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Stages and Critical Success Factors in ERP Implementation: Insights from Five Case Studies

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Abstract. This study proposes a conceptualization of the implementation stages of an ERP system and identifies the critical factors that ensure success. Data collection was done in two main stages. The first stage was aimed at identifying the Critical Success Factors (CSFs) for ERP implementation and was achieved by developing a structured, self-administered electronic questionnaire, which was sent to a panel of 31 Spanish experts in information systems. The aim of the second stage was to confirm the relevance of each of the identified CSFs in the different stages of the proposed ERP life cycle model. Specifically, this stage consisted of four semi-structured interviews with five Spanish firms, from different industries, which have implemented an ERP system. The results of our case studies offer an understanding of the dynamics and complexity of each case, highlighting the success factors, processes, critical issues, relevant agents and influences on the five ERP implementation stages.

Keywords: ERP systems; ERP life cycle; Critical success factors; Implementation; Information systems, Case Studies.

1. Introduction

Enterprise Resource Planning (ERP) systems are software packages for managing organizational information systems that integrate all business processes ([1]), sharing information and using a single common database ([2]). ERP systems combine business processes and information technology (IT) features ([3]). Companies worldwide of any type or size that have implemented or are implementing ERP systems consider their use a determining factor of their competitive advantage ([4]; [5]; [6]; [7]; [8]; [9]).

In general, these systems help companies manage their business more effectively and efficiently, by integrating process flows across functional areas ([1]; [10]; [8]); standardizing core activities to meet industry standards ([11]); improving the quality of data analysis for better strategic planning of assets, decision-making, and managerial control; reducing inventory levels; optimizing supply chain coordination ([12]) and enabling higher quality customer service ([13]; [11]; [14]; [15]; [8]). The adoption of these types of systems also has a significant effect on sustainability ([16]), helping to reduce costs, material use, and waste.

However, some authors claim that more than 50% of attempts to implement an ERP unfortunately end in failure or do not meet the expected objectives ([17]; [18]). The high failure rate in ERP implementation is also due to the multiple organizational, strategic, and

human factors involved in the process ([19]; [20]). In this context, it is essential to understand the structure and key factors in the ERP life cycle. This process includes the initial stages of needs and scope analysis, followed by the implementation and deployment of the solution, and its subsequent maintenance and updating. A better understanding of the stages of the ERP life cycle and its critical success factors is needed, not only by academia but also the companies themselves, who see the successful implementation of these information systems as an important guarantee of their current and future competitiveness ([5]; [6]; [7]; [8]; [9]).

Despite the growing number of theoretical works (e.g. [17]; [21]; [22]) and exploratory studies ([11]; [21]; [23]; [24]) that contribute to the related knowledge base, very few studies have sought to understand the dynamics and results of ERP implementation in business practice ([3]; [25]), and fewer still in a context marked by the COVID pandemic, which justifies the main focus of this study.

Through an in-depth study of five business cases, this work contributes to the existing research by clarifying the causes of problems that arise when implementing these information systems, the key success factors, and generally offering a better understanding of the ERP implementation process and the main agents involved.

To this end, the paper has been structured into five main blocks. After this introduction, the second section reviews the models in the literature that describe the stages of the ERP implementation process and the ERP life cycle. The following section details the critical success factors in the implementation process identified by the literature. The fourth section presents the methodology. Then, the fifth section details the main results of the quantitative research involving a panel of experts and the study of five business cases. The final section sets out the conclusions and implications, both for academia and for business practice, as well as future research lines.

2. Models of the ERP life cycle

Although there is a large body of literature on the ERP life cycle, there is no clear consensus on the number of stages that should be included. The academic community offers a wide variety of proposals with different numbers of stages. Table 1 compiles a sample of the models that are most widely recognized by the research community, based on the number of citations.

From the analysis of the Table 1 , it is clear that the most widely adopted ERP life cycle models by the research community are those proposed by Cooper and Zmud (1990) [30] and Markus and Tanis (2000) [27].

The model proposed by Markus and Tanis (2000) [27] consists of four phases: **"Chartering"**, **"Project"**, **"Shakedown"**, and **"Onward and upward"**. The **"Chartering"** phase involves crucial decisions related to funding an enterprise system, and the engagement of key players such as suppliers, consultants, executives, and IT specialists. Key tasks include developing a clear business model, selecting software packages, identifying a project manager, and approving timelines and budgets.

The **"Chartering"** phase in the Markus and Tanis (2000) [27] model is split into **"Initiation"** and **"Adoption"** in the model proposed by Cooper and Zmud (1990) [30]. The **"Initiation"** phase includes actively or passively searching for business opportunities and

Table 1. Models of the ERP life cycle

Stages	Authors	Article	Journal/Book	Citations
2	Plant and Willcocks (2007) [24]	Critical success factors in international ERP implementations: a case research approach	The Journal of Computer Information Systems	259
3	Loh and Koh (2004) [26]	Critical elements for a successful enterprise resource planning implementation in small-and medium-sized enterprises	International Journal of Production Research	542
4	Markus and Tanis (2000) [27]	The enterprise systems experience-from adoption to success	Framing the domains of IT research: Glimpsing the future through the past	2497
5	Ross and Vitale (2000) [28]	The ERP revolution: surviving vs. thriving	Information Systems Frontiers	959
5	Esteves and Pastor (2006) [29]	Organizational and technological critical success factors behavior along the ERP implementation phases	Enterprise Information Systems	55
6	Cooper and Zmud (1990) [30]	Information Technology Implementation Research: A Technological Diffusion Approach	The Institute of Management Science	4518
7	Shanks (2000) [31]	A model of ERP project implementation	Journal of Information Technology	997

Source: own elaboration

threats, as well as potential IT solutions, culminating in the selection of a software package. The **"Adoption"** phase involves negotiating the resources needed for implementing the selected IT solution.

In the **"Project"** phase, the aim of the activities conducted is to operationalize the information system across organizational units, involving the project manager, project team members (often non-technical staff from various business and functional areas), internal IT specialists, suppliers, and consultants. This phase includes software configuration, system integration, organizational adaptation, and training organization members. In terms of the objectives as well as the scope and composition, this phase corresponds to the Adaptation phase defined by Cooper and Zmud (1990) [30].

The **"Shakedown"** phase involves the organization coming to terms with the enterprise system. The project team may continue to be involved or may hand over control to operational managers and end-users. It ends when daily operations with the new application become normalized or if the organization decides to discontinue the ERP implementation process. This phase corresponds to the Acceptance and Routinization phases of the Cooper and Zmud (1990) [30] model.

Lastly, the **"Onward and upward"** phase entails the assessment of whether the investment has yielded benefits. It begins once daily operations stabilize and continues until the system is replaced by a disruptive update or a new system. This phase features the intense involvement of operational managers, end-users, IT support staff, and potentially the IT system provider and consultants. It focuses on continuous improvement, user skill development, and benefit evaluation. Finally, this phase is reflected in the Infusion phase of Cooper and Zmud (1990) [30].

Comparing and analysing the models of Cooper and Zmud (1990) [30] and Markus and Tanis (2000) [27] it can be seen that, despite the robustness and specificity of the second model regarding the definition of each stage of ERP implementation, the **"Chartering"** stage proposed in this model should be divided into two, as proposed by Cooper and Zmud (1990) [30].

