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Research Article

Adoption of ERP Systems in Small and Medium Enterprises: A Study of Multiple Cases In Southern Of Minas Gerais

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ARTICLE INFO	ABSTRACT
	This work analyzes the adoption of Enterprise Resource Planning (ERP) information systems in small and medium enterprises (SMEs). Adoption of ERP in SMEs can provide better control of organizational processes and quality to the information that drives decision-making. However, small and medium-sized enterprises have long remained outside the scope of ERP adoption research. Current scientific literature cover, at first, large firms and when SMEs are the unit of analysis, results are not similar whether compared to the large firms. Thus, this research aims to identify and analyze the factors that influence the adoption of ERP in SMEs. This purpose was achieved through a qualitative approach, inductive logic, interpretive epistemology, and a multiple case study (six firms) in companies located at the southern of Minas Gerais state, Brazil. Data were collected by interviews with the managers (administrative or IT) and analyzed by two techniques: Lexical and Content Analysis. We used Iramuteq software to support Lexical Analysis. We observed that the adoption of ERP in SMEs has higher influence by Technological and Organizational constructs than by Environmental factors. Variables such as commercial partnerships, external support and competitiveness were not observed as a factor that influence ERP adoption in SMEs. Otherwise, added value, compatibility, firm size, and the composition of the steering body were observed as a factor that positively influence ERP adoption in Brazilians SMEs. **Keywords:** Small and medium enterprises, Information systems, Enterprise Resource Planning, Technology-Organization-Environment.

INTRODUCTION

The shift of competitiveness from a local to global level requires small and medium businesses better control of their organizational processes and quality in the information that can direct the decision-making process (Ruivo et al., 2012). In this context, the adoption of Information Systems (IS) type ERP is observed as one of the premises for SMEs to have minimum levels of procedural controls and generation of structured information holistically in the firm (Ruivo et al., 2012). According to (Prates and Ospina, 2004, p. 12), in SMEs "the increase in organizational accuracy, aided by information systems, can lead to greater efficiency in the administration of their processes, resources, activities and greater effectiveness in obtaining previously established results".

The relevance of this work lies in presenting, through a multiple case study in the South of Minas Gerais, Brazil - the factors that lead to the implementation of ERP Information Systems in SMEs. SMEs are companies that have limited human, financial resources and lack strategic practices (Rodrigo Franklin Frogeri et al., 2019). These characteristics do not allow SMEs to make large investments, as is the case with the implementation of an ERP, without a prospect of return for the organization (Tomar, 2017).

Increasingly used in companies, ERP can provide advantages such as agility in organizational processes (Ruivo et al., 2012). Moreover, the adoption of ERP type SI in SMEs can improve the quality of organizational information, support the strategic decision-making process and, indirectly, provide competitive advantage in relation to companies that do not have such IT capacity (Rodrigo Franklin Frogeri et al., 2019).

However, small and medium-sized enterprises have long remained outside the scope of ERP research (Tomar, 2017). The contents found in the current bibliography cover, at first, large companies and when they are applied in SMEs do not present similar results (Tomar, 2017). Thus, this research can contribute to the expansion of the literature involving SMEs and the adoption of ERP in SMEs.

This study aims to identify and analyze the factors that influence the adoption of ERP Information Systems in SMEs. Thus, the following research question led the study: factors associated with Technology, the Organization, and the Environment to which the organization is subject influence the adoption of ERP systems in SMEs?

This purpose was achieved through a qualitative, inductive logic approach with interpretive epistemology and a multiple case study in companies in the South of Minas Gerais. The data were analyzed through Content Analysis (Bardin, 2011) and Lexical Analysis (Marchand and Ratinaud, 2012).

THEORETICAL FRAMEWORK

Theoretical framework was organized into three sections. First section discusses Information System types and its concept. Second section discusses ERP information system characteristics. Third section presents the ERP information systems adoption model based on (Awa and Ojiabo, 2016).

Information Systems

According to (Laudon and Laudon, 2015, p. 15) an Information System (SI) can be technically defined as "a set of interrelated components that collect (or retrieve), process, store, and distribute information designed to support decision-making, coordination, and control in an organization. In addition, information systems also help managers and workers analyze problems, visualize complex issues, and create new products". According to (Stair, 1998, p. 12) "information systems are a series of interrelated elements or components that collect (input), manipulate and store (process), disseminate (output) data and information, and provide a feedback mechanism."

