; Section 3, which features the description on Critical Success Factors; Section 4, where the methodology applied in this study is presented; Section 5, which describes the literature review, presenting the 20 CSF grouped and employed for this research; Section 6, which presents the ranking of CSF in the experts perception within the pre-implementation, implementation and post implementation phases and the considerations of the results; and, finally, Section 7, which features the conclusion of the study.

2. ERP SYSTEMS

ERP systems became one of the most important tools used in the organizations' management. These systems contribute to the companies' efficiency, by means of integrated resource management, automation processes and optimization of the information flow. When successfully implemented, the ERP can facilitate management under various aspects; however, its implementation is not a simple task (Morton *et* Hu, 2008).

These systems are composed of a set of modules that are linked. The functional areas of an organization, such as: finance, accounting, production, procurement and customer service, are interconnected in a single system, with a common platform for the information flow across the enterprise (Beheshti *et al.*, 2014).

Méxas *et al.* (2012) claim that in ERP systems information is centralized in one database and this centralization is advantageous because it provides integration and data flow for all organization sectors, favoring managers' access to agile and reliable information. This common database provides the ERP the ability to integrate the key business management functions of an organization, enabling efficient infor-

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mation communication within the company. To the authors, the ERP systems must be well understood, since they are at the heart of the company's business and, therefore, meet the three main objectives within the organization, namely, the operational, tactical and strategic.

The ERP system implementation should not only be viewed as a technology exchange within the organization, because this migration involves changes where the organizational structure will be anchored in the company's internal processes. In addition, its implementation is complex, due to the fact that clients can make adjustments in the system to contemplate their need, increasing not only the complexity, but also the time for this implementation (Mendes *et* Escrivão Filho, 2002).

Bernroider *et al.* (2014) claim that implementation of the ERP system is difficult and not always successful. Many organizations do not seem to be prepared for proper planning for this project, producing as a result, a partial implementation success or abandonment of the project before its completion.

Tasevska *et al.* (2014) declare that the ERP systems have been developed to allow the organization global integration of business processes, producing as a final result, the effective management of the entire company; however, its implementation is not an easy task.

Considering that the ERP systems management involves various difficulties, due to its complexity, Corrêa (2015) suggests the training of technicians and users, in order to contribute to ERP implementation-related issues reduction.

Esteves-Souza *et* Pastor-Collado (2000) claim that ERP implementation has been one of the major themes for ERP system researchers and scholars. The authors comment that it is quite common for project managers to focus only the technical and financial aspects of the project implementation, forgetting to observe aspects related to cultural change, user activity and involvement of senior management.

An ERP system can be a powerful weapon in terms of competition and competitiveness for an enterprise; however, its implementation can be very risky if there is no appropriate planning and management (Sun *et al.*, 2015).

2.1. Stages of ERP implementation

Ashja *et al.* (2015) developed a work whose aim was to identify the ERP system life cycle and find the CSF that stood out at every point in its lifecycle. The authors state that several researchers presented models of ERP system lifecycle, watching the special features of the system; however, Ashja *et al.* (2015) proposed the classification of the ERP system life cycle in three essential stages in that all information system goes through pre-implementation, implementation and post-implementation processes.

According to Ashja *et al.* (2015), the pre-implementation stage begins when the organization understands that the ERP system is the best solution to enhance and develop its business. This phase involves the financial question and selecting the appropriate ERP system package.

On the implementation stage, these authors assert that this phase includes providing an action plan for implementing the ERP system, the application of the software package, users training and the execution system.

Ashja *et al.* (2015) claim that the last stage, post-implementation, includes two main stages: first, stabilization and, secondly, improving and updating. The authors state that, in this step, users' problems and difficulties stand out and, in addition, the project team must be ready for the correction of possible bugs and system settings for better performance, until all organization operations happen within normality.

For these authors, the system improvement and upgrade are crucial. They are related to the software update or the new modules addition to be integrated into the implemented system.

This stage ends when the organization notes that the ERP system in use needs to be replaced by another or when there is the need for exchanging the system's principal components.

Therefore, based on the study of Ashja *et al*. (2015), this work will structure the CSF in the three stages of the proposed ERP life cycle, so that the CSF may be evaluated by ERP system experts from educational institutions, within these three phases.

3. CRITICAL SUCCESS FACTORS

The concept of Critical Success Factors (CSF) was developed in early 1960s. Ronald Daniel was the first scholar who discussed, in the literature devoted to management, the idea of CSF. He stated that the information analysis should have the focus on success factors to help organizations achieve their targets (Alqashami *et* Mohammad, 2015).

