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# Determinants of Post Implementation Success of ERP In Tunisian Companies: An Empirical Study of The Moderating Role of The Technical Fit

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## *Abstract*

*Studies on Enterprise Resource Planning system (ERP) are many, but few of them dealt with the post-implementation stage. The aim of this paper is to identify the determinants that affect the post implementation success (PIS) of ERP and check for the moderating effect of the variable technical fit on this relationship. Data are collected through a questionnaire of 47 Tunisian companies that have already implemented an ERP system for at least two years. The collected data are processed using SPSS 18 software. Given the nature of the variables, we chose the simple linear regression to test our research hypotheses. The results of the survey indicate a significant relationship between PIS of ERP and the following critical success factors (CSFs): Top management support, organizational fit, and external support. However user involvement has no statistically significant effect on the PIS of ERP. On the other hand, we were able to point to the effect of the mediator variable technical fit.*

***Key Words:*** *Top management support, organizational fit, external support, user involvement, post implementation success of ERP, Tunisian Companies.*

## Introduction

Around the world, companies are more likely to engage in ERP systems (Kanellou & Spathis, 2013). These systems rely on the integration of the entire business of the company through a common shared database (Rom and Rohde, 2006; Spathis, 2006). Therefore, information is available in real time for all users. At first, these systems were designed for large enterprises and the market has gradually expanded to reach small and medium-sized enterprises. In recent years, Tunisian companies have grown oriented to new information technologies, more particularly to informational integration in order to improve inter-organizational communication. Now, it is well known that ERP systems are complex, risky and need significant resources and skills to succeed in their implementation (Rowe, 1999). Today, many Western companies are struggling to achieve the desired objectives of the adoption of these systems and the failure rate was sometimes quite alarming (Shore, 2005; Wang et al., 2007). Most researchers have focused on the study of the adoption and implementation phases of the ERP system while the post-implementation stage of ERP has been neglected (Severin et al., 2011). Lack of research related to this phase of the life cycle of the ERP system is the main motivation for this study. Most previous studies which focused on the study of the post implementation of the ERP system are case studies (Zhu et al., 2009). In addition, studies that have treated the post implementation stage relate mainly to large companies in developed countries. Chwen et al. (2004) show that the impact of ERP system differs from one country to another. This paper attempts to clarify the PIS of the ERP system in the Tunisian context. Therefore, it aims at identifying the determinants that most contribute to the PIS phase of the ERP system and investigate the moderating effect of degree of system compatibility with the hardware and old software applications installed in Tunisian companies.

To achieve these goals, we organized our work into four sections. Section 1 provides a review of the literature that relates to the research problem, proposed model and research hypotheses. Section 2 describes the research methodology. Section 3 reports and analyzes the results. Section 4 presents the findings, the practical implications of the research, as well as limitations of the study and future research.

## Literature Review

### Post –implementation success of ERP

Implementing an ERP system is an opportunity for the company to bring the best practices of successful companies (El Sawah et al., 2008). The ERP system has the ability to avoid duplication and especially to provide real time information. This facilitates and accelerates the process of decision making (Barua, Kriebel, & Mukhopadhyay, 1995). Markus & Tanis (2000), in (Zhu et al., 2009), identified four phases of an ERP project: the Chartering phase, the Project phase, the Shakedown phase, the Onward and upward phase. The aim of this study is to understand more the specifics of the post implementation phase of the ERP project. This phase begins with the first use of the ERP system until it is replaced by another and takes place after the Shakedown phase (Haekkinen & Hilmola, 2008).

Some researchers believe that companies which adopted ERP systems have achieved their goals, while for others the result was lower than expected (Sun, Yazdani, & Overend, 2005; He, 2004). Mabert et al (2000) concluded that 70% of U.S. companies have been able to implement their ERP systems, while Wang et al. (2007) consider that 70% of ERP projects fail to achieve the desired objectives. This discrepancy results from a lack of a clear and precise definition of success / failure of ERP. In fact, each author assesses the success / failure of ERP according to their point of view. Like all information systems, the success of ERP has been the subject of multiple measures (DeLone and McLean, 1992; Klein and Jiang, 2001). Several assessment approaches have been adopted: operational performance (Madapusia and D'Souza, 2012) and financial performance (Ifinedo 2006). Hawari et al. (2010) classified the definition of success / failure in two categories: factors related to the project itself: cost and time and Success is measured by the achievement of the objectives related to the project: informational integration organization, decision-making, improving inter-organizational communication (Hsu et al.,2004; Olhager et al., 2003).