(Laudon and Laudon, 2015) suggest different types of information systems, including: Transaction Processing Systems (TPS), Management Information Systems (MIS), Decision Support Systems (DSS) and Executive Support Systems (ESS). TPS can be defined as computerized systems that perform and record day-to-day transactions for the operation of a firm, such as sales and payments (Laudon and Laudon, 2015). Using the data generated by TPS, MIS provides reports with the organization's current performance to managers and thus helps monitor and control the firm. With the information generated by TPS, MIS and information from external sources, DSS focus on unique problems. Finally, the ESS support senior management in non-routine decisions, where there is a need for perception and common sense (Laudon and Laudon, 2015).

ERP Information Systems

According to (Laudon and Laudon, 2015), the need to integrate all types of information systems resulted in the emergence of ERP systems, acronym of Enterprise Resource Planning. According to Souza and Zwicker (200, p. 47), ERP systems can be defined as: "Integrated information systems, acquired in the form of commercial software packages, in order to support most of a firm's operations (supplies, manufacturing, maintenance, financial administration, accounting, human resources, etc.)".

According to (Pan and Jang, 2008, p. 100), "ERPs facilitate the automation of many, if not all, basic processes in order to integrate information into a firm and to eliminate complex and expensive interfaces between computer systems". This type of IS can be a differential to the firm because can integrate data, consolidating information and making them available quickly (Carvalho et al., 2008). The information is stored in a single database that increases reliability, security and access (Carvalho et al., 2008).

Integrated management systems are software purchased to meet the computerization needs of a wide gama of firm operations. A single, centralized database mediates the various information that will be processed in modules with integrated processes between the departments of a firm (Escobar-Rodriguez et al., 2014).

(Zwicker and de Souza, 2000) present a set of characteristics found in ERP type systems that distinguishes it from other systems, that is: (i) ERP's are commercial software packages - ERPs are software ready to be purchased; (ii) ERP's incorporate standard business process models. ERPs are designed with traditional business process models to serve more companies and have scale; (iii) ERPs integrate the various areas of a firm. ERPs integrate information between departments. A single system serves multiple departments of the firm; (iv) ERP's use a corporate database. All firm information is stored in a single data source; (v) ERP's have a wide functional scope. For each business process, ERPs provide many functions. The set of these functions form the modules, usually connected to a department; (vi) ERP's require adjustment procedures. They allow customization and parameterization in their processes to suit the particularities of a firm. They are always up to date for improvements and bug fixes.

Finally, an Enterprise Resource Planning (ERP) can be conceptualized as a type of software that organizations use to manage day-to-day business activities such as accounting, procurement, project management, risk management and compliance, and supply chain operations. A complete ERP suite also includes enterprise performance management, software that helps plan, budget, predict, and report on an organization's financial results. However, organizations' realities are not all identical and ERP's functionalities may vary depending on the industry branch.

ERP Information Systems adoption model

To analyze the factors that involve the adoption of an ERP in Small and Medium Enterprises (SMEs), we sought in the study of (Awa and Ojiabo, 2016) the constructs that involve this phenomenon. (Awa and Ojiabo, 2016) present a taxonomy of the TOE (Technology, Organization and Envinronment) structure of .The structure suggested by (Awa and Ojiabo, 2016) defines three constructs for the adoption of an ERP, namely: Technology, Organization, and the Environment. For each construct, variables were defined, as shown in **Figure 1**, as follows:
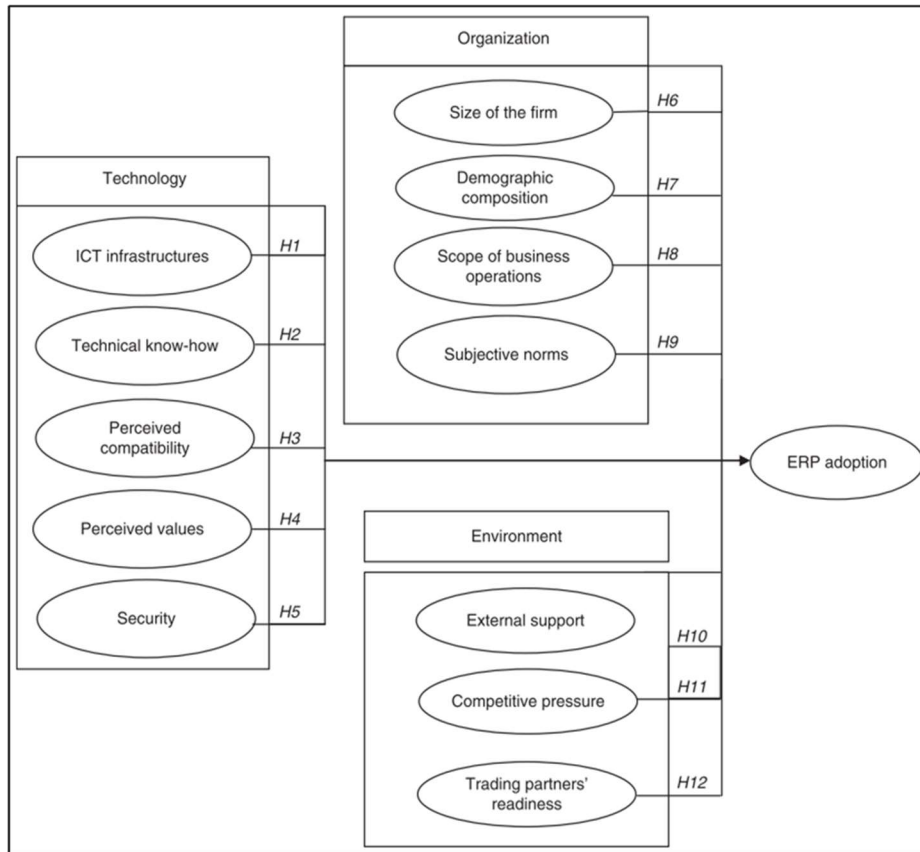
Figure 1. Proposed structure for ERP adoption