Rockart (1979) was the one who issued the CSF method, describing it in a Harvard Business Review article, entitled "Chief Executives Define Their Own Data Needs" and, since then, the method of CSF came to be accepted and employed, in increasing numbers, in organizations (Bullen *et*

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Rockart, 1981).

According to the Bullen *et* Rockart's (1981) definition, the CSF are the key areas in a company in which favorable results are absolutely necessary, in order to ensure the organization productive performance.

Rockart (1979) noted that the CSF could lead the company to achieve satisfactory results, ensuring productive performance in the organization.

This methodology is still being applied, even today, by scholars in the organizational management area; thus, some aspects of the company are actually crucial to its success. Researchers, both in the past and present, have been devoted to studying and list multiple CSF that are essential for the successful implementation of ERP systems (Ciubotaru, 2012).

Ram *et al.* (2014) highlight that the implementation of the CSF tool, when properly managed, can have a significant impact on the success, contributing directly or indirectly to the positive outcome of the organization's performance.

Bullen *et* Rockart (1981) state that the set of CSF is relatively small, however, of great importance; therefore, it is a truly relevant affair, to which the manager must, in fact, focus his attention. For this reason, the term "critical success factors" is aptly chosen, because it represents the "factors" that are "critical" to the "success" of the implementation of any management project, within the organization. The key to success, for most managers of coordinated projects, is concentrating their focus on what really makes the difference between success and failure.

Bullen *et* Rockart (1981) state that it is quite important that the CSF characterize the key areas of activities, which should receive constant attention from management. In addition, the status of the project performance in each key area should be continuously measured and the status information must be accessible for managers' use.

Organizations must understand that the CSF are indicators and their performance should be regularly monitored in order to achieve the success in the expected results (Moreira, 2013).

Hoorn (2016) points out that there is a CSF set specific to each type of organization, varying the CSF importance in each project lifecycle phase; thus, the set of CSF is dynamic. For this reason, scholars investigating the success of factors in different projects, concluded that the factors are not universal and that they are subject to the specific project type. Vezzoni *et al.* (2013), however, point out that there is agreement on the fact that it is always best to focus attention on a few critical features that may interfere with the project, thus ensuring success.

4. RESEARCH METHOD

The present study was carried out through the development of the following steps:

- Step 1: Initially, aiming to provide theoretical support to the study, a literature review, through articles available on Scopus and Web of Science.
- Step 2: While reading the articles, the CSF cited by the authors were registered, and those that fit the reality of ERP system implementation in educational institutions were selected for this study. In this process, 30 CSF were observed, and among these, 20 CSF were selected for the survey.
- Step 3: The 20 CSF selected were then grouped into five categories, which are presented in section 5 in this article.
- Step 4: Based on the literature review, an online questionnaire was developed using the "encuestafacil.com" tool, which has been submitted to ERP systems in educational institutions experts, with the purpose of obtaining of these respondents, the perception on the CSF that most influence the implementation of ERP systems in educational institutions. Before the questionnaire was sent, a pre-test with five experts in ERP systems was conducted.
- Step 5: 70 experts in the implementation of the ERP systems in Brazilian public education institutions responded to the questionnaire. The responses were collected and tabulated in order to obtain the respondents' profile, as well as their perception of the degree of importance "too high" to the CSF in each phase of the ERP implementation.
- Step 6: A ranking of the 20 CSF was prepared and its position concerning the degree "too high", was perceived by the questionnaire respondents for each phase of the lifecycle of ERP.

5. LITERATURE REVIEW: GROUPING OF THE 20 CSF APPLIED TO THE RESEARCH

This bibliographic survey was determined by looking for articles that report on research that were related to or similar to the problem treated in this study. The articles selec-

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tion was held through the *Comissão de Aperfeiçoamento de Pessoal do Nível Superior* Journal Portal (CAPES - Commission for the Improvement of Higher Education Personnel), searching on Scopus and Web of Science, without restriction of publication year, using the keywords "ERP" AND "CRITICAL SUCCESS FACTORS".

The selection process of these articles was based on observation of the research objectives, the methodology and techniques used in the areas of knowledge, the results achieved with the use of the methods and the encountered problems in the process of implementation of the tooling used in the research. As a result of this search, 33 articles were selected for this job and 30 CSF were observed. Among these, 20 CSF were selected for this survey, because they fit the reality of ERP systems implementation in educational institutions.