This division is appropriate due to the nature of the processes that occur in each stage, as well as the agents involved and their strategic position. Thus, in the first stage, which Cooper and Zmud (1990) [30] call **"Initiation"**, our proposal includes the analysis and assessment of the suitability of incorporating an ERP system, either replacing the current one or installing one for the first time. This analysis must be based on a strategic planning vision. As emphasized by recent research, it is crucial to ensure the alignment of the ERP process implementation with the organizational strategic plans [32].

To carry out this analysis, it is essential to define the company's needs and assess different solution alternatives—not just from a technical or functional standpoint, but adopting a strategic perspective, exploring what opportunities an ERP system can offer and what problems it can resolve. This stage concludes with the identification and planning of project objectives and scope, and the selection of the project manager and their team. The outcome of this stage may necessitate seeking an ERP solution that aligns with the company's strategic goals, or the end result may be that the company decides against such a change. To emphasize the information gathering and analytical capabilities of project management and the project team, we propose naming this stage **"Analysis"**.

Then comes the second phase in our model, called **"Adoption"**, which involves other stakeholders beyond the steering committee, such as suppliers, consultants, executives, and IT specialists. This stage involves interactions with developers and implementers of IT solutions. Thus, in the **"Adoption"** stage, the company makes contact with vendors and determines the approach and specific resources allocated for project implementation. In this stage, the identification and planning from the previous stage are translated into a concrete plan of action. The subsequent stages of our model align with those proposed by Markus and Tanis (2000) [27]. Table 2 shows the two analysed models of Cooper and Zmud (1990) [30] and Markus and Tanis (2000) [27], as well as our proposed ERP implementation model.

Table 2. Proposed ERP Implementation Model

Cooper and Zmood (1990) [30]	Initiation	Adoption	Adaptation	Acceptance	Routinization	Infusion
Markus and Tanis (2000) [27]	Chatering		Project	Shakedown		Onward and Upward
Own Model	**Analysis**	**Adoption**	**Project**	**Delivery and stabilization**		**Continuity and Improvement**

Source: own elaboration

3. Critical Success Factors in ERP Implementation

The study of factors that determine the successful implementation of ERP systems has been a key research issue in the literature ([23]; [20]). However, some authors argue that research in this field has often been limited to simply identifying possible critical success factors (CSFs), without understanding their role and effective influence in a real-life business context ([33]).

Among all the analysed studies, that of Somers and Nelson (2001) [34] is the most cited and has informed many other studies, both theoretical and empirical (e.g. [17]; [35]).Based on the literature review, we consider it appropriate to add three CSFs to the 22 identified by Somers and Nelson (2001) [34].

Studies such as those by Osman (2018) [36] and Reitsma and Hilletofth (2018) [37] and Finney and Corbett (2007) [22] highlight the importance of "Software development, testing, and troubleshooting" as a critical component of ERP implementation. This involves testing organizational and production processes within the ERP, including a specific plan for such testing. Since the startup of an ERP system requires configurations, adaptations, and programming, a mechanism for checks and verifications is needed to ensure the proper functioning of the system.

Furthermore, Osman (2018) [36], Shatat and Dana (2016) [38] and Finney and Corbett (2007) [22] discuss the "Delegation of authority to workers" as a means to motivate employees and encourage them to make a greater effort to ensure a successful implementation. This delegation of authority enhances trust, productivity, proactivity, and leads to greater involvement in the process, thereby improving efficiency.

Additionally, there is the crucial role of "Internal and external benchmarking" processes, as considered necessary by Butarbutar et al. (2023) [39], Ahmed et al. (2017) [40] and Finney and Corbett (2007) [22]. These processes enable organizations to learn and incorporate new ideas and knowledge, particularly in information systems and, by extension, in ERP implementation. As such, they are directly linked to strategic organizational decisions. Table 3 presents the 25 factors considered in this study and their main antecedents in the literature.

These 25 factors are grouped into organizational-related, technological-ERP-related, project-related and individual-related factors, in line with studies such as those by Ram and Corkindale (2014) ([20]) and Ayat et al. (2021) ([41]). In addition, we test the association of these 25 factors with both the achievement of success in ERP implementation and post-implementation stages ([39]) and with performance improvements [20] (Table 3).

Table 3. Critical Success Factors

Organization-related	
F1	Top management support
F2	Management of expectations
F3	Vendor / customer partnerships
F4	Use of consultants
F5	Dedicated resources
F6	Change management
F7	Clear goals and objectives
F8	Interdepartmental communication
F9	Interdepartmental cooperation
F10	Ongoing vendor support
F11*	Empowered decision-makers
Technological/ERP-related	
F12	Use of vendors' development tools
F13	Careful selection of the appropriate package
F14	Data analysis and conversion
F15	Business process reengineering
F16	Defining the architecture
Project-related	
F17	Project champion
F18	Project management
F19	Steering committee
F20	Minimal customization
F21	Project team competence
Individual-related	
F22	User training and education
F23	Education on new business processes
F24*	Software development, testing and troubleshooting
F25*	Benchmarking, internal and external

Source: own elaboration

Note: * New factors added to the model proposed by Somers and Nelson (2001)

4. Research methodology

The research strategy primarily consisted of a multiple-case design with five Spanish companies, from different sectors, which had recently completed the implementation of an ERP solution. The rationale for the multiple-case design was that the focus could be directed at understanding the dynamics and complexities of each case; specifically, the processes, critical issues, agents and influences of the different stages — *"Analysis"*, *"Adoption"*, *"Project"*, and *"Delivery and Stabilization"* — in each organization's ERP implementation project. This approach proved to be particularly well suited for this study because it unveiled a multitude of factors, dimensions and stages that make the implementation of ERP software such a complex process.

4.1. Data collection

Data collection was done in two main stages. The first stage was aimed at identifying the CSFs with the greatest impact on the success of ERP implementation, which led to the development of a structured self-administered electronic questionnaire for a panel of 31 experts in information systems. These experts come from academic and/or professional backgrounds.

The survey consists of three parts; in the first part, we collect the experts' personal characteristics; in the second part, the experts assess the impact of the CSFs on the overall ERP implementation process (yes/no questions); and in the last part of the survey, the same group of experts also assess the degree of importance of each CSF in the different stages of our proposed ERP life cycle model. The question block in this second part is based on Likert-type scales with seven possible answers ranging from 1 to 7 (1 = Null, 2 = Quite Low, 3 = Low, 4 = Medium, 5 = Quite High, 6 = High, and 7 = Very High). The third part consists of a group of questions asking the experts to indicate in which stage or stages, according to our proposed model, they consider each of the 25 CSFs most relevant. Each factor is presented along with the option to select the stage or stages they consider relevant.

This questionnaire lasted approximately 20 minutes and was administered at the end of 2018, following the recommendations of Stanton and Rogelberg (2001) [42] for the planning and implementation of Internet-based research and to avoid possible technological risks. In the end, we obtained 29 responses. Table I in A. Appendix shows the percentage importance that experts assigned to each of the 25 factors for the development of the five stages of our ERP life cycle model. Although all the percentages are presented in the Table I in A. Appendix, only those greater than 50% are highlighted.