(Awa and Ojiabo, 2016) define that the Technology construct is composed of variables related to the availability of physical resources, knowledge of technical support, the benefits that ERP adoption can result and data security. **Table 1** presents the Technology construct, its variables, and assumptions with its respective definition. The Organization construct, its variables, and assumptions with the respective definition is presented in **Table 2**. The last construct of taxonomy suggested by (Awa and Ojiabo, 2016) is the Environment, composed of three variables (competitiveness, external support, and commercial partnerships). **Table 3** presents the Environmental construct, its variables, and assumptions with the respective definition.

Thus, based on the taxonomy of the TOE model suggested by (Awa and Ojiabo, 2016) the twelve assumptions of this study were established.

Table 1. Technology - TOE taxonomy

Variable	Assumptions	Definition
Infrastructure IT	P1. The availability of IT infrastructure significantly determines the adoption of an ERP-type Information System.	IT infrastructure is made up of hardware and software. Thus, the availability of hardware such as computers, networks and internet can influence the adoption of ERP
Technical knowledge	P2. The availability of technical know-how significantly determines the SMEs adoption of ERP.	Technical knowledge supports ERP definitions and maintenance.
Compatibility	P3. Compatibility between ERP software and existing platforms makes it possible to be used among SMEs.	Possible ERP integrations with other internal or external platforms (such as tax obligations) significantly determines the adoption of ERP.
Added value	P4. The added value and/or benefits of ERP software to facilitate operations make it possible to adoption among SMEs.	Added value as competitive advantage can significantly influence ERP adoption.
Safety	P5. There is a significant relationship between information security and ERP adoption.	The information unified and stored in a database represents more security and this can determine the adoption of ERP.

Table 2. Organization - TOE taxonomy

Variable	Assumptions	Definition
Firm Size	P6. The size of SMEs significantly determines the possibility of the adoption of ERP installations.	The size, in this case, is related in the scope of operation (local, regional, state, national and international) and the number of services provided.
Composition of the steering body	P7. The composition of the governing body of the decision-making team significantly determines the adoption of ERP facilities by SMEs.	The organization's strategies are defined by senior management. The knowledge related to the innovation of managers can support the adoption of ERP.
Scope of business operations	P8. The scope of business operations is more likely to positively determine ERP adoption.	Companies with more technological business operations such as e-commerce make them more receptive to innovation.
Subjective norms	P9. Subjective standards significantly determine the possibility of adoption of ERP resources.	The subjective norm is inserted in the social influence in a group. If decision makers belong to a group with innovative people, innovation can thus be influenced, such as ERP.

Table 3. Environmental - TOE taxonomy

Variable	Assumptions	Definition
Competitiveness	P10. Competitive pressure significantly determines the adoption of ERP solutions by SMEs.	A firm inserted in a market with high competitiveness will be motivated to innovate to gain an advantage over its competitor.
External Support	P11. External support significantly influences the adoption of ERP software by SMEs.	External support, such as state funding, can influence the adoption of an ERP in an SME.
Commercial partnerships	P12. The readiness of trading partners significantly determines the adoption of ERP by SMEs.	The need to be integrated with your suppliers and customers can determine the adoption of ERP.

