

Technology Acceptance Model of ERP software in Small Business: A Systematic Literature review

(Modelo de Aceptación Tecnológica de un software ERP en pequeñas empresas: Una revisión sistemática de literatura)

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Abstract

Adopting an ERP system could become a task that does not necessarily lead to success. In this work, we have conducted a systematic review of the literature considering the technology acceptance model (TAM) in an exhaustive search of 11 scientific databases, applying the PRISMA method. A total of 341 articles were obtained, and 53 were selected as eligible. The Iramuteq tool under R was applied to perform text analysis to quantify the results. We conclude that the relevant factors to consider in implementing an ERP become the mitigation of computational anxiety. The literature identifies some strategies, such as adequate end-user formation programs, documentation, technical facilitation conditions, social influence, and organizational motivators.

Keywords

TAM; Technology Acceptance Model; ERP; Enterprise Resource Planning; SMEs; SLR; Literature Review; PRISMA Model; information technology; IT.

Resumen

Adoptar un Sistema ERP puede convertirse en una tarea que no necesariamente conlleve al éxito. En este trabajo se realiza una revisión sistemática de literatura considerando el Modelo de Aceptación Tecnológica (TAM) en una exhaustiva búsqueda en 11 bases de datos científicas, aplicando el método PRISMA. Se obtuvieron 341 artículos en total, y de estos, 53 fueron considerados como elegibles. Para cuantificar los resultados, se utilizó la herramienta Iramuteq sobre R para ejecutar el análisis de texto. Se concluye que los factores relevantes por considerar en una implementación de un ERP se resumen en la ansiedad computacional, para las cuales algunas estrategias han sido identificadas en la literatura, como un adecuado programa de formación para el usuario final, documentación, condiciones de facilitación técnica, influencia social, y motivadores organizacionales.

Palabras clave

TAM; Modelo de Aceptación Tecnológica; ERP; Planeamiento de Recursos Organizacionales; PYMES; SLR; Tecnologías de Información; TIC.

1. Introduction

Currently, Enterprise Resource Planning (ERP) solutions have been implemented by companies worldwide (Witjaksono et al., 2021). They are classified as the best information management systems (Varasteh et al., n.d.) due to their positive impact on efficiency and effectiveness in both business processes and in improving employee performance (Witjaksono et al., 2021). Although having Enterprise Resource Planning software within an SME can bring significant advantages

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compared to similar organizations, some scenarios can become serious disadvantages when adopting this software.

The high cost and complexity in the implementation phase (Chou & Hong, 2013), acceptance by end-users, and possible managerial and socio-environmental factors affect user behaviour and adoption in a different organizational context (Kwak et al., 2012). Despite the advantages of having an ERP solution in an organization, these are not always following the reality of an SME, and far from becoming a solution, it can show a false causality in its management. Thinking about the needs that human beings maintain can be understood philosophically from Maslow's theory (Maslow, n.d.), which proposes the pyramid of needs: i) basic, ii) security, iii) social, iv) recognition, and v) self-realization. Under this premise, the Technology Acceptance Model (TAM) developed by Davis (Davis, 1989) raises two questions aimed at predicting the acceptance of information systems by users within organizations: i) perceived utility, defined as "the degree to which a person believes that the use of a particular system would improve their job performance", and ii) perceived ease of use, a factor that refers to "the degree to which a person believes that using a particular system will make less effort to perform their tasks". In a mature vision of TAM, a third question is incorporated: behaviour regarding the intention of use and the use of the information system (Boughzala, 2014).

The literature review is an essential feature of academic research (Xiao & Watson, 2019), and ERP systems are becoming essential in business activities. This research focuses on performing a systematic literature review of the Technology Acceptance Model (by its acronym TAM) of ERP software in SMEs, identifying relevant factors concerning the perception of users who use this kind of information system. On the other hand, the purpose of this research is to solve the following questions:

(1) Q1: To what extent does a person believe that using an ERP will help them carry out work tasks?; (2) Q2: What variables affect or advantage the behavioural intention of using an ERP? (3) Q3: What is the degree of enjoyment perceived by a company employee when using an ERP?; and (4) Q4: What are the acceptance and use factors of the applied technologies when using an ERP?