The second stage was aimed at corroborating the relevance of each of the CSFs mentioned in the literature and evaluated by the panel of experts in the different stages of our proposed ERP life cycle model. In each of the four stages, we analysed aspects related to how planning has been developed, time and resource management, the participation of people, both internal to the company and external, how training of staff has been carried out, and the degree of achievement of objectives, among others.

Specifically, this stage consisted of four semi-structured interviews. The interviews were conducted with one or two individuals from each of the five firms that had recently implemented the ERP project. Therefore, the interviews took place after the completion of each stage of the ERP life cycle in each of the studied companies. We did not conduct

interviews regarding the fifth and final stage of the ERP life cycle in our model (Continuity and Improvement) as we believe that companies require a period of work and development in this stage before it can be studied. Thus, we have left it for future research.

Each of the four interviews lasted around an hour and a half. The interviews related to the first stage, **"Analysis"**, all took place in 2018 except for Ventur, which was the first case analysed in 2016 (see Figure 1). However, the complexity of ERP implementation required different timings for the following interviews, as explained later (see Figure 1). The case study concluded in 2022.

All of the informants were directly involved in the ERP implementation process and were selected based on their roles in the project. Therefore, for the design of the interview, the selection of the most important aspects in the implementation of the ERP and the most relevant CSFs in each stage was based on the results obtained in the qualitative research with the panel of experts (see Table I in A. Appendix for the results of the panel of experts).

Open-ended questions were used throughout the interviews (see Table II in A. Appendix). They allowed for flexibility and provided the "possibilities of depth; and to make better estimates of the respondent's true intentions, beliefs, and attitudes" ([43]).

All interviews were audio-taped for subsequent transcription and for verification of accurate interpretation. Member checks were performed during which the informants were asked to review the transcription of their interviews for verification or amendment of the content. Follow-up questions were asked, when required, to further clarify ambiguities or discrepancies.

The data from this study were validated using a triangulation method ([44]). To this end, we kept in touch with the panel of experts, the individuals inside the firms (in some case studies we had the opportunity to talk with both the firm's CEO and a member of the top management team) and external suppliers of the software solution. The results show that while each of the five cases is different with regard to the type of software solution that was being implemented, the same process was developed, similar tasks were performed, and similar factors impacted the process. Although the generalizability of the findings has yet to be determined, there is no obvious reason to believe that the results would not apply to a larger population.

4.2. The cases

The information on the five organizations that participated in the study are presented in Table 4 and Table 5. Figure 1 presents the timeline over which the different companies addressed each of the four implementation stages analysed. As can be seen, the COVID-19 pandemic coincided with the project stage of two of the five analysed companies, whose **"Delivery and stabilization"** stages were extended until 2022.

5. Results

5.1. Analysis stage

In the first stage of our model, **Analysis**, our goal is to understand the strategic aspects or reasons why the organization has decided to replace the current information system with an ERP ([40]; [21]; [22]).

Table 4. Characteristics of the companies

Company	Number of Employees	Annual turnover 2018	Foundation	Sector or activity
FM Iluminación, S.L.U.	15	€1.7 million	1992	Manufacture of lighting fixtures, recessed and hanging lights
Logicus Engineering, S.L.U.	12	€600,000	2013	Project management services, technical and legal directions
Molcaworld, S.L.U.	27	€4 million	1998	Branding and visual communication
Visionis Distribución, S.L.	45	€5.5 million	2008	Distribution of optical products for the optical professionals' sector
Internacional Ventur, S.A.	52	€24 million	1988	Manufacture and distribution of dental products and dental logistics platform

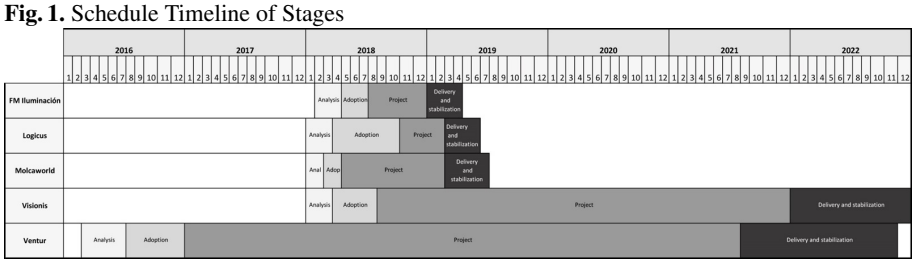
Source: own elaboration

Table 5. Characteristics of the respondents

Company	Position	Years of experience	Education
FM Iluminación, S.L.U.	CEO	20	Degree in Architecture
FM Iluminación, S.L.U.	Administration Manager	21	Degree in Business Adminitration
Logicus Engineering, S.L.U.	CEO & Founder	15	Industrial Engineer
Molcaworld, S.L.U.	Strategic Account Manager	12	Degree in Labour Relations
Visionis Distribución, S.L.	Deputy Director	3	Degree in Business Administration, MBA (Master of Business Administration) and Master of Innovation
Internacional Ventur, S.A.	IT and Logistics Manager	22	Degree in Computer Management

Source: own elaboration

Fig. 1. Schedule Timeline of Stages



Source: own elaboration

The administration manager of FM Iluminación states that:

"The technological changes of recent years mean that the company's ERP has to be able to evolve and adapt to these changes".

The need to adapt to new environmental changes and stakeholder needs is also the main driving factor for ERP adoption in the case of Visionis, according to the statements of its deputy director:

"We want the ERP not only to cover current needs, but also future needs, taking a long-term perspective".

Additionally, the company is committed to entering new marketing channels, all framed within a strategic plan for expansion and growth of the company. According to the CEO:

"We want to enter online marketing through our own platform. Having a new ERP with modules that allow us to do e-commerce is a fundamental aspect".

On the other hand, the use of unstructured tools generates problems for companies. This has been the main reason for ERP adoption, according to the CEO of Logicus:

"We have had problems such as not having the requested material from suppliers when we need them, due to errors in the delivery dates of these products, as a result of poor information management in the spreadsheet. With Excel sheets, more errors are made, and work is duplicated, unlike what would happen if we worked with an integrated tool".

Companies face new challenges that require the optimization of their processes, making it necessary to redefine business and process strategies. At the same time, they need to improve the way they collect and manage information, to ensure quicker, more efficient decision-making. This aspect is considered of vital importance by the IT manager of Ventur:

"We want to work to achieve a single data point, with a central, reliable, and efficient information centre for decision-making; this aspect has currently become a problem. The ERP can help us make decisions with a unique and irrefutable data point, a characteristic that should define a good ERP".

Moving on to analyse the important success factors in this first **Analysis** stage, the interviewees agree on the importance of having **"Clear goals and objectives"** (F7).

Specifically, the administration manager of FM Iluminación points out:

"With the information we gather from various work meetings, we analyse the needs that the new system should cover".

Along the same lines, the strategic accounts manager of Molcaworld explains:

"We must conduct a good analysis, properly understand what we need, in order to select the most appropriate ERP".