Dezdar *et* Sulaiman (2009) conducted a study on the CSF taxonomy for ERP implementation projects and they were categorized in five main groups: ERP software, ERP expertise, ERP user, ERP project and ERP organization. According the authors, this classification type gives the chance to the responsible for the ERP system implementation project to have clarity in terms of what area may be presenting problems, allowing evaluation of the ERP implementation from five points of view.

Under this perspective, the 20 selected CSF for the search were then grouped in five categories proposed by Dezdar *et* Sulaiman (2009). It is noteworthy that these 20 CSF were chosen in order to contemplate a better implementation of ERP systems in Brazilian public education institutions.

Next, in table 1, the 20 selected CSF are arranged within the respective grouping, according to the Dezdar *et* Sulaiman's proposal (2009). The table is composed by two columns – on the left several authors who have cited the CSF and on the right column a brief description of what the CSF means.

6. RESULTS ANALYSIS

From the 20 CSF presented in the previous section, a questionnaire was prepared. It consisted of two types of issues: the introductory, in order to obtain the respondents' profiles; and the following, which asks the perception about the 20 selected CSF importance levels, within each ERP lifecycle phase. The responses were received by assigning values from 1 to 5, in a Likert scale, proposed as follows: level of importance 5-very high, 4-high, 3-average 2- low and 1- very low.

The Likert scale application aimed to get these specialists insight about the value 5-"very high importance", for each of the CSF presented, in each of the phases - pre-implementation, implementation and post-implementation, with the purpose of registering the CSF position as for the importance "too high", in the ERP system implementation project in its three phases.

The questionnaire, during the period from March 29 to June 29, 2016, was forwarded to 356 e-mails, belonging to public education institutions specialists of all Brazil 70 questionnaires returned filled in correctly, and the following is the description of the profile of these respondents and the result of the ranking of the CSF.

6.1 Respondents Profile

Follow up of the result of the introductory questions about the respondents' profile.

About the experience time in ERP implementations in Brazilian public education institutions, 19% had between 0 and 3 years, 28% had between 3 and 6 years, 22% had between 6 and 9 years and 31% had 10 years or more. It is observed that most of the participants in the survey had 10 years or more of experience in ERP system implementation.

As for participation in ERP system implementation, the vast majority has already participated in such implementation, as 93% of the respondents said "yes" and 7% said "no".

As regards to participation in the ERP implementation phases, 90% of respondents participated in the pre-implementation phase, 94% were active in the implementation phase and 84% attended the post-implementation phase.

The questionnaire also sought the percentage of the respondents' who participated in all 3 stages of ERP implementation – pre-implementation, implementation and post-implementation. More than half of the respondents (57.1%) participated in the 3 stages of the ERP implementation.

On the distribution by Brazilian regions, the answered questionnaires came from experts from all regions of Brazil: 8% were from the North; 27% from the Northeastern region; 35% from the Southeast region; 16% from the South; and 14% from the Midwest region.

In the second part of the questionnaire the experts were requested to report the degree of importance for each of the 20 CSF, described in section 6, in the pre-implementation, implementation and post-implementation phases, assigning values from 1 to 5, according to the Likert scale presented in this section.

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Table 1. CSF's categories, authors that cited them and a brief description