The study is structured as follows. Section 2 provides the state of the art of related works with the application and use of the Technological Acceptance Model in ERP solutions in SME organizations. Section 3 presents the PRISMA methodology and the research design. PRISMA was used to guide the systematic literature review from 1980 to 2021. Section 4 shows the findings that arose from the analysis and discusses them. Finally, conclusions addressing the implications of the findings and possible directions for future research are given in section 5.

2. Methodology

The methodological approach of this review is known as a systematic literature review. A systematic literature review aims to map the existing literature in each field and assess its extent and range and the quality of its evidence. For this purpose, the PRISMA systematic literature review method employing a manual search of 25 journal articles, 16 conference papers, 7 research articles, 1 book chapter, 1 review, and 3 chapter and conference papers in 11 databases was used: i) Scopus; ii) IEEEXplore; iii) ACM; iv) Springer Economics; v) Springer Computer Science; vi) SAGE; vii) Emerald; viii) Proquest; ix) Microsoft Academics; x) Scielo; and xi) Science Direct. Journals, Books, Book Chapters, Research Articles, and Conference Papers were considered. In

addition, to perform the searches, the AND, OR, Parenthesis, Quotes, and asterisks were used for string construction. The following search strings were defined, considering the use of these operators: ("technology acceptance model" or "TAM") and ("enterprise resource planning" or "ERP") and ("business" or "management" or "supply chain"). For each database, the search strings used are exposed in [Table 1](#).

The following criteria were considered for this work: i) the time interval considered was from January 1st 1980 to October 29th 2021; ii) only scientific literature is written in English and Spanish as the primary languages were contemplated. After completing these searches, 341 works were identified in total. [Figure 1](#) exposes the results in the PRISMA method flowchart.

Table 1. Search strings used for each database

Database	Search String
Scopus	TITLE-ABS-KEY (("technological acceptance model" OR "TAM") AND ("enterprise resource planning" OR "ERP") AND ("business" OR "management" OR "supply chain")) AND (LIMIT-TO (SUBJAREA , "COMP") OR LIMIT-TO (SUBJAREA , "BUSI")) AND (LIMIT-TO (LANGUAGE , "English")) AND (LIMIT-TO (SRCTYPE , "j") OR LIMIT-TO (SRCTYPE , "p") OR LIMIT-TO (SRCTYPE , "b"))
IEEE	"query": { Abstract:(("technology acceptance model" or "TAM")) AND Abstract:(("enterprise resource planning" OR "ERP")) } "filter": { Publication Date: (01/01/1980 TO 12/31/2021), ACM Content: DL }
ACM	((("technology acceptance model" OR "TAM")) AND ((("enterprise resource planning" OR "ERP")) AND ((business OR management OR "supply chain"))
Springer Economics	((("technological acceptance model" OR "TAM") AND ("enterprise resource planning" OR "ERP") AND ("business" OR "management" OR "supply chain"))
Springer Computer Science	("technology acceptance model" or "TAM") and ("enterprise resource planning" or "ERP")
Science Direct	((abstract:"Technology Acceptance Model") OR (abstract:"TAM")) AND ((abstract:"Enterprise Resource Planning") OR (abstract:"ERP")) AND ((abstract:"business") OR (abstract:"management") OR (abstract:"supply chain management"))
SAGE	("technology acceptance model" or "TAM") and ("enterprise resource planning" or "ERP")
Emerald	((abstract:"Technology Acceptance Model") OR (abstract:"TAM")) AND ((abstract:"Enterprise Resource Planning") OR (abstract:"ERP")) AND ((abstract:"business") OR (abstract:"management") OR (abstract:"supply chain management"))
Proquest	("technology acceptance model" OR "TAM") AND ("enterprise resource planning" OR "ERP")
Microsoft Academics	("technology acceptance model" or "TAM") and ("enterprise resource planning" or "ERP") and ("business" or "management" or "supply chain")
SCIELO	(ab:(("technology acceptance model" or "TAM") AND ("enterprise resource planning" or "ERP")))