The deputy director of Visionis confirms the importance of this factor in his statements:

"During the last year, everything that has been modified in the current ERP has been compiled into a document, and all needs have been collected".

The IT and logistics manager of Ventur also emphasizes the importance of a good analysis of the company's situation and objectives to perform a proper diagnosis.

"Top management support" (F1), providing resources, global vision, and authority, is another determining factor in this first stage, as demonstrated by the statements of the interviewed companies' representatives. Specifically, the CEO of FM Iluminación notes:

"As the top executive of the company, I have directly participated in almost the entire project. I honestly believe that this should always be the case, and that the company's management should be fully involved for the benefit of the project".

The strategic accounts manager of Molcaworld also notes its importance:

"The CEO has participated in some of our meetings and has always been informed of all the aspects discussed. He has also agreed on the need to incorporate an ERP software solution and integrate a tool for the company's information system".

In terms of the human element, the role of the **"Steering Committee"** (F19) factor is also corroborated in these interviews. Specifically, the administration manager and CEO of FM Iluminación state:

"We have considered all of our employees' opinions, although the main core consisted of the two of us, along with the production manager, the purchasing manager, and the deputy director".

The IT and logistics manager of Ventur highlights the importance of having a steering committee formed by people who have a broad knowledge of the organization, its needs, and its strategic plan:

"The group of people who have carried out the analysis of needs and objectives are the members of the executive committee, that is, the heads of each department, plus the CEO of the company".

Other cross-cutting issues related to human resources highlighted by the interviewed representatives are the relationships among all the people in the organization, included in the **"Interdepartmental communication"** (F8) and **"Interdepartmental cooperation"** (F9) factors. The administration manager and CEO of FM Iluminación indicate:

"Numerous meetings have been held with the rest of the workers to see the relationships between them, as far as information system needs are concerned".

Additionally, the strategic accounts of Molcaworld points out that:

"It has been important for everyone to participate, in order to collect as much information as possible and thus share it among all of us".

Likewise, the IT manager of Ventur states:

"In order to gather the maximum amount of information, we held some meetings with department heads, as well as occasional meetings in which other department members participated".

The deputy director of Visionis also confirms the importance of these factors:

"Maximum participation and information from all company personnel is very important".

The final factor highlighted in this stage is the **"Project champion"** (F17). The administration manager and CEO of FM Iluminación speak to its importance:

"We were aware that we had to make the change sooner or later, and both the administration manager and I have led this process".

According to the strategic accounts manager of Molcaworld, it is another key element:

"The person in charge of leading the project has been the procurement manager. As with any project, it is important to have someone responsible for it, to guide and push it in the right direction".

The deputy director of Visionis declares that the project needs to be headed up by someone who is both a leader and an initiator:

"It is necessary for the person who leads and coordinates the project to know all the organization's processes very well and to rely on the rest of the people".

5.2. Adoption Stage

This process includes analysing the various potential ERP solutions, contacting companies that develop and implement these solutions, and making the final decision on which one to select.

In this second stage, the interviewees highlight the **"Careful selection of the appropriate package"** (F13) as crucial. Specifically, the two interviewees from FM Iluminación emphasize the need for thorough research and analysis:

"We started by searching for information and evaluating several programs, but we discarded many of them because they did not meet our needs. We had meetings with several software providers; we first explained our company and what we expected from the new ERP, and they gave us demonstrations of the computer applications they distribute".

Regarding the process of analysing and selecting the IT solution, the CEO and founder of Logicus emphasizes that:

"This process is long and delicate; the decision about which solution is the most appropriate is very important and can be considered strategic for the company".

The enormous effort dedicated to this search and analysis process is also evident in the words of the IT and logistics manager at Ventur:

"We contacted all the software suppliers, explained our needs, and told them about our business model and the internal workings of our organization. Each of them gave us a demonstration, showing us how their ERP could help us achieve our goals".

Closely related to the previous factor, we observe the relevance of the **"Vendor / customer partnerships"** (F3) factor, highlighted by the different interviewees as a fundamental factor in the development of any new information system implementation project. Thus, the IT manager of Ventur points out that:

"We value the partner very much, we are talking about ERPs that are all leaders in the field. We probably wouldn't have gone wrong with choosing any of the solutions; the really important thing is to choose a good travel companion".

A good understanding between the company that will implement the ERP and the ERP provider is also essential for the successful development of the process in Visionis. According to the deputy director:

"The physical proximity and good references we received about out partner Odoo were another determining factor in our decision, but above all, the close relationship and good rapport we have had from the beginning with the people of this company. For us, the human element is fundamental".

The strategic accounts manager at Molcaworld describes the relationship with the ERP provider as strategic and long-term:

"This is a long-term relationship. The ERP provider has to be a strategic supplier for us and will certainly help us become much more efficient".

As in the first stage, the interviewed companies consider factors related to human resources essential in this second stage.

The CEO of FM Iluminación highlights the importance of the factor **"Top management support"** (F1):

"I have always actively participated in the implementation of the ERP, as I understand that the company's management should do".

In addition, the deputy director of Visionis recognizes the prominent role of the **"Steering committee"** (F19) factor:

"The directors of all departments have participated in the entire process, attending internal meetings and meetings with ERP distributors".

At the same time, this interviewee recognizes the importance of the work done between departments and, consequently, the importance of the factors **"Interdepartmental cooperation"** (F9) and **"Interdepartmental communication"** (F8):

"The people who make up the different departments have participated in the entire process of selecting the new ERP; their contribution has been very valuable. A meeting was held with practically everybody, explaining what was going to be done, to make everyone aware of what the change of the ERP was going to entail. At the same time, we requested their collaboration and patience, preparing people for the change. It is good for people to be informed of what we are going to do".

The **"Project champion"** (F17) is also recognized as one of the outstanding factors by FM Iluminación. The two interviewees from the company agree that:

"It was the administration manager who led the project, participating in all meetings, coordinating, and encouraging all members of the company".

5.3. Project Stage

The **Project** stage comprises the activities aimed at putting the information system into operation in one or more organizational units; that is, it is the stage prior to the implementation of the ERP in the company as a whole. This is the stage where we find the largest number of factors deemed relevant by the interviewed companies, which is a reflection of its complexity.

The team designated to this stage and their associated responsibilities are critical aspects included in the **"Project management"** (F18) factor, the importance of which was corroborated by the CEO of Logicus:

"The team in charge of coordination and implementation is a fundamental piece for the success of the project".

"Software development, testing and troubleshooting" (F24) of the project is another crucial aspect in this stage, as indicated by the strategic accounts manager of Molcaworld:

"It is important to carry out scheduled monitoring on a weekly basis, depending on the degree of urgency of the needs".

"The use of consultants" (F4) is another factor that the same person interviewed recognizes as decisive:

"The help and guidance of a consultant has been very important for us, due to their knowledge of the tool".

The IT and logistics manager of Ventur also emphasizes the importance of having the support of expert ERP consultants to guide them in the development of the project. In fact, they consider that changing consultants during the **Project** stage was one of the causes of the delay in implementing the ERP:

"The ERP consultants are responsible for directing the project. They help us in the entire process of implementation, and are essential in this stage. From the beginning of

the project, we were working with a consultant with whom we had already established work guidelines; they had extensive knowledge of all our needs and the functioning of the company. The consulting company notified us of a change in the person who was going to take charge of our project, which had a negative impact on the dynamics of project management and made us feel we were starting over. Without a doubt, this change was one of the causes of the delay in implementing the ERP".