METHODOLOGY

Methodologically, the study has a qualitative approach, inductive logic and interpretive epistemology. As for the objective, it is descriptive and is characterized by being a multiple case study.

The diversity of classifications given to the concept of SMEs interfere in scientific studies that seek comparative conclusions with other countries (R.F. Frogeri et al., 2019). In Brazil, for example, we have institutions such as Sebrae that define the size of the firm according to the number of employees and the National Development Bank (BNDES) that considers annual gross operating revenue or annual income. **Table 4** shows the BNDES classification for companies according to their size, used in this study:

The companies participating in this study are in Pouso Alegre, south of Minas Gerais. Pouso Alegre is the second largest city in southern Minas Gerais, with more than 150,000 inhabitants. Due to its location, where it is 200 kilometers from the capital São Paulo and 400 from Belo Horizonte, it has become an industrial hub.

Table 4. BNDES Classification

Classification	Annual Gross Operating Revenue or Annual Income
Microenterprise	Less than or equal to R$ 360,000
Small business	Greater than R$ 360,000,00 and less than or equal to R$ 4.8 million
Medium enterprise	Greater than R$ 4.8 million and less than or equal to R$ 300 million
Large firm	Greater than R$ 300 million

Table 5. Companies participating in the study

Firm Id	Sector	Size
Alpha	Provision of services	Small business
Beta	Provision of services	Medium enterprise
Gama	Industrial	Medium enterprise
Delta	Industrial	Medium enterprise
Zeta	Industrial	Medium enterprise

Table 6. Interviewees participating

Enterprise Id	Name	Gender	Position	Time in the position	Education
Alpha	E1	Male	Administrative Manager	3 years old	Graduation in Information Systems. Specialization in IT Governance
Beta	E2	Female	Administrative and Financial Manager	5 years old	Graduation in Business Administration
Gama	E3	Female	Administrative Manager	2 years old	Graduation in Human Resources Management
Delta	E4	Female	Administrative Manager	2 years old	Graduation in Business Administration. Postgraduate in production planning and control
Delta	E5	Male	IT Manager	6 years old	Graduation in Information Systems. Specialization in IT Governance
Zeta	E6	Female	Administrative and Financial Manager	6 years old	Graduated in Accounting. Specialization in business management

Data collected occurred by semi-structured interviews conducted according to the script described in **Appendix I**, based on the taxonomy of the TOE model suggested (Awa and Ojiabo, 2016). The interviews happened with six managers and decision makers of the firms involved in this study. Data analysis was performed using the Content Analysis (Bardin, 2011) and Lexical Analysis (Marchand and Ratinaud, 2012).

(Bardin, 2011) suggests that the Content Analysis technique occurs in three stages: pre-analysis, exploration of the material and treatment of the obtained results and interpretation. In the first stage, the preparation and reading of the material were performed, going to the coding and categorization stage of the material, and reaching the analysis and interpretation of the results.

Lexical Analysis was elaborated through the Iramuteq textual analysis software that allows analysis such as word cloud, similitude analysis, factor analysis of correspondence (CFA) among others (Camargo and Justo, 2013).

To follow the best practices in scientific research involving human beings, the study was submitted to the Research Ethics Committee in Brazil (CEP) and is approved under the number of Certificate of Presentation of Ethical Appreciation (CAAE) 39615720.3.0000.5111.

ANALYSIS AND DISCUSSION

Table 5 shows the classification of the companies participating in this study. Due to the diversity of classifications of a firm, it was decided to classify the firms by BNDES classification because it involves the annual income of a firm and not the number of employees. According to (Torrès and Julien, 2005), a small firm is not necessarily a small business; a small firm, but with characteristics of a large business, has decentralized management, high level of work specialization, explicit and long-term strategy, complex and formal internal and external information systems and, for the most part, operate in world markets (Torrès and Julien, 2005). **Table 5** present the identification of the firm, sector, and size.

Among the firms described, only Zeta operates internationally, the others nationwide. Alfa has been in the market for more than 20 years, specializes in cleaning and conservation, outsourcing of labor, urban pest control, services with various trucks and equipment rental. The Beta firm operates since 1996 providing industrial technical cleaning service, mechanized sweeping, highway maintenance, hyper vacuum and equipment leasing. In the market for 15 years, Gama operates in the productive sector of natural assets, through the extraction of essential oils from wood. For more than 30 years in the market, Delta operates in the production sector of popsicle and ice cream. And the zeta firm, operates in the import of cosmetic raw material for more than 2 years.

Data were collected between October and November 2020. Part of the interviews were conducted via videoconferencing software (3), and part in person (2). **Table 6** highlights the socio-demographic data of the interviewees, and of the 5 companies (Delta firm had two interviewees).