Consequently, the academic literature on ERP adoption or rejection found in the previous searches allowed us to 1) detect the most relevant studies, 2) identify new theoretical postulates, and 3) analyze the success factors, barriers, and risks conceptually. Then, the second phase was executed. This phase reduces the number of studies identified in the previous phase through two processes: a) filtering by search limiters, relevant areas, and duplications, and b)

irrelevant articles were excluded based on the titles and abstracts. As a result, 27 articles were removed because they were considered duplicates, and 17 were rejected because they did not meet the defined search requirements.

Table 2. Synthesis of results (Count)

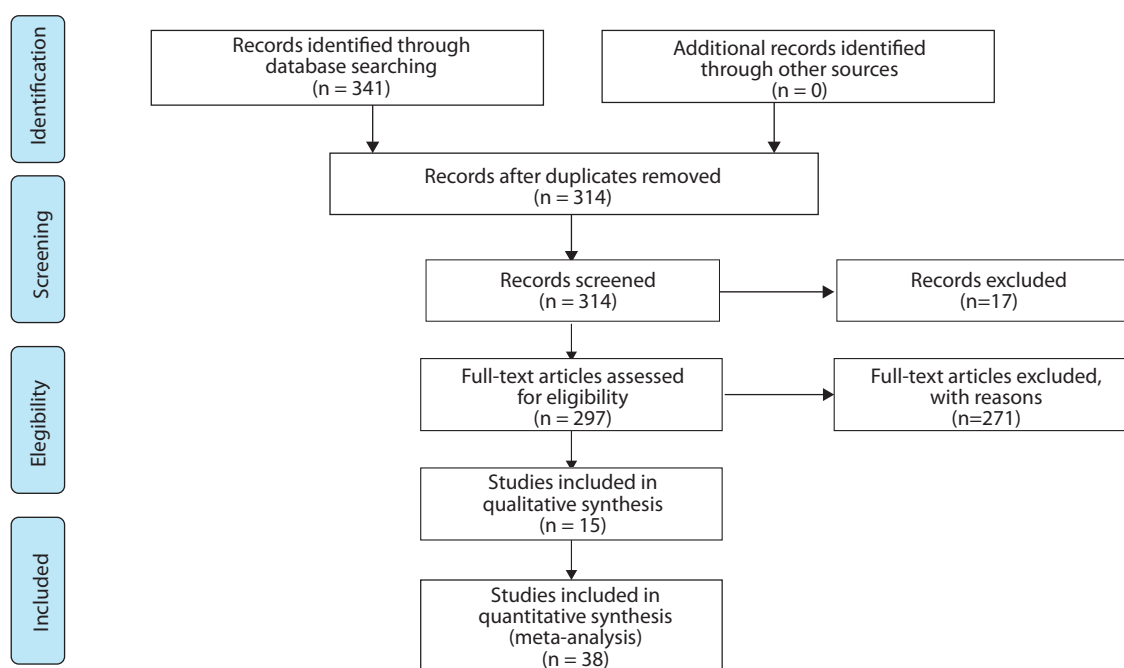
	Scopus	IEEE	ACM	SE	SCS	SD	SAGE	EMD	PROQ	MS	SCI	TOTAL
ID Step	42	7	2	13	217	5	3	4	27	20	1	341
YES	28	2	2	3	8	1	1	0	1	5	1	53

* SE=Springer Economics, SCS=Springer Computer Science, SD=Science Direct, EMD=Emerald, PROQ=ProQuest, MS=Microsoft Academics, SCI=Scielo

Finally, 271 articles were excluded because they did not respond to the proposed research questions. A total of 53 documents were considered eligible. Of those, 15 were categorized as Qualitative, and 38 were classified as Quantitative. These results are summarized in [table 2](#).