Logically, the process of implementing the new ERP also affects internal work processes. The company must ensure that its business processes and needs are aligned with the ERP system being implemented, adapting and/or restructuring the organization's processes with the new system to make them as efficient as possible. Hence the importance of the **"Business process reengineering"** (F15) factor. Specifically, the CEO and the administration manager of FM Iluminación point out that:

"At the same time as we wanted to adapt the software to our way of working, we wanted to see what possibilities the new system offered us to improve our procedures".

This intention fully coincides with that of Logicus, as indicated by its CEO— even more so in their case, as they had not previously worked with an ERP:

"We were not working with an ERP system, and we wanted to take advantage of the fact that we were going to incorporate such a system to review our procedures and make changes regarding our internal work processes".

According to the deputy director of Visionis, ERP implementation is inextricably linked with **"Business process reengineering"** (F15) factor.

"In this stage, we are reviewing all the processes we carry out in the organization and restructuring them, with the aim of simplifying them and making them more efficient".

Therefore, this process requires special attention to be paid to the elements intended for cultural and organizational change management, understanding it as a process that encompasses the entire organization, all of which is captured in the **"Change management"** (F6) factor. According to the statements of the CEO of FM Iluminación:

"We all have to be able to adapt to changes. There is always resistance to change, more from some people than from others, but we must overcome that resistance and adapt to better procedures for our tasks".

Visionis deputy directors also pointed out:

"Another noteworthy challenge is changing management. Addressing the scope of the changes to be made, their impact on the organization and on workers requires a considerable management effort".

The changes defined in organizations for the ERP implementation process must also be developed with a holistic vision of the organization itself. The strategic account manager at Molcaworld highlights the importance of this factor by pointing out that:

"We cannot focus our efforts on just one department, leaving aside any other areas; they are all interconnected".

During this stage, certain necessary adaptations and customizations must be made in the ERP. In addition, to ensure that its operation meets the company's requirements, numerous tests and continuous checks are necessary. The CEO of Logicus emphasizes the importance of the **"Software development, testing, and troubleshooting"** (F24) factor:

"Continuous testing has been carried out with the different adaptations and developments required. This continuous and constant process has allowed us to settle the new system well before making the final switch".

For his part, the IT and logistics manager at Ventur points out that companies agree to make use of the original functionalities of the ERP, as customization entails an increase in cost, time, and, in some cases, may incur other problems relating to the evolution and updating of the system. In this respect, the **"Minimum customization"** (F20) factor is valued as crucial by different interviewed companies. Specifically, the CEO of FM Iluminación states:

"We did not want to give into the temptation of starting to program everything; the less programming we had to do, the better, but I think it is necessary to be able to make certain adaptations that, due to our sector and our way of working, are essential for our efficiency".

Similarly, the CEO of Logicus also emphasizes the importance of this factor:

"Our intention has always been for the investment to be controlled and to minimize the economic impact. As much as possible, we have tried to avoid customized programming; we wanted to adapt, to a greater extent, to the standard".

"Education on new business processes" (F23) s also an essential component in this stage, referring to both the changes made to organizational procedures and the new information system. The administration manager of FM Iluminación makes this clear:

"Everyone has been trained on the changes in internal procedures, and this training has been carried out gradually".

The changes in internal processes and the reformulation of work procedures have involved specific training for this purpose, as the CEO of Logicus tells us:

"It has also been important to explain and train all employees of the company on the changes in internal processes that we have made".

The deputy director of Visionis fully agrees with the other interviewees:

"The staff requires appropriate training, as we have restructured many of the organization's processes".

The strategic accounts manager of Molcaworld comments that, in this stage, employees have been trained on both the operation of the new information system and the specific changes made to the processes resulting from the implementation. She also adds that:

"Everyone has participated in the training. Training has been made available to everyone and remains available and will continue to be so. We must train ourselves by getting to know all the devices that the program offers to make it more effective and efficient. Daily life consumes us. We must make sure that the program is not an obstacle but a very easy tool. I believe that training never ends; it is an evolution. Other changes will come, such as new versions, and that adaptive and evolutionary mentality must be up to date".

This same interviewee recognizes the importance of the factors **"Education on new business processes"** (F23) and **"User training and education"** (F22).

At Logicus, the CEO himself has led this stage, recognizing the importance of the factor **"Top management support"** (F1):

"I also performed the coordination function for everyone, both people from my own company and from the external consulting team. I understand that it is important to be directly involved".

The meetings held by the **"Steering committee"** (F19) at Molcaworld serve to ensure the project's smooth development, as the strategic accounts manager explains:

"The heads of each department created a list of objectives and functions, so that the program could be implemented through the work of those reporting to them".

The administration manager of FM Iluminación also confirms the importance of the factors **"Interdepartmental cooperation"** (F9) and **"Interdepartmental communication"** (F8):

"There are not many of us in the company, but we have all participated. Communication and collaboration between departments have been especially important since all the areas are interconnected".

In addition, this company states that the administration manager was the person in charge of leading the project, highlighting the importance of the **"Project management"** (F18) factor in this stage:

"In the meetings, both the CEO and I were present, and this is a very important aspect in project management. There should always be someone in charge of leading it, and that responsibility fell on me".

The IT and logistics manager at Ventur also point outs that:

"Those in charge of leading this type of project must be able to create expectations and generate the necessary motivation for the successful completion of the project, and to achieve this, the management of all the people involved is key".

5.4. Delivery and Stabilization Stage

This stage begins when the entire company starts working with the new ERP, that is, it begins to use the new system to manage the information of its business processes. The start of this stage is one of the most critical moments of the ERP implementation process, as all the work done in the previous stage is put into practice, and the success or failure of the project largely depends on this moment.

In this context, and following the work carried out in the previous stage, the importance of the **"Software development, testing, and troubleshooting"** (F24) factor is verified. Specifically, the strategic account sales manager at Molcaworld explains that the focus in this fourth stage is on resolving problems that were not detected in the previous stage, and then making adjustments or modifications to the software development:

"In this start-up stage, we have mainly been correcting detected issues, not so much developing the software itself, as that was the task we completed in the previous stage".

The support of consultants in this stage, as captured in the **"Use of consultants"** (F4) factor, is identified as a core factor by the Logicus CEO:

"The help and support of the Odoo technical consulting team has been essential for the launch of the new application".

The project manager at Ventur also confirms this:

"The start of operations with the new information system generates a lot of tension and uncertainty. The first few days were chaos. We had many fronts to turn to and crises to solve. The consultants determined the order and type of action in each case. Under their direction, we managed to prevent the project from failing".

Continuous learning, both about the new ERP system and the organizational procedure changes, are two aspects highlighted by the companies. Therefore, the **"User training and education"** (F22) and **"Education on new business processes"** (F23) factors are decisive in this stage, as evidenced by the statements of the top executive at Logicus:

"Training continues to be very important, even in this stage, for the good functioning of the system. We have made changes in our way of working and we need to know the new application well, as well as assimilate these changes properly."