All interviewees have at least complete higher education. Four of the interviewees are female and two are male. The predominant position among the interviewees is administrative manager (5) and only one IT manager.

Analysis was initiated by the Technology construct according TOE taxonomy. We observed that the variables "IT Infrastructure" and "Technical knowledge in IT" are variables to support the adoption of an ERP and are not determining factors, according to the interviewees' statements: "The infrastructure is robust and supported the adoption. But it was not decisive" (E5) and "We start from the premise that all employees of our firm have technical knowledge, so this did not affect the choice of ERP." (E1).

The variables "Value added" and "Compatibility" were cited in most responses as determining factors. The variable "Added value" had 100% (6) of the respondents' answers initiated by affirmation words. The responses demonstrate the benefits gained from the adoption of ERP information system, according to the statements: "With the ERP, the information is more reliable, fast and organized, and also contributed to the reduction of operating costs." (E1); "[…] more planning, real-time information, control and agility in information" (E2); "[…] optimization of time, safety, greater control" (E3); "[…] agility in information to aid decision-making" (E4); "[…] cost reduction, elimination of rework and integration of information" (E5) and "[…] ensures beyond the finely tuned control of costs, reliability of information and compilation of results more efficiently and in little time." (E6). The variable "Compatibility" was cited as a

determining factor in four of the six possible responses motivated, for example, by the need for integration with legacy software, as reported: "Yes, the firm has legacy software and the integration with this software was essential." (E5).

All interviewees (6) affirmed the importance of the variable "Security", according to the statements: "Yes, for information security" (E4); "[…] is a security for the firm." (E5). However, only three interviewees considered that the supposed security of information that an ERP information system can provide is a determining factor for its adoption, according to the statements: "Yes, for sure! This was a determining factor for the adoption of ERP" (E1); "Yes, we believe it was a determining factor as well." (E3) and "Yes, no doubt, security and ease of sharing information as a whole." (E6).

To complete the analysis of the technology construct, lexical analysis was applied to the textual *corpus* of the statements (**Figure 2**).

Word cloud analysis presents a predominance of the word "Yes - Sim" (frequency equal to 16), "determinant - determinante" (12), and "ERP" (11), suggesting that the Technology construct is a determining factor for the adoption of an ERP. The analysis of similitude allowed identifying the relationship between these words and evidenced the term "determinant - determinante" as central, supporting the analysis by word cloud and ratifying the construct "Technology" as a determining element in the adoption of an ERP. However, we observed in the analyses of this construct that only the variables "Value added" and "Compatibility" had several citations above the mean value (see **Table 7**).

Thus, the analyses suggest that the variables "Value added" and "Compatibility" are the most relevant within the Technology construct, agreeing with the results of (Awa and Ojiabo, 2016). However, the variables "IT Infrastructure" and "Technical Knowledge" were not observed as a determining factor for the adoption of an ERP in an SME, contradicting the results presented by (Awa and Ojiabo, 2016).

(Awa and Ojiabo, 2016) suggest as an explanation for the variables "IT Infrastructure" and "Technical knowledge" as relevant for the adoption of an ERP the following arguments: "(...) Nigeria, when compared to other economies (including South Africa, India and even Ghana), modern technologies have not yet reached a relatively high level of adoption - few SME employees/owners own computers and integrate online operations" (Awa & Ojiabo, 2016, p. 917).
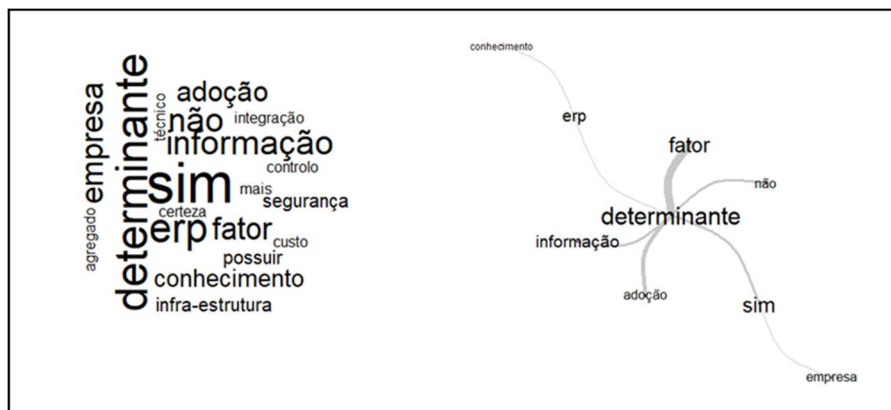