All obtained articles were registered in a Google Sheet document. In each sheet, the results were recorded in the following structure: i) the unique identifier - ID, ii) the type of document, iii) the title, iv) authors, v) keywords, vi) the resume of the paper, vii) the publisher, viii) book title or the name of the journal, ix) year of publication, x) language, xi) DOI, xii) URL from the obtained document, xiii) it serves (yes, maybe, not), xiv) the reason, xv) the research question that will be responded to, xvi) the scientific database consulted, xvii) it is duplicate (yes or no), xviii) the kind of applied method (if it was qualitative or quantitative), and finally, xix) the commentaries from the document. After that, a multidimensional text analysis using IRAMUTEQ Version 7 alpha 2 software was performed.

Figure 1. PRISMA application (Liberati et al., 2009)



3.1.1 SIMILARITY ANALYSIS

Finally, a similarity analysis was performed. This analysis allows us to identify close relationships between words by representing a graph according to the chi-square of association (Bueno et al., 2021). In this respect, Figure 5 represents these relationships using lines to highlight the presence of a relationship. It is essential to consider two aspects in the representation: i) the frequency of occurrence is represented by font size proportional to the terms, and ii) the strength of the relationship and potential semantic changes indicated through the line thickness.

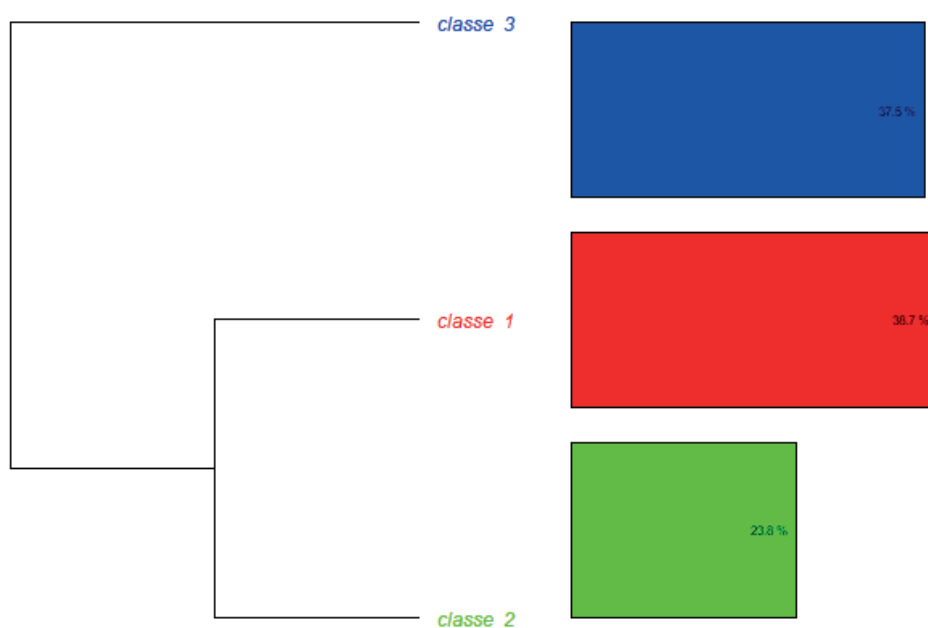
3.2. Detailed results

The clusters formed to show the existence of three groups of scientific articles through which it is possible to understand current research about ERP systems. The descriptions and interpretations of these groups are exposed in the following section. Figure 3 shows the cluster classification by size, and the factorial correspondence analysis is exposed in Figure 4.