The statements from the IT and logistics manager of Ventur endorse the importance of these two factors:

"We knew that training on the ERP and the changes we had introduced should continue during the implementation stage; in this way, the staff was able to adapt much better".

The deployment of an ERP tool requires the participation of top management and its team, making the importance of **"Top management support"** (F1) and **"Steering committee"** (F19) key factors in this stage. The strategic account manager of Molcaworld underlines this:

"Everything has remained the same as in the previous stage. There has been direct participation from top management and all departmental managers, as well as from the company's own personnel".

The deputy director of Visionis also confirms this:

"In this stage, all departmental managers, executive management, and company ownership have come together. It was the same in the other stagestages, but this one required greater dedication".

The administration manager and CEO of FM Iluminación also agree on the importance of **"Interdepartmental cooperation"** (F9) and **"Interdepartmental communication"** (F8):

"The project team was made up of the same people as in previous stages, but the work dynamics were much more intense than in the previous stage. Although we coordinated the work and tasks to be carried out, most of the time we were working with other people from our company, especially the procurement and manufacturing departmental managers".

The deputy director of Visionis notes the salient role of both factors, in his experience:

"During the start-up stage of the new ERP, an extra effort is required from all company personnel, who must work as a team".

The **"Project management"** (F18) also reveals his or her importance in this stage, as reflected in the words of the strategic account manager of Molcaworld:

"As in the previous stage, I was responsible for leading the project. It may be even more important in this stage, as problems emerge again and there is a lot of tension. In addition, time is of the essence when solving these problems, requiring an extra effort in decision-making and coordination of all teams."

For his part, the IT and logistics manager of Ventur declares:

"In this stage, I led the project, maintaining a constant relationship with the consultants and with the rest of my colleagues (of the steering committee). The project requires the figure of the leader to ensure that it develops smoothly".

6. Conclusions and future lines of research

6.1. Academic implications

The COVID-19 pandemic has raised awareness of the main social and economic roles of firms. Furthermore, the pandemic has motivated organizations to look for analytical tools that allow them to better understand the environmental forces affecting them and control

their impact on business operations ([16]; [45]). According to a recent report published by European (2022) [46], there has been a continuing rise in the number of companies, both large and small, adopting ICT solutions and specifically ERP systems to facilitate their management. This demonstrates the importance of strategic information management for the competitiveness of companies ([10]; [5]; [47]), especially in today's dynamic and globalized environment.

However, organizational processes in companies are becoming increasingly complex and interconnected, which makes ERP implementations more challenging ([10]). It is important to address the study of ERP systems holistically, considering the intangible resources that allow the company to successfully implement these systems, thus enabling progress towards more flexible and competitive business models. This study aims to analyse the factors that are critical to the success of each stage of an ERP implementation, through in-depth case studies of five companies. This work proposes a conceptualization of the stages of the ERP implementation life cycle by drawing on a comprehensive review of ERP life cycle models. This review confirms that there is no clear consensus on the specific stages that make up the life cycle, as demonstrated by the diversity of existing models. The lack of consensus hinders researchers' progress on identifying the activities and factors that ensure a successful ERP implementation.

Therefore, one of the objectives of this work has been to develop a model of the ERP life cycle in five stages, based on an in-depth analysis of the two most widely adopted, highly valued, and commonly cited models by the research community; namely, those of Markus and Tanis (2000) [27] and Cooper and Zmud (1990) [30].

This model proposed in this study highlights the strategic planning stage, since any information system must be integrated into corporate strategy ([48]; [49]), which may entail significant changes in corporate culture ([21]; [50]).

The proposed model of the ERP life cycle in five stages contributes to the academic field by providing a structured framework for understanding and analyzing ERP implementation. It addresses the lack of consensus in existing models, paving the way for more standardized research methodologies in this area. Researchers can utilize this model as a foundation for further studies on ERP systems, allowing for more comparable and consistent results.

Once these conceptual foundations of the ERP implementation model have been established, it is essential to understand and identify the Critical Success Factors (CSFs) in the implementation process. To this end, we reviewed and extended the study of the CSFs by Somers and Nelson (2001) [34] , eventually identifying a total of 25 factors considered relevant in the existing literature, comprising organizational, technological, project and individual factors.

In order to analyse the expected impact of each factor on the success of ERP implementation in each of its stages, a quantitative study was conducted, relying on a panel of information systems experts from the academic and professional fields. The results allowed us to understand the overall impact of each factor on the success of ERP implementation, as well as its contribution to each specific stage of its life cycle. The findings from the expert panel served as the basis for the subsequent qualitative in-depth study of five companies that were initiating the ERP implementation process. We were able to dynamically analyse the contingencies and CSFs of this process, thereby fulfilling the main research objective.

The identification of Critical Success Factors (CSFs) and their impact on each stage of the ERP life cycle adds valuable insights to the academic community. This detailed analysis provides a basis for future research on the specific factors influencing successful ERP implementation, facilitating a deeper understanding of the nuances involved.

The combination of quantitative and qualitative methods in this study offers a comprehensive approach that can serve as a model for future research in the field of ERP implementation. The integration of expert opinions with real-world case studies enriches the academic understanding of ERP dynamics, creating a robust basis for further exploration and refinement of ERP life cycle models. Below, we discuss the main practical implications for business management.

6.2. Practical implications

The interviews conducted with those responsible for the preparatory analysis and implementation of ERP in five companies underscore the importance of a **"Clear goals and objectives"** (F7) that the ERP must address. It is necessary to define this purpose in the first stage of the ERP life cycle and it must be understood strategically, aligning with the company's objectives ([48]; [49]).

The need to establish project objectives is clearly corroborated by the empirical study, where we can see that one of the reasons why two of the five companies have not yet been able to complete the implementation process is inadequate definition of objectives in the first stage, generating subsequent delays in the process and overrunning the initially estimated period.

Another element that we identify in the study as crucial to the success of ERP implementation projects is the relevance of the role played by **"Use of consultants"** (F4), and the need for a good **"Interdepartmental communication"** (F8) between them and the company's executives ([36]; [40]; [35]). This result confirms previous studies such as Osman (2018) [36], Maditinos et al. (2011) [3] and Finney and Corbett (2007) [22] on the importance of consultants' technical knowledge and expertise in helping users to implement and upgrade [39] a new ERP system. Therefore, companies should consider the attention paid to consultant selection in specific business contexts as a future investment or guarantee of ERP implementation success. Consultants not only have technical skills required but also genuine expertise on best practices in a business context.

Therefore, the role played by consultants, and the **"Interdepartmental cooperation"** (F8) between them and the company's employees that are involved in the ERP implementation, is crucial. Consequently, poor consultant performance or problems in the coordination between the two parties can generate serious issues that considerably hinder the ability to achieve ERP project success.

Effective **"Interdepartmental communication"** (F8) and **"Interdepartmental cooperation"** (F9) between different areas or departments of the company is also highlighted as a key factor in transferring knowledge and building solid internal capabilities related to ERP usage and post-implementation [39]. Building these capabilities will ensure that the how-how provided by consultants is properly institutionalized throughout the organization. This result is consistent with previous studies such as Cho and Lee (2024) [12], Maditinos et al. (2011) [3] and Wu and Wang (2007) [51].). In fact, the more dynamic the industry in which a company competes, the greater the need for it to enhance its

technological capabilities through internal learning and cooperation with other companies [12].