Figure 2. Word cloud analysis and similitude for the Technology construct[1]

Table 7. Content analysis of the Technology construct

Variable	Determining factor
Added Value	6 quotes
Compatibility	4 quotes
Safety	3 quotes
Technical knowledge	1 quote
IT Infrastructure	No quote

The arguments of (Awa and Ojiabo, 2016) are more supported when observing the study by (Premkumar and Roberts, 1999) and (Thong, 1999) where the variable "IT Infrastructure" is not observed as a predictor of the adoption of an Information System. SMEs with owners with innovative characteristics and greater knowledge in Information Technology are a determining factor for the adoption of an IS (Thong, 1999) while companies that are in more competitive markets and suffer from external pressures tend to already have an IT infrastructure, and this is not a relevant factor to adopt an IS (Premkumar and Roberts, 1999).

The analysis of the Organization construct presented the variables "Firm size" and "Composition of the steering body" as determining factors for the adoption of an ERP information system. Among the interviewees, four highlighted the variable "firm Size", according to the statements: "Our firm operates at the national level, and its growth was a determining factor for the adoption of ERP." (E1); and "[...] from a certain size the firm needs an ERP to support the operation." (E5). The variable "Composition of the steering body" was also mentioned four

[1] *Data were analyzed in brazilian portuguese language.*

times as a determining factor, according to reports: "Yes, the direction of the firm was a determining factor for the implementation of the ERP." (E1); and "The starting decision of the board is crucial to the understanding of adoption by the rest of the firm." (E5).

We observed that the variables "Scope of business operations" and "Subjective norms" are not determining factors for the adoption of an ERP information system, according to

the statements: "[…] the branch of the firm may have delayed adoption, due to high seasonality that does not allow well-defined scenarios for implementation" (E5) and "[…] innovation is something always discussed but did not influence adoption" (E4).

To complete the analysis of the Organization construct, the lexical analysis was applied to the textual *corpus* of the statements (**Figure 3**).

Figure 3. Word cloud analysis and similitude for the Organization construct[2]

Table 8. Content analysis of the Technology construct

Variable	Determining factor
Firm Size	4 quotes
Composition of the steering body	4 quotes
Subjective norms	2 quotes
Scope of business operations	1 quote

Table 9. Content analysis of the Environment construct.

Variable	Determining factor
Commercial partnerships	2 Quotes
Competitiveness	No quote
Commercial partnerships	2 Quotes

Word cloud analysis presents a predominance of the word " firm - empresa" (14), "ERP" (12), "no - não" (11) and "yes - sim" (10), suggesting that this construct was formed with determinant variables and other variables not determinant for erp adoption. The analysis of similitude allowed to identify this division. Therefore, it confirms what is observed in the statements of this construct, since the variable "Firm size" and "Compatibility" had citations of determining factors and on the other hand the variables "Scope of business operations" and "Subjective norms" were not mentioned in most statements as a determining factor. **Table 8** presents, in summary, the analysis for each variable belonging to the Organization construct. ´

The analyses presented in **Table 8** have close alignment with the results found by (Awa and Ojiabo, 2016). The variables "Subjective norms" and "Scope of operation" were also observed by (Awa and Ojiabo, 2016) with low explanatory power for the adoption of an ERP in SMEs, unlike the variable

"Firm size" which presented a strong positive influence and "Composition of the steering body" with a moderate influence (Awa and Ojiabo, 2016).

The last construct analyzed was the Environment. Among the eighteen answers of the interviewees to the construct variables, fifteen contained the word "No - Não", according to the analyses performed. The variables that presented a certain highlight were only "Commercial partnerships" (2) and "External support" (1), but there were no statements that suggested these variables as determinants for the adoption of an ERP (see **Table 9**):

The results about the construct "Environment" are, in its entirety, aligned with those observed by (Awa and Ojiabo, 2016) when observing Nigerian SMEs. The three variables of the construct "Environment", although influential in the phenomenon, do not provide explanation for the adoption of an ERP.

The analyses suggest that the model of adoption of an ERP,

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[2]*Data were analyzed in brazilian portuguese language.*

presented by (Awa and Ojiabo, 2016), should be rethought for a context of Brazilians small and medium-sized firms, as shown in **Figure 4**.