3.2.1 CLUSTER 1: ERP ACCEPTANCE AND IMPLEMENTATION

This group has been labelled ERP acceptance and implementation. This is the largest cluster, representing 38,7 % of the total forms (122 of 315). In the context of information systems, three elements are identified: i) a subject that uses the ERP information system (User), ii) the object used (System), and iii) a function of a system done (task). According to Wang et al. (2013), one factor that affects the intention of use comes from the trial experience. Beliefs based on direct experience predict the attitude-behaviour better than beliefs based on indirect experience. Satisfaction with prior use is the primary factor leading to the repurchase or continued use of that product or service.

Figure 3. Cluster classification by size



example, i) technological complexity (Meyliana et al., 2018), ii) technical facilitation conditions (Emhmed et al., 2019), iii) social influence (Kim & Kankanhalli, 2009), and iv) organizational impact (Bueno & Gallego, 2010). Complexity is one important qualitative dimension of knowledge that determines the cost and time of knowledge imitation, and consequently, complex knowledge represents an entry barrier, as it is more challenging to learn and copy (Mewes & Broekel, 2020). Technological complexity produces an effect of various team design factors on innovation speed, like staff-related factors (experience, functional diversity) and structural-related factors (stability, co-location, dedication) (Carbonell & Rodríguez, 2006).

Interconnectivity and intelligence features are the characteristics that enable the 4.0 technological revolution, and, plus the technological complexity, challenge organizations to reshape the work environment, working activities, and, eventually, the organization of the factories (Johnson & Powers, 2005). Technological complexity is defined in terms of depth and relates to the technological newness and difficulty of the development project. In software adoption, few projects can be relatively technologically simple or technologically complex. Technologically simple projects are those that apply mature technologies and for which the understanding of the technology is high (Carbonell & Rodríguez, 2006). A conception of technological, moral action (TMA) and the distinction between TMA and human action without technology is presented by Johnson and Powers (2005). They mention that the ascriptions of responsibility for TMA are technologically complex and argue that moral responsibility for TMA cannot be ascribed or apportioned without sorting out the technological complexity. TMA includes both human behaviour with human-made material objects and the human behaviour that makes those objects.

Technical facilitation conditions are identified as enablers or even barriers in the setting that determine an individual's impression of ease or trouble in performing an activity, including technological aspects. On the other side, promoting health conditions refers to the level to which a specific person thinks that a company and technological or commercial infrastructure exists to support using a device (Emhmed et al., 2021). Social influence becomes part of one of the four components of UTAUT proposed by Venkatesh et al. (2003). It is a factor like the subjective norm presented in TAM2 (Venkatesh & Davis, 2000). The main objective of social influence is to measure the degree to which a person believes that others they care about feel they should use the system. The perceived social influence represents a determining factor in a group of users since it can positively influence the intention to use ERP software (Dabi et al., 2018).

Research on the adoption and implementation of organizational IT shows that user attitudes toward innovation are essential to success, as Lucas explains (1981). Yang et al. (2009) suggest that according to Innovation-Diffusion Theory, the rate at which an innovation is adopted is highly dependent on the user's beliefs toward that innovation on social influence. Yang et al. (2009), who investigated the process of how others influence users in innovative IT adoption, found that knowledge workers care about others' opinions on the use of innovative IT, suggesting that new IT service providers need to develop and make an excellent reference to socially influential people and ask them to endorse the use of such innovative IT.

As explained by agile development models such as Design Thinking (Meinel & von Thienen, 2016), products must be developed according to customer requirements. In this way, coinciding with Yang et al. (2009), IT service providers must be concerned about the perceptions and general feedback from user experiences and feature enhancements. While a traditional value proposition seeks to define the value a business offers its markets and customers regarding product and service experience, social businesses define value by the impact their solutions

will have and what kind of meaning it creates (Ericsson Networked Society Lab, 2016). The PMIS user satisfaction determines an ERP project's success is influenced by the user ease of use, system quality, available information, and support service quality (Nguyen et al., 2016). Factors that must be interrelated, affecting the system acceptance, could be related to individuals or organizations, and their four core variables are individual belief (attitude), technical facilitating conditions, organizational facilitating conditions, and habits (Emhmed et al., 2019).