Category: ERP organization	
Critical Success Factor	**Description**
Top Management Support Authors that cited it: Ashja et al. (2015); Sun et al. (2015); Bintoro et al. (2015); Kapur et al. (2014); Beheshti et al. (2014); Hart et Snaddon (2014); Ziemba et Obląk (2013); Oliveira et Hatakeyama (2012); Hanafizadeh et al. (2010); Liu et Seddon (2009); Bologa et al. (2009); Ngai et al. (2008); Plant et Willcocks (2007); Nah et al. (2007); Finney et Corbett (2007); Soja (2006); Nah et Delgado (2006); Ehie et Madsen (2005); Gargeya et Brady (2005); Umble et al. (2003); Akkermans et Helden (2002).	It is the senior management's involvement in the project, clarifying the objectives, ensuring focus on the needs and ensuring that the organization employees recognize that the ERP implementation is a priority.
Effective Communication, Cross-Departmental Cooperation Authors that cited it: Ashja et al. (2015); Sun et al. (2015); Bintoro et al. (2015); Kapur et al. (2014); Beheshti et al. (2014); Hart et Snaddon (2014); Ziemba et Oblak (2013); Ahmad et al. (2012); Norton et al. (2013); Hanafizadeh et al. (2010); Françoise et al. (2009); Liu et Seddon (2009); Bologa et al. (2009); Ngai et al. (2008); Nah et al. (2007); Finney et Corbett (2007); Plant et Willcocks (2007); Nah et Delgado (2006); Gargeya et Brady (2005); Akkermans et Helden (2002).	The effective communication in the organization must occur between the various functions and levels of the organization, between the institution's departments, and, specifically, between the business staff and the IT staff in the ERP system implementation.
Clear Targets Project Authors that cited it: Ashja et al. (2015); Beheshti et al. (2014); Ziemba et Obląk (2013); Oliveira et Hatakeyama (2012); Hanafizadeh et al. (2010); Bologa et al. (2009); Umble et al. (2003).	The Organization must clearly define their targets, expectations and deliveries foreseen for each phase of the project. The targets must be logical and measurable.
Organizational Culture Authors that cited it: Ashja et al. (2015); Beheshti et al. (2014); Shaul et Tauber (2013); Ahmad et al. (2012); Norton et al. (2013); Hanafizadeh et al. (2010); Françoise et al. (2009); Liu et Seddon (2009); Bologa et al. (2009); Finney et Corbett (2007); Umble et al. (2003).	The organizational culture, in the context of the ERP system implementation, concerns how employees deal with the new technology in the organization and how they relate to this innovation, in the ERP implementation in the institution.
Business Mission and Vision Authors that cited it: Ashja et al. (2015); Ram et al. (2014); Hart et Snaddon (2014); Shaul et Tauber (2013); Ahmad et al. (2012); Hanafizadeh et al. (2010); Françoise et al. (2009); Liu et Seddon (2009); Ngai et al. (2008); Finney et Corbett (2007).	The organization must have a clear definition of its mission and vision. The ERP implementation in the institution must be justified on business targets.
Adequate Infrastructure Authors that cited it: Oliveira et Hatakeyama (2012); Hanafizadeh et al. (2010).	IT availability in the organization must be adequate, including architecture and skills. If necessary, the infrastructure needs to be refreshed and renewed for the ERP implementation.
Data Accuracy and Reliability Authors that cited it: Ashja et al. (2015); Ram et al. (2014); Beheshti et al. (2014); Hart et Snaddon (2014); Ram et al. (2013); Shaul et Tauber (2013); Ziemba et Obląk (2013); Ahmad et al. (2012); Oliveira et Hatakeyama (2012); Norton et al. (2013); Hanafizadeh et al. (2010); Françoise et al. (2009); Liu et Seddon (2009); Bologa et al. (2009); Ngai et al. (2008); Plant et Willcocks (2007); Nah et al. (2007); Finney et Corbett (2007); Soja (2006); Ehie et Madsen (2005); Gargeya et Brady (2005); Umble et al. (2003); Akkermans et Helden (2002).	The input data must be accurate and reliable, since they generate the information that must bring efficient and effective results.
Category: ERP project	
Critical Success Factor	**Description**
Project Management Authors that cited it: Ashja et al. (2015); Ram et al. (2014); Beheshti et al. (2014); Hart et Snaddon (2014); Ram et al. (2013); Shaul et Tauber (2013); Ziemba et Obląk (2013); Ahmad et al. (2012); Oliveira et Hatakeyama (2012); Norton et al. (2013); Hanafizadeh et al. (2010); Françoise et al. (2009); Liu et Seddon (2009); Bologa et al. (2009); Ngai et al. (2008); Plant et Willcocks (2007); Nah et al. (2007); Finney et Corbett (2007); Soja (2006); Ehie et Madsen (2005); Gargeya et Brady (2005); Umble et al. (2003); Akkermans et Helden (2002).	Project management refers to the plan management of the ERP system implementation. This involves not just the planning phase, but also assigning responsibilities, setting goals and human resources.