Another key practical implication of the work is the importance of adequate **"Dedicated resources"** (F5) by the company, mainly human capital resources. The company's employees who participate in the project play a substantial role in this process ([39]; [52]), and their satisfaction significantly influences the success of ERP implementation ([51]; [53]). Individual participation is relevant, but the participation of the **"Steering committee"** (F19), made up of top executives from different functional areas, project managers, and end-users of the ERP, is particularly significant, as demonstrated by the results of the empirical study. This result is consistent with previous studies such as Gill et al. (2020) [52] , Osman (2018) [36], and Nagpal et al. (2017) [35].

Companies need to ensure participative and proactive management of human resources, designing a **"User training and education"** (F22) plan for the personnel responsible for the implementation of the ERP, as well as promoting structures that encourage employee participation in knowledge exchange ([54]; [3]). In order to shorten the learning cycle and enhance productivity, new users should be taught both the technical aspects of the newly implemented ERP and their new organizational responsibilities ([3])), before, during and after ERP implementation [39].

In this respect, ERP implementation requires continuous support from the organization's management, departmental directors, and the leader of the strategic project itself. These findings highlight the importance of **"Top management support"** (F1) as key determinants of the success of ERP implementation. The support of top management is needed to drive a radical shift in the organization's culture, in order to encourage the investment in new technologies to share knowledge and expertise across all levels of the organization ([16]; [12]).

We have also been able to demonstrate the relevance of specific tasks related to **"Software development, testing and troubleshooting"** (F24) during the third stage of the ERP life cycle ([39]; [36]; [37]). Companies should understand the implementation process of an ERP as a dynamic, ongoing process since the system must be regularly reviewed and upgraded, and adapted to changes in user/system requirements [55]. The continuous deployment of ERP ensures that the system is aligned with both changes in business strategy and objectives, and changes in the competitive and technological arenas.

The acknowledgment of the impact of external shocks, such as the COVID-19 pandemic, underscores the importance of building resilience into ERP strategies. Businesses should, thus, proactively design ERP systems that can adapt to unforeseen disruptions and changes in the external environment.

The acknowledgment of the impact of external shocks, such as the COVID-19 pandemic, underscores the importance of building resilience into ERP strategies. These disruptions have highlighted the fragility of systems that fail to adapt quickly to unforeseen circumstances, leading to operational inefficiencies and even failure. Therefore, businesses should proactively design ERP systems that can adapt to such disruptions and changes in the external environment. A resilient ERP system must be agile, flexible, and scalable, enabling organizations to pivot swiftly when confronted with challenges such as supply chain interruptions, shifts in consumer demand, or changes in regulatory frameworks, because, as shown by the results of this study and previous research by Choo and

Lee (2024) [12], internal and external factors are equally important for a successful ERP implementation.

6.3. Future lines of research

Our study has focused on five SMEs located in the Valencian Community with different characteristics related to the sector of activity, size, age, and business volume, among others, which clearly condition the ERP requirements. We believe it is appropriate to extend this work to companies in other sectors, including service sector companies, as well as other geographical areas outside the Valencian Community.

Conducting a longitudinal study to track the evolution of companies post-implementation offers an opportunity to explore the long-term impacts and challenges associated with ERP systems. This could involve a more in-depth examination of the Continuity and Improvement stage, providing valuable insights into sustained success and areas for enhancement.

The interviews with the companies were conducted with people directly involved in the implementation projects, who held positions of responsibility and leadership in the organizations. In this respect, we believe it would be interesting to compare these responses with the opinions of other employees who have participated in the process, both those responsible for some areas or departments and end-users of the ERP.

Another central element, also reflected in our conclusions, is the importance of adequate human resource management, due to its impact on the success of ERP implementation ([52]). We believe it is necessary to analyse management and organizational leadership styles that allow the creation of collaborative and participatory environments conducive to ERP implementation. Understanding how leadership styles impact the management of human resources in the context of ERP implementation can contribute to best practices for successful project execution.

It would also be interesting to analyse how Industry 4.0 technologies—including IoT, artificial intelligence, big data analytics, and cyberphysical systems—influence the future of ERP systems and can help to create more efficient, innovative and interconnected business processes [56]. Additionally, future research on ERP systems should also focus on studying new fields that stand to benefit from the proper management and implementation of these systems, such as the circular economy, green supply chains and sustainability ([57]; [58]).

In line with the research by Kahraman and Bicen (2022) [45], future studies should delve deeper into the specific conditions and demands imposed by the COVID-19 pandemic on ERP systems, such as those related to the development of new technological competences by employees and new ways of organizing work. Exploring how organizations can adapt their ERP strategies to address the challenges posed by global disruptions enhances the relevance of ERP research in the context of rapidly changing external environments.

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A. Appendix

Table I. Results of the panel of experts

Factor Clave Éxito	Analysis	Adoption	Project	Delivery and stabilization	Continuity and improvement
1. Top management support	**62,10%**	**65,50%**	*48,30%*	*27,60%*	*3,40%*
2. Project team competence	*48,30%*	*44,80%*	**82,80%**	**58,60%**	*0%*
3. Interdepartmental cooperation	*34,50%*	*31,00%*	**51,70%**	**51,70%**	*3,40%*
4. Clear goals and objectives	**86,20%**	**51,70%**	*41,40%*	*13,80%*	*3,40%*
5. Project management	*17,20%*	*34,50%*	**89,70%**	*48,30%*	*3,40%*
6. Interdepartmental communication	*41,40%*	*31,00%*	**69,00%**	*48,30%*	*3,40%*
7. Management of expectations	**58,60%**	*37,90%*	*37,90%*	*48,30%*	*3,40%*
8. Project champion	**65,50%**	**62,10%**	**86,20%**	**51,70%**	*3,40%*
9. Ongoing vendor support	*13,80%*	*17,20%*	**55,20%**	**62,10%**	*3,40%*
10. Careful selection of the appropriate package	**72,40%**	**55,20%**	*31,00%*	*6,90%*	*3,40%*
11. Data analysis and conversion	*31,00%*	*24,10%*	**65,50%**	*48,30%*	*0%*
12. Dedicated resources	*44,80%*	**58,60%**	**62,10%**	*20,70%*	*3,40%*
13. Steering committee	**72,40%**	*44,80%*	*48,30%*	*31,00%*	*0%*
14. User training and education	*3,40%*	*24,10%*	*37,90%*	**79,30%**	*3,40%*
15. Education on new business processes	*13,80%*	*24,10%*	*44,80%*	**51,70%**	*3,40%*
16. Business process reengineering	**51,70%**	*24,10%*	**62,10%**	*24,10%*	*3,40%*
17. Minimal customization	*31,00%*	*6,90%*	**62,10%**	*41,40%*	*3,40%*
18. Defining the architecture	**62,10%**	*44,80%*	*44,80%*	*6,90%*	*0%*
19. Change management	*37,90%*	*31,00%*	**55,20%**	**58,60%**	*3,40%*
20. Vendor / customer partnerships	*41,40%*	*37,90%*	**55,20%**	**65,50%**	*3,40%*
21. Use of vendors' development tools	*17,20%*	*27,60%*	**65,50%**	*31,00%*	*0%*
22. Use of consultants	**58,60%**	*41,40%*	**62,10%**	*44,80%*	*0%*
23. Empowered decision-makers	*27,60%*	*48,30%*	**65,50%**	*48,30%*	*3,40%*
24. Software development, testing and troubleshooting	*10,30%*	*10,30%*	**79,30%**	**75,90%**	*0%*
25. Benchmarking, internal and external	*24,10%*	*17,20%*	*44,80%*	*31,00%*	*3,40%*