According to Bueno & Salmeron (Bueno & Salmeron, 2008), the success factors in an ERP system are grouped into five categories: i) top management support, ii) communication, iii) training, iv) cooperation, and v) technological complexity. One of the advantages of technology is coverage (Ericsson Networked Society Lab, 2016), and through technology, quality information can be made accessible from any place (Nguyen & Luc, 2018). An ERP implementation in an organization differs from traditional information systems in many aspects like scale, complexity, business changes, etc. (Cheng et al., 2008), which implies that some success factors are identified and analyzed. For example, Somers and Nelson (Somers & Nelson, 2001) propose a list of 22 critical success factors, while Nah et al. (Fui-Hoon et al., 2001) identify 11 critical success factors for successful ERP implementation.

Nah et al. (Nah & Tan, 2015) propose the following critical success factors: i) ERP teamwork and composition, ii) Change management program and culture, iii) top management support, iv) business plan vision, v) BRP and minimum customization, vi) effective communication, vii) project management, viii) software development, testing, and troubleshooting, ix) monitoring and evaluation of performance, x) project champion and xi) appropriate business and IT legacy systems. In contrast with Nah et al. (2015), Somers and Nelson (2001) identify the following success factors: i) top management support, ii) project champion, iii) user training and education, iv) management of expectations, v) vendor/customer partnerships, vi) use of vendors' development tools, vii) careful selection of the appropriate package, viii) project management, ix) steering committee, x) use of consultants, xi) minimal customization, xii) data analysis and conversion, xiii) business process reengineering, xiv) defining the architecture, xv) dedicated resources, xvi) project team competence, xvii) change management, xviii) clear goals and objectives, xix) education on new business processes, xx) interdepartmental communication, xxi) interdepartmental cooperation, and xxii) ongoing vendor support.

On the other hand, some critical success factors were considered by Song et al. (Song et al., 2007) for an ERP system adoption, grouped into two TAM domains: i) user-perceived fit, compatibility of an ERP system, and change management of an organization will influence user adoption; and ii) top management support was critical to change management, business process, and interdepartmental communication. These findings imply that users' needs and organizational compatibility should be considered in constructing and implementing an ERP system. ERP implementations represent high-risk projects that need to be adequately managed. Uncertainty and switching costs positively increase perceived risk, and perceived risk negatively and switching benefits that positively affect the adoption intention of cloud-based ERP platforms (Su & Chen, 2021).

Somers and Nelson (Somers & Nelson, 2001) suggest that organizations must learn how to identify the critical issues that affect the implementation process and know when in the process to address them effectively to ensure that the promised benefits can be realized and potential failures can be avoided.

The ERP post-implementation environment (Fryling, 2012) exposes an updated conceptual model to face ERP management challenges, most of them arising from complex social,