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Change Management Authors that cited it: Ashja et al. (2015); Sun et al. (2015); Bintoro et al. (2015); Kapur et al. (2014); Beheshti et al. (2014); Hart et Snaddon (2014); Shaul et Tauber (2013); Ziemba et Obląk (2013); Ahmad et al. (2012); Oliveira et Hatakeyama (2012); Norton et al. (2013); Hanafizadeh et al. (2010); Françoise et al. (2009); Liu et Seddon (2009); Bologa et al. (2009); Ngai et al. (2008); Plant et Willcocks (2007); Nah et al. (2007); Finney et Corbett (2007); Soja (2006); Nah et Delgado (2006); Gargeya et Brady (2005); Akkermans et Helden (2002).	With the ERP implementation, changes occur in the organization. If these changes are not managed effectively, they can cause resistance, confusion and redundancies. Change management is related to the company's transformation guidance, aligning it to the strategy and the implementation of the ERP plan.
BPR (Business Process Reengineering) Authors that cited it: Ashja et al.(2015); Bintoro et al.(2015); Ram et al. (2014); Beheshti et al.(2014); Hart et Snaddon (2014); Ram et al. (2013); Ahmad et al. (2012); Norton et al. (2013); Hanafizadeh et al. (2010); Françoise et al. (2009); Liu et Seddon (2009); Ngai et al. (2008); Nah et al. (2007); Finney et Corbett (2007); Nah et Delgado (2006); Ehie et Madsen (2005); Gargeya et Brady (2005); Akkermans et Helden (2002).	When the software is incompatible with the institutions, the researchers suggest that the organization needs to be redrawn. The BPR makes a deep analysis of the organization and its goals, proposing the redesign of its processes, making the organization lighter, more agile and more competitive.
The Champion Role Authors that cited it: Ashja et al. (2015); Kapur et al. (2014); Shaul et Tauber (2013); Ahmad et al. (2012); Norton et al. (2013); Françoise et al. (2009); Liu et Seddon (2009); Bologa et al. (2009); Ngai et al. (2008); Plant et Willcocks (2007); Nah et al. (2007); Finney et Corbett (2007); Nah et Delgado (2006); Gargeya et Brady (2005); Umble et al. (2003); Akkermans et Helden (2002).	At least one person within the organization should be recognized as the champion, defending the ERP plan implementation in the organization. The champion, can be male or female and must be respected in the institution, and may interfere in favor of the ERP implementation project, in the decisions of the organization.
Competent Project Team Authors that cited it: Kapur et al. (2014); Hart et Snaddon (2014); Shaul et Tauber (2013); Bologa et al.(2009).	It is a team formed by different groups, from different sectors and departments, where partnerships and synergies occur, involving the organization as a whole, in the acceptance of ERP implementation project.
Performance's Monitoring and Evaluation Authors that cited it: Hatakeyama (2012); Ngai et al. (2008).	This monitoring concerns the measurement of ERP system performance, since the implementation beginning, including the schedule, employees' performance and users' satisfaction. This is a regular measurement on the implementation progress, to control the ERP system effectiveness and efficiency.
Crisis Management and Problem Solving Authors that cited it: Finney et Corbett (2007); Ngai et al. (2008).	The crises and problems management monitoring, working together with consultants, in order to solve the problems, ensuring that the ERP system performance takes place according to the schedule.
Category: ERP software	
Critical Success Factor	**Description**
IT Used Before the ERP System Authors that cited it: Ashja et al. (2015); Hart et Snaddon (2014); Norton et al. (2013); Ahmad et al. (2012); Bologa et al. (2009); Dezdar et Sulaiman (2009); Ngai et al. (2008); Bradley (2008); Nah et al. (2007); Finney et Corbett (2007); Soja (2006); Nah et Delgado (2006); Ehie et Madsen (2005); Gargeya et Brady (2005); Holland et Light (1999).	This is about the transition and adaptation of the existing system to the ERP system management.
Minimal Customization Authors that cited it: Ashja et al. (2015); Bintoro et al. (2015); Kapur et al. (2014); Beheshti et al. (2014); Hart et Snaddon (2014); Shaul et Tauber (2013); Momoh et al. (2010); Bologa et al. (2009); Françoise et al. (2009); Ngai et al. (2008); Nah et al. (2007); Nah et Delgado (2006); Umble et al. (2003); Akkermans et Helden (2002).	The researchers claim that the ERP system to be implemented should be minimally customized and coded. Changes in the ERP system generate complexities, interfere with the implementation schedule and increase the project cost.