The model presented in **Figure 4** suggests that the Technological and Organizational constructs are more relevant than the Environmental construct for the adoption of an ERP information system in an SME. It is suggested the removal of the variable "IT Infrastructure" from the Technology construct, since it was not relevant in the analyses performed. The analyses suggest that the adoption of an ERP does not consider the variable "IT Infrastructure" as a determining factor, suggesting that this analysis will occur at a time after the adoption decision. Moreover, the variable "Competitiveness" of the Environment construct was also observed as non-determining for the adoption of an ERP. The dashed line in **Figure 4** suggests the little influence of the Environment construct for the adoption of an ERP in the context of an SME. Although present in the interviewees' statements, the variables "External Support" and "Commercial Partnerships" were not listed as determinants in the adoption of an ERP.
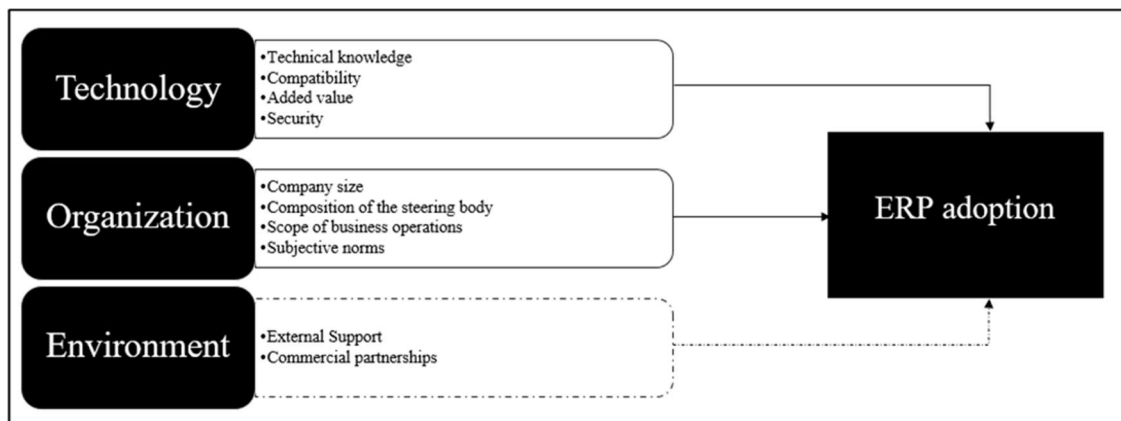

Figure 4. Adoption mode of ERP information systems in Brazilians SMEs

CONCLUSION

At this moment, it is opportune to resume the research question that led the study - factors associated with Technology, the Organization itself and the environment to which the organization is subject influence the adoption of ERP systems in SMEs? The results of the study showed that the adoption of ERP information systems in Brazilians SMEs is more influenced by technological and organizational constructs than by environmental factors.

In one hand, the variables belonging to the Environment construct, such as Commercial Partnerships, External Support and Competitiveness were not observed as determinants for the adoption of an ERP. On the other hand, the variables "Added value" and "Compatibility" were observed as the most relevant within the Technology construct, while the variables "IT Infrastructure" and "Technical knowledge" were not relevant to influence the adoption of an ERP in Brazilians SMEs. These results were divergent with some literature and convergent with other ones. We believed that this divergence may be associated with the level of maturity that companies have in the use of Technologies. Organizations operating in more dynamic and competitive markets tend to have levels of maturity in the use of higher Information Technologies in relation to firms that operate in markets that are not dynamic and less competitive and may influence the factors that most contribute to the adoption of an ERP.

For the Organization construct, the variables "Subjective Norm" and "Scope of business operations" proved to be non-determining for the adoption of an ERP in SMEs, unlike the variables "firm size" and "Composition of the steering body" were observed as determinants. We believed that the variable "Composition of the steering body" reflects the organizational structure found in small and medium-sized firms, where hierarchical levels are lower as regards to large companies, thus promoting direct influence of directors and decision makers.

The variable "firm size" can be observed in two perspectives. Following recommendations from (Torrès and Julien, 2005), a small firm is not necessarily a small business. Therefore, the variable "firm size" as an influencing factor in the adoption of an ERP can be aided by other variables such as type of management (centralized or decentralized), level of specialization of work (high or low), explicit and long-term strategy, use complex and formal internal/external information systems, and market operation (local, regional, national, or global).

We believed that the present study contributes to the academy and, especially, to the SMEs firms and professionals who are involved with the adoption of ERP information system. For the academy, the study expands the discussions about the unit of analysis "factors that influence the adoption of ERP information system in SMEs". In the organizational and professional field, the study discusses structural and social characteristics that can influence the adoption of an ERP in SME firms.