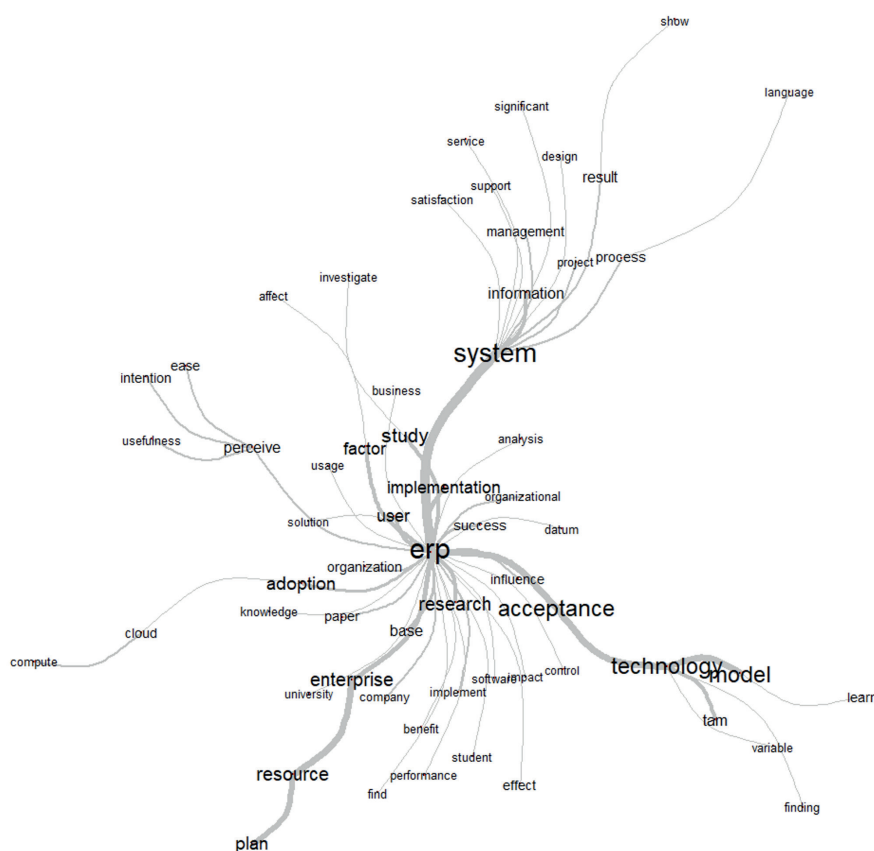
managerial, and economic systems. This model is updated from the original system dynamics methodology developed by Forrester in 1961 (Forrester, 1993), which is useful for this type of research because it helps individuals understand the dynamics occurring in the real world (Meadows, 1989) and explore the impact of alternative decision options.

3.2.3 CLUSTER 3: PERCEIVE, EASE OF USE, AND LEARN

This group has been labelled Perceive, ease of use, and learning. This is the second cluster in size, representing 37,5% of the total forms (118 of 315). The documents included here talk about the perception of ease of learning and the use of ERP software in enterprises. (Meyliana et al., 2018). For example, the ease-of-use dimensions used in their research are physical effort, mental effort, satisfaction, and performance. In the intention of use, the identified facts are i) attitude and ii) subjective norms.

According to the TAM model proposed by (Davis, 1989), the perceived utility (PU) is the grade in which a person believes that using software will improve their job performance. (Ling Keong et al., 2012) point out that according to research from Ramayah and Lo (2007), this factor essentially predicts the intention to adopt an ERP system and perceived ease of use (PEU) (Davis, 1989) is the degree to which a person believes that using a system will not require effort, this means that the expectation of greater ease of use of an ERP system is more likely to be accepted.

Figure 5. Similarity analysis representation



The enterprise resource planning (ERP) system, a comprehensive, integrated system, has been increasingly utilized in most organizations (Bany Baker & Yusof, 2017). TAM posits that perceived usefulness and perceived ease of use of IT are significant determinants of its usage (Amoako-Gyampah & Salam, 2004), whereas Davis (Davis, 1989) argues that research on this model needs to address how other variables affect core TAM variables, such as usefulness, ease of use, attitude and user acceptance. Factors contributing to the acceptance of an IT are likely to vary with the technology, target users, and context (Markus et al., 2000). Unlike many IT systems, ERP systems, by their very nature, require simultaneous changes in business processes and information sharing and use that make it very challenging to implement (Amoako-Gyampah & Salam, 2004). According to Eisenstat et al. (1990), communication is considered a critical element in enabling people to change their attitudes and behaviour, providing and getting information and creating understanding among organizational participants that leads to the formation of shared beliefs among organizational participants.