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Category: ERP User	
Critical Success Factor	**Description**
Training and Education Authors that cited it: Ashja et al. (2015); Kapur et al. (2014); Ram et al. (2014); Beheshti et al. (2014); Hart et Snaddon (2014); Ram et al. (2013); Shaul et Tauber (2013); Ahmad et al. (2012); Oliveira et Hatakeyama (2012); Norton et al. (2013); Hanafizadeh et al. (2010); Liu et Seddon (2009); Bologa et al. (2009); Plant et Willcocks (2007); Finney et Corbett (2007); Nah et al. (2007); Soja (2006); Nah et Delgado (2006); Umble et al.(2003); Akkermans et Helden (2002).	Training and education aim to simplify the ERP system use for the company staff. Organizations must have a detailed and formal training program for the ERP system use.
User Feedback Analysis Authors that cited it: Shaul et Tauber (2013); Soja (2006); Nah et Delgado (2006); Holland et Light (1999).	It is the user's feedback follow-up of the ERP system use.
Category: ERP expertise	
Critical Success Factor	Description
External Consultants, Qualified Consultancy Authors that cited it: Ashja et al. (2015); Bintoro et al. (2015); Kapur et al. (2014); Beheshti et al. (2014); Liu et Seddon (2009); Bologa et al. (2009); Plant et Willcocks (2007); Nah et al. (2007); Akkermans et Helden (2002).	The external consultant has experience in terms of the ERP system use and can help the organization in this system implementation.
Suppliers Support Authors that cited it: Ashja et al. (2015); Sun et al. (2015); Kapur et al. (2014); Beheshti et al. (2014); Shaul et Tauber (2013); Ahmad et al. (2012); Norton et al. (2013); Hanafizadeh et al. (2010); Bologa et al. (2009); Ngai et al. (2008); Plant et Willcocks (2007); Nah et al. (2007); Finney et Corbett (2007); Soja (2006); Akkermans et Helden (2002).	The suppliers support concerns the assistance, emergency maintenance, technical updates and user training, as well as ERP system upgrade and new modules introduction.

Resource: The authors' own.

6.2. Ranking of Very High Importance CSF

From the result of the values assigned to the CSF in each phase of the ERP life cycle, the values for the degree 5 - high importance, to the CSF in the stages of implementation of ERP were tabulated so that a ranking was prepared.

The result was the production of 3 rankings corresponding to the 20 CSF, each ranking referring to a phase of the ERP lifecycle. The 10 highest percentages were highlighted in bold, in cells differentiated by color and presented in tables 2, 3 and 4. These tables were constructed from the works of Paixão (2014) and Oliveira (2016), and consist of four columns: CSF dimension according to Dezdar et Sulaiman (2009); the CSF name; the responses percentage with degree of importance "too high"; and its ranking position.

Table 2, below, shows the CSF's ranking established from the percentage of the importance "too high" degree in the pre-implementation phase.

It is observed that, in table 2, the "Top Management Support" has a very high percentage in relation to the second position. Note that the factors IT Used before the ERP System and Competent Project Team, corresponding to the 3rd and 4th positions have the same percentage in the ranking. As to the dimensions of the CSF, note that ERP User and ERP Expertise dimensions are not among the 10 top positions in the ranking, which shows that, for this stage, these dimensions are not so relevant in the respondents' perception.

Table 3, below, shows the CSF's ranking established from the percentage of the degree of importance "too high" in the implementation phase.

It is observed that the CSF in the first position, Training and Education, is quite close to the CSF in the second position, Suppliers Support. Note that the CSF in the 4th position, Effective Communication, Cross-Departmental Cooperation and the 5th position, Adequate Infrastructure, have the same percentage. Moreover, the same occurs to the CSF in the 6th and 7th positions, Project Management and Competent Project Team. As regards to CSF dimensions, all of them are present in the top 10 ranking, which highlights the importance of all these dimensions in this phase.

Table 4, below, shows the CSF's ranking established from the percentage of the degree of importance "too high" in the post-implementation phase.

In Table 4, it is observed that the CSF of the 2nd and 3rd positions, Accuracy and Reliability of the Data and Suppliers Support, are present in the top 3 of table 3 ranking. Note that the monitoring and evaluation of Performance's Monitoring and Evaluation and Crisis Management and Problem Solving, corresponding to the 8th and 9th positions have the

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Table 2. CSF's ranking valued with "high importance" degree in the pre-implementation phase