Source: own elaboration

Table II. Questionnaire

Analysis	Adoption	Project	Delivery and Stabilization
What **aspects or strategic reasons** motivate adopting or changing the existing ERP?	Have different software **solutions been evaluated?** What aspects have been key when deciding the type of ERP and the **software provider**?		How has the work of **incorporating the new ERP** into the daily operation of the company been developed? Have **problems** been found? If so, what kind of problems and how have they been resolved? Has there been any problem that could not be resolved?
In what **aspects do you think** the company will improve when the new ERP is implemented? What **improvements or benefits** will the new ERP bring regarding the following aspects? Economic, Social, Organizational, Environmental, etc. Did the company establish any type of **business plan** on the **strategic impact** of the ERP implementation? What **mechanisms of analysis or diagnosis** of the needs have been carried out to identify the strategic needs of the company?			What is the **level of company satisfaction** regarding the implementation of the new ERP? Which areas/departments have experienced more/less satisfactory implementation? What has been the **biggest challenge** in implementing the new ERP system? What would you change or improve about the whole implementation process? Has the company **reached the objectives** defined in the Analysis stage? If not, do you think these objectives were realistic and achievable? What were the objectives that have not been (fully) achieved? What are the reasons why they have not been achieved? Has the scope been changed during the implementation process? If so, what changes have been made and why?
Has **the work team** been defined for this stage? If so, which people and from which areas / departments make it up? What has the contribution of these people consisted of? How much of your working day have you dedicated to this project? Has a work schedule been defined for this task?	Has **the work team** been defined for this stage? If so, were the same group of people as in the previous stage? If not, which people and from which areas/departments make it up? How much of your working day have you dedicated to this project? Has a work schedule been defined for this task?		
Have there been any people in charge of **leading or coordinating** this stage? If so, what have been the requirements or characteristics for your designation? What roles and responsibilities have they performed? Has the person or people in charge of leading in this stage been assigned a specific role or authority?	Have there been any people in charge of **leading or coordinating** this stage? If so, were the same group of people as in the previous stage? Otherwise, what have been the requirements or characteristics for your designation? What roles and responsibilities have they performed? Has the person or people in charge of leading in this stage been assigned a specific role or authority?		
What has been the **role of the ownership and the management** of the company? What have been their functions and level of participation in this stage?			

(Continued)

Have regular meetings been held? If so, what have these meetings consisted of, what aspects have been discussed and how often have they been held?		
How and why was the **decision made to continue** to the Adoption stage?	Has the company's management **motivated and/or granted authority to workers** to make decisions in relation to the ERP implementation process? If so, what have been the motivating and authoritative elements?	
Has a **group of experts been defined** to make the decision to continue to the next stage? If so, which people have composed it? What have been their roles and responsibilities?	Will the implementation process be carried out only with **your own resources** or will you have an **external consultant**? If external resources are going to be used, have different software providers/consultants been assessed? What have been the decisive aspects when selecting the consulting company for the implementation of the ERP?	Has this stage been carried out only with your own resources or has an **external consultant been used**? If an external consultant has been used, was the consultant selected the same as in the previous stage? If the consultant has changed, what have been the reasons for the change? How was the work process with the external consultant? What have been the functions of the consultants?
Has the ERP change been promoted by the needs/demands of any ***stakeholder*** (customers, suppliers, public administration, etc.)?	Have **planning methodology and/or tools** to be used in the implementation process been assessed? Does the software provider or the implementing consultant work with any specific methodology and/or tools for its planning	**Have planning methodologies and/or tools** been used during the implementation process in this stage?
Have **internal factors,** such as the design of the organizational structure (level of centralization, departmentalization and formalization) and competitive strategy been taken into account in the strategic analysis of the ERP?	Has **the degree of customization of the ERP** been analyzed with respect to the standard that will be necessary?	**Have implementation milestones** been defined based on the Analysis stage? If so, were the objectives realistic and achievable? Were these milestones or objectives followed during this stage? Was their scope changed during the stage? If so, why?
		Has there been an adequate **allocation of resources** to this stage? Why? To which items or tasks were the financial resources allocated? Were there deviations from the budget? If so, why, and what percentage of deviation have you reached?
	Has the **information** that needs to be transferred from the current system to the new ERP been analyzed? If so, what areas/departments of the company is this information from? What volume and type of information do you want to transfer?	How has the **information been transferred** from the current system to the new ERP? If so, from what areas/departments of the company has the information been transferred and what has the process been like? Have problems been found? If so, what kind of problems and how have they been resolved? Has there been a problem that could not be resolved?
		What have been the **key departments and areas** in this stage of development? Why? What are those departments or people less involved in this stage of ERP implementation? What have been the reasons for their lesser participation?
	Has the need **to integrate the ERP** with other systems been identified?	Has the **ERP** been **integrated** with other systems?

(Continued)

	If so, what kind of integration and with what scope?	If so, has the type of integration and scope been the same as that expected and identified in the previous stages? How has the process been developed? Have problems been found? If so, what kind of problems and how have they been solved? Has there been a problem that could not be resolved?	
	Have **communication and coordination** channels been defined between all the people/departments participating in this stage? If so, what type, frequency and for what purpose?		
	Have there been **changes in the organizational / production processes** because of the adoption of the ERP? If so, which areas/departments have been affected? What have these changes consisted of? Has **training** on these new business processes been carried out? **Has a training** calendar been defined at the beginning of this stage? If so, for what period, and what people and contents made it up?		
Have the **Data Warehouse** structures influenced the strategic implementation of the ERP?	Have the **Data Warehouse** structures been considered?	Have there been important changes in the **necessary data structures** (Data Warehouse) between the old and the new ERP? If so, to what extent has the difference in data structure affected the implementation process?	
	Have **benchmarking** tasks been carried out to learn and incorporate improvement ideas, new knowledge, and best practices for ERP adoption? If so, what did these tasks consist of? Which areas of the organization and people have been responsible for carrying these tasks out?		
		Has a specific plan for **custom programming** of the software been developed? If so, what has been the process followed, the communication and coordination channels adopted, people/departments involved, type of tests and verifications done, and results obtained? Were deadlines defined? Were they met?	**Has a custom programming** of the software been adequately developed? Has more custom programming of the software been carried out than planned in the previous stage? If so, what was the reason? In which areas or departments has more custom programming been developed? If so, what has been the process followed, the communication and coordination channels adopted, people/departments involved, type of tests and verifications done, and results obtained?

Source: own elaboration

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