Perceptions of computer self-efficacy (by its acronym CSE) and computer anxiety are valuable predictors of various computer-related behaviours, including acceptance and utilization of information systems IS (Ahmed & Hasan, 2010), where the authors concluded that the direct effect of its application on perceived ease of use and perceived usefulness were almost equal, but in opposite directions. However, the indirect effects on attitude and intention were more robust than application anxiety. Perceived ease of use indirectly affected attitudes towards and behavioural intentions to use via the perceived usefulness of the information system (Erasmus et al., 2015). Regarding using cloud ERP solutions, when firms perceive higher service uncertainty this type of service, the concerns of performance risk will also be engendered since firms might be aware of several adverse outcomes and associated transaction costs related to the adoption of cloud ERP systems (Su & Chen, 2021).

In the era of the Covid-19 pandemic, they were attempting to teach and learn with technologies teachers and students frequently found frustrating (Pinar, 2021), with bad socioeconomic conditions (Bonaccorsi et al., 2020). This pandemic produced adverse psychological problems other than mortality, including increased anxiety. University students have experienced a new way of approaching university life, with social distancing and remote learning (online lessons and exams), with a profound impact on their social life and mental health (Busetta et al., 2021).

So, it is important to ask if business personnel are ready to use and interact with ERP software. They have to learn how to use ERP software to manipulate their tasks (Lakawathana, 2018) because inadequate end-user training could result in one of the barriers to ERP implementation (Venkatraman & Fahd, 2016).

4. Conclusions

Solving the proposed research questions, we have concluded that:

Q1: To what extent does a person believe that using an ERP will help them in carrying out tasks at work?

ERP implementations represent high-risk projects that need to be appropriately managed. Technical facilitation conditions are identified as enablers or even barriers in the setting that determine an individual's impression of ease or trouble of performing an activity, including using the technological aspects. Users must have to learn how to use ERP software to manipulate

their tasks because inadequate training processes could be one of the most critical barriers in ERP use. The influence of the rest of the users of the company and the communication of the processes before, during, and after the implementation become important factors in the belief that an ERP can help to execute the tasks with ease, added to aspects such as the ease of use, documentation, and technical support, create an influencing environment that acts on the perception of support for daily tasks.

Q2: What are the variables that affect or advantage the behavioural intention of using an ERP?

A user's behavioural intention is determined through attitude and belief; habit is another variable that influences ERP acceptance. Design and adoption, characteristics that come from technological complexity, technical facilitation conditions, social influence, and organizational impact are added to the variables. Complexity is one of the essential qualitative dimensions because it determines the cost and time of knowledge imitation. Communication is another critical factor that affects or advantages the use of an ERP, providing and getting information and creating understanding among organizational participants that leads to the formation of shared beliefs. Finally, Social influence becomes part of the variables that will affect or advantage the behavioural intention of using an ERP.

Q3: What is the degree of enjoyment perceived by a company employee when using an ERP?

As a result of the pandemic caused by Covid-19, university students have seen a new way of generating university life, an aspect that is replicated in professional and business activity under a concept called "Society 5.0". Thinking about this new reality implies that we do not see the world as it was but as it will be in the future in which similar situations may arise. The degree of enjoyment of technology occurs when there is self-satisfaction with the results achieved and the mitigation of computational anxiety, an aspect that occurs especially with those generations that have not been close to information technologies. Thus, it can be said that the degree of enjoyment of an ERP is directly linked to the level of computational anxiety and that the perceived ease of use indirectly affects the attitudes and behavioural intentions of use through the perceived usefulness of the information system.

Q4: What are the acceptance and use factors of the applied technologies when using an ERP?

The acceptance and use factors of the applied technologies when using an ERP are summarized in ease of use, adequate end-user training program, computer anxiety mitigation strategies, and flow communication between technical, stakeholders, and end-users. Also, technological projects must be adequately managed because uncertainty and switching costs positively increase perceived risk; and perceived risk negatively and switching benefits positively affect the adoption intention of the ERP platform.

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