DIMENSION	CRITICAL SUCCESS FACTOR	PRE-IMPLEMENTA-TION	RANKING
ERP Organization	Top Management Support	66,15%	1ª
ERP Organization	Clear Targets Project	53,85%	2ª
ERP Software	IT Used before the ERP System	48,33%	3ª
ERP Project	Competent Project Team	48,33%	4ª
ERP Organization	Mission and Vision of the Business	47,69%	5ª
ERP Project	Project Management	46,67%	6ª
ERP Project	BPR (business process reengineering)	45,00%	7ª
ERP Organization	Adequate Infrastructure	43,08%	8ª
ERP Project	Change Management	41,67%	9ª
ERP Organization	Effective Communication, Cross-Departmental Cooperation	40,00%	10º
ERP User	Training and education	37,21%	11ª
ERP Expertise	External Consultants, Qualified Consultancy	37,21%	12ª
ERP Project	The Champion Role	36,67%	13ª
ERP Software	Minimal customization	33,33%	14ª
ERP Organization	Accuracy and Reliability of the Data	32,79%	15ª
ERP Organization	Organizational Culture	32,31%	16ª
ERP Expertise	Suppliers Support	30,23%	17ª
ERP Project	Performance's Monitoring and Evaluation	28,33%	18ª
ERP Project	Crisis Management and Problem Solving	28,33%	19ª
ERP User	User Feedback Analysis	25,58%	20ª

Resource: The authors' own.

Table 3. CFS's ranking valued with "high importance" degree in the phase of implementation

DIMENSION	CRITICAL SUCCESS FACTOR	IMPLEMENTATION	RANKING
ERP User	Training and Education	53,49%	1ª
ERP Expertise	Suppliers Support	51,16%	2ª
ERP Organization	Accuracy and Reliability of the Data	50,82%	3ª
ERP Organization	Effective Communication, Cross-Departmental Cooperation	47,69%	4ª
ERP Organization	Adequate Infrastructure	47,69%	5ª
ERP Project	Project Management	46,67%	6ª
ERP Project	Competent Project Team	46,67%	7ª
ERP Organization	Clear Targets Project	43,08%	8ª
ERP Organization	Top Management Support	41,54%	9ª
ERP Software	IT Used before the ERP System	40,00%	10º
ERP User	User Feedback Analysis	39,53%	11ª
ERP Project	Crisis Management and Problem Solving	38,33%	12ª
ERP Project	Change Management	36,67%	13ª
ERP Organization	Organizational Culture	35,38%	14ª
ERP Expertise	External Consultants, Qualified Consultancy	32,56%	15ª
ERP Project	Performance's Monitoring and Evaluation	31,67%	16ª
ERP Organization	Mission and Vision of the Business	30,77%	17ª
ERP Project	BPR (business process reengineering)	28,33%	18ª
ERP Software	Minimal customization	28,33%	19ª
ERP Project	The Champion Role	26,67%	20ª

Resource: The authors' own.

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Table 4. CSF's ranking valued with "high importance" degree in the post-implementation phase

DIMENSION	CRITICAL SUCCESS FACTOR	POST-IMPLEMENTATION	RANKING
ERP User	User Feedback Analysis	67,44%	1ª
ERP Organization	Accuracy and Reliability of the Data	60,66%	2ª
ERP Expertise	Suppliers Support	58,14%	3ª
ERP Organization	Adequate Infrastructure	53,85%	4ª
ERP User	Training and education	51,16%	5ª
ERP Project	Change Management	43,33%	6ª
ERP Organization	Effective Communication, Cross-Departmental Cooperation	43,08%	7ª
ERP Project	Performance's Monitoring and Evaluation	41,67%	8ª
ERP Project	Crisis Management and Problem Solving	41,67%	9ª
ERP Project	Competent Project Team	40,00%	10º
ERP Organization	Clear Targets Project	33,85%	11ª
ERP Project	BPR (business process reengineering)	33,33%	12ª
ERP Organization	Top Management Support	32,31%	13ª
ERP Organization	Organizational Culture	32,31%	14ª
ERP Project	Project Management	31,67%	15ª
ERP Software	IT Used before the ERP System	26,67%	16ª
ERP Software	Minimal customization	26,67%	17ª
ERP Organization	Mission and Vision of the Business	26,15%	18ª
ERP Expertise	External Consultants, Qualified Consultancy	25,58%	19ª
ERP Project	The Champion Role	15,00%	20ª

Resource: The authors' own.