Even though methodological principles required by a scientific study have been adopted, limitations should be considered. The diversity of characteristics involving an SME can be considered a limiting factor for generalizations to be established in the literature. In this sense, we tried to select organizations with characteristics that represent a well-defined stratum of SMEs, but that may not represent the majority of this group of firms. In addition, we observed the phenomenon only the perspective of the main decision makers of the firm. However, it is known that the adoption of an ERP involves not only the strategic level, but also employees of operational levels, and these can awaken factors that greatly influence the adoption of an ERP - e.g., culture, resistance to the adoption (Frogeri et al., 2020b).

From a social perspective, some studies suggest that the culture of the organization or even the cultural traits of a people can influence in different ways in the adoption of an information system (Frogeri et al., 2020a), which may be a phenomenon observed in future studies. The framework proposed by (Awa and Ojiabo, 2016), although relevant to the literature, is subject to variations in the results that can be minimized by further studies involving both quantitative and qualitative approaches, especially if other constructs or variables were used.

Our results can support further studies in the pursuit to comprehend the role of ERP information systems in the era of Industry 4.0 and digital transformation, and how to combine new technological tools with organizational needs at information level.

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APPENDIX

Appendix I. Interview Script

Construct	Variable	Assumption	Question
Technology	Infrastructure IT	P1. The availability of IT infrastructure significantly determines the adoption of an ERP-type Information System in SMEs.	How is your organization's IT infrastructure? Do you believe that your organization's IT infrastructure was a determining factor in the adoption of an ERP system?
Technology	Technical knowledge	P2. The availability of technical know-how significantly determines the adoption of an ERP-type Information System in SMEs.	How is the technical knowledge of your employees? Do you believe that the technical knowledge of your employees was a determining factor for the adoption of an ERP-type information system?
Technology	Compatibility	P3. The compatibility between ERP software and existing platforms makes it possible to use an ERP-type Information System in SMEs.	Do you believe that integration with existing software (e.g. banking and tax obligations) was a determining factor in the adoption of an ERP-type information system in your organization?
Technology	Added Value	P4. The added value and/or benefits of the ERP information system motivates its adoption in SMEs.	Do you believe that the added value that an ERP-type information system was a determining factor for its adoption here in the firm? What benefits, in your perception, has ERP brought to the firm? For example, has it brought competitive advantage, reduced operating costs or something similar?
Technology	Safety	P5. There is a significant relationship between information security and erp adoption in SMEs.	Would you say that having your firm's information in an ERP-type information system is a security for the firm? If so, was it a determining factor for the adoption of an ERP system?
Organization	Firm Size	P6. The size of The SME significantly determines the possibility of the adoption of an ERP-type information system in SMEs.	Located in Pouso Alegre, what is the scope of the firm's operations? How would you rate your firm relative to size? Do you believe that this dimension of the firm was a determining factor for the adoption of an ERP?
Organization	Composition of the steering body	P7. The composition of the steering body of the decision-making team contributes significantly to the adoption of ERP-type information systems in SMEs.	How is the composition of the organization's governing body? Who participates in the decision-making process? Do you believe that the composition of the governing body influenced the adoption of an ERP system? If not, what was the determining factor for the adoption of ERP, in your perception?
Organization	Scope of business operations	P8. The scope of business operations is more likely to positively determine the adoption of an ERP-type information system in SMEs.	Do you believe that the business of the firm was a determining factor for the adoption of ERP? At some point did you find yourself pressured to adopt an ERP system? If so, how was that pressure and on whose part?
Organization	Subjective norms	P9. Subjective norms significantly determine the possibility of the adoption of an ERP-type information system in SMEs.	In your social cycle, would you classify people as innovative? Do people in your business-associated social cycle often discuss new technologies and their business impact? If so, how does it happen? Would you say that this social cycle has influenced, in some way, the adoption of an ERP system?
Environment	Competitiveness	P10. Competitive pressure significantly determines the adoption of ERP-type solutions in SMEs.	In your opinion, was the adoption of an ERP-type system in your organization due to its competitors? Do you believe that the competition pressured you in some way to adopt an ERP system? If so, was it the determining factor?
Environment	External Support	P11. External support significantly influences the adoption of ERP-type information systems in SMEs.	Have you had any support for technological innovation through an outside institution? At any time have you been encouraged, externally to the organization, to adopt some kind of information technology? Comment! If so, was it the determining factor for the adoption of the ERP system?
Environment	Commercial partnerships	P12. The readiness of business partners significantly determines the adoption of ERP-type information systems in SMEs.	Do you believe that the organization's relationships with external business partners have influenced, in some way, the adoption of an ERP? If so, how did it happen?