Table 5. CSF's ranking with "high importance" degree in 3 phases

		RANKING		
DIMENSION	CRITICAL SUCCESS FACTOR	PRE-IMPLEMENTATION	IMPLEMENTATION	POST-IMPLEMENTATION
ERP User	User Feedback Analysis	20ª	11ª	1ª
ERP Organization	Top Management Support	1ª	9ª	13ª
ERP Expertise	Suppliers Support	17ª	2ª	3ª
ERP Project	BPR (Business Process Reengineering)	7ª	18ª	12ª
ERP Organization	Effective Communication, Cross-Departmental Cooperation	10º	4ª	7ª
ERP Expertise	External Consultants, Qualified Consultancy	12ª	15ª	19ª
ERP Organization	Organizational Culture	16ª	14ª	14ª
ERP Project	Competent Project Team	4ª	7ª	10º
ERP Project	Change Management	9ª	13ª	6ª
ERP Project	Crisis Management and Problem Solving	19ª	12ª	9ª
ERP Project	Project Management	6ª	6ª	15ª
ERP Organization	Adequate Infrastructure	8ª	5ª	4ª
ERP Software	Minimal customization	14ª	19ª	17ª
ERP Organization	Mission and Vision of the Business	5ª	17ª	18ª
ERP Project	Performance's Monitoring and Evaluation	18ª	16ª	8ª
ERP Project	The Champion Role	13ª	20ª	20ª
ERP Organization	Accuracy and Reliability of the Data	15ª	3ª	2ª
ERP Organization	Clear Targets Project	2ª	8ª	11ª
ERP Software	IT Used before the ERP System	3ª	10ª	16ª
ERP User	Training and education	11ª	1ª	5ª

Resource: The authors' own.

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same percentage in the ranking. As for the dimensions of the CSF, note that the ERP Software dimensions is not among the top 10 in the ranking; therefore, this dimension was not considered very important for this stage.

Table 5, below, is a summary of previous three tables. It was built with the purpose of observing each factor placement, comparatively within each phase of the ERP life cycle, enabling a vision of the factor importance for each step of the ERP implementation. The table highlights, with shaded cells, ranking positions from the 1st to the 10th place in the pre-implementation, implementation and post-implementation phases.

It is observed that the CSF – Effective Communication, Cross-Departmental Cooperation; Competent Project Team and Adequate Infrastructure are within the top 10 ranking in the three phases of the ERP life cycle.

7. CONCLUSION

The objective of this work was to map specialists in Brazilian public education institutions regarding their perception of ERP systems, about the CSF considered of high importance for these systems' implementation, however, from the perspective of the 3 stages of implementation: pre-implementation, implementation and post-implementation.

Initially, a literature review was made, in order to obtain the CSF cited by the authors, for ERP system implementations. In this literature review 30 FCS were identified and, among these, 20 were selected for the survey and grouped into five categories: ERP Organization, ERP Project, ERP Software, ERP User and ERP Expertise. This grouping allows the responsible ERP system implementation project to have ease of perception in terms of what area can be occurring problems in the ERP system implementation within the company.

Based on the literature review the field research was prepared, via electronic questionnaire, requesting specialists in ERP systems in the Brazilian public education institutions about their perception in terms of the importance of 20 CSF in pre-implementation, implementation and post implementation stages, within a Likert scale, with the purpose of observing the very high importance CSF.

The questionnaire was forwarded to 356 e-mails, of which, 70 have been filled. Through the results tab, it could be observed that the respondents belong to Brazilian public education institutions; most of them have over 10 years of experience, have participated in the 3 phases of the ERP system implementation and belong to the Brazilian Southeast region.

As regards to the CSF evaluation, we conducted a ranking of CSF considered with "too high" degree of importance in each of those phases, in order to propose a set of the most influential CSF for the success, in the pre-implementation, implementation and post-implementation phases of ERP systems. It was found that the 3 CSF more cited as "very important" in the pre-implementation phase were: Top Management Support, Clear Targets Project and IT Used before the ERP System. In the phase of implementation were: Training and Education, Suppliers Support and Accuracy and Reliability of the Data. Finally, in the post-implementation stage, the 3 CSF more cited as "very important" were: User Feedback Analysis, Accuracy and Reliability of the Data and Suppliers Support.

It is worth noting that the prospect of the three phases of the ERP system life cycle: pre-implementation, implementation and post-implementation, allows a more rigorous control of the organization activity areas, where the results of monitoring can ensure the productive performance in the implementation of the ERP system.

It is expected that this research may help researchers and managers to apply, with greater precision, studies on CSF for success in ERP system implementations in education organizations.

It is expected, as well, that this research may help the debate on the success of ERP systems implementations among researchers, offering other theme views aimed to development.

As a suggestion for future work, it is suggested the observation and monitoring of critical success Factors in loco, demonstrating the need for adjustments to the initial proposal of CSF presented in this work, in ERP systems implementations in the context of educational organizations, from the grouping proposed in this research and within the 3 stages of implementation, also suggested in this study.

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