The evaluation of a project or phase of a project is usually measured by the degree of achievement of the planned objectives (DeLone and McLean, 2003). Shang and Seddon (2000), in Zhu et al. (2009), show that firms that adopt an ERP system have five categories of benefits: operational benefits, managerial benefits, strategic benefits, organizational benefits, IT infrastructural benefits. Generally operational and managerial benefits and IT infrastructure are made in the post implementation stage (Esteve, 2009; Kamhawi, 2008). Zhu et al (2009) evaluated the post implementation of the ERP system through operational and managerial advantages. Operational benefits are expressed in terms of improved productivity, reduced costs, inventory-level reduction, and customer service enhancement (Davenport, 1998; Shang and Seddon, 2000). Mooney, Gurbaxani, & Kraemer (1995) believe that transparency increases coordination and control of the operation. On the other hand, managerial benefits may be summarized in improving the quality of management decisions. Thus, the ERP system has the ability to collect, store, process and disseminate information (Karimi et al, 2007; Mooney et al, 1995). In this study, we have adopted the approach chosen by Zhu et al (2009) to assess the post implementation phase.

## Determinants of ERP systems

Previous research has identified several determinants or CSFs for implementation ERP system (Bradley, 2008; Chang et al, 2008). Our study focuses only on four frequently factors related to post implementation of ERP system namely: Top management support, user's involvement, organizational fit, and external Support.

## Top management support

Ifinedo (2008) states that top management support is seen in the resources made available to the project team, in the coordination between the various management and services, and finally in the identification of the company process. The success of an ERP project requires continuous support from top management, which starts from the adoption decision until the achievement of all objectives of the project (Somers & Nelson, 2004; Bradford & Florin, 2003, Wickramasinghe and Gunawardena, 2010). Most previous research has confirmed the positive relationship between top management support and PIS of ERP project (Davenport, 1998; Bingi et al, 1999; Somers and Nelson, 2004).

Top management support expressed generally the importance given to ERP project. The higher the top management support is, the more the staff accepts the new system. Similarly, lack of top management support is often seen as one of the causes of failures observed in companies. Top management support is necessary during all phases of the ERP project (Ifinedo, 2006). Therefore, the performance of the post implementation of an ERP project is determined by the total commitment of top management from the start to the implementation of the new system. The higher top management support is, the higher are chances of success of the ERP project. Liu (2011) confirms the positive relationship of the top management support and business performance. Zhu et al. (2009) concluded, from an empirical study of Chinese companies, that PIS of an ERP system is partly explained by top management support. Following the foregoing discussion, it is predicted that:
H1: The PIS of ERP is positively related to management support.

## User involvement

User involvement is manifested by their participation in the definition and identification of business processes. Wu et al. (2007) showed that the greatest risk facing the implementation of the ERP system is the involvement of people and especially direct users. Zhang et al. (2003) state that user involvement occurs either when defining business needs or during the implementation of the ERP system. User involvement allows a better adaptation of the system to the specificities of the company's business. It is recommended to involve end users in all stages of the implementation of an ERP project (Zhang et al., 2005). Active participation of the end user greatly facilitates the detection of problems and especially the adequacy of the software with the specifics of the company. Thus, it is hypothesized:
H2: The PIS of ERP is positively related to user involvement.

## Organizational fit

The ERP system induces changes in the organization of the company. In fact, the biggest challenge that faces the manager of a company is how a standard system is adapted and expanded for a broader customer to the specifics of the business. There are two possible ways: package adoption and organizational adoption (El Sawah, 2008). It is often recommended to make no change in the ERP system to facilitate the operations of maintenance and updating.
The changes must then focus on the organization and not on the system. To avoid the gap between business processes and the ERP system processes and avoid drastic changes, the company is expected to choose the system that is closest to its business and its organization. Thus overgrown customization of the system according to the characteristics of the company is usually risky and could cause huge problems. The company that chose to adapt its processes according to the process proposed by the ERP system is more likely to succeed its implementation with minimal problems. Hong and Kim (2002) found a positive relationship between organizational fit and ERP system success. Zhu et al. (2009) show the existence of a positive relationship between organizational fit and PIS of ERP. Given the above arguments, the following hypothesis was proposed:
H3: The PIS of ERP is positively related to organizational fit.

## External support

External support targets consultants and suppliers of an ERP system. The role of an ERP system vendor is materialized by the sale of the system, technical assistance and training (Gable, 2003). The need for external expertise is necessary especially in case of lack of internal expertise able to solve failures and problems encountered during all stages of the ERP system (Zhang et al., 2005). The contribution of external consultants is crucial for the whole process of implementation of the ERP system (Bingi et al., 1999). The support provided by partners such as consultants and suppliers is of great importance in the success of the post implementation stage of the ERP system (Doom et al., 2010). A lack of support from this group of partners leads to the failure of all projects (Bradford & Florin, 2003). Thus, it is hypothesized:
H4: The PIS of ERP is positively related to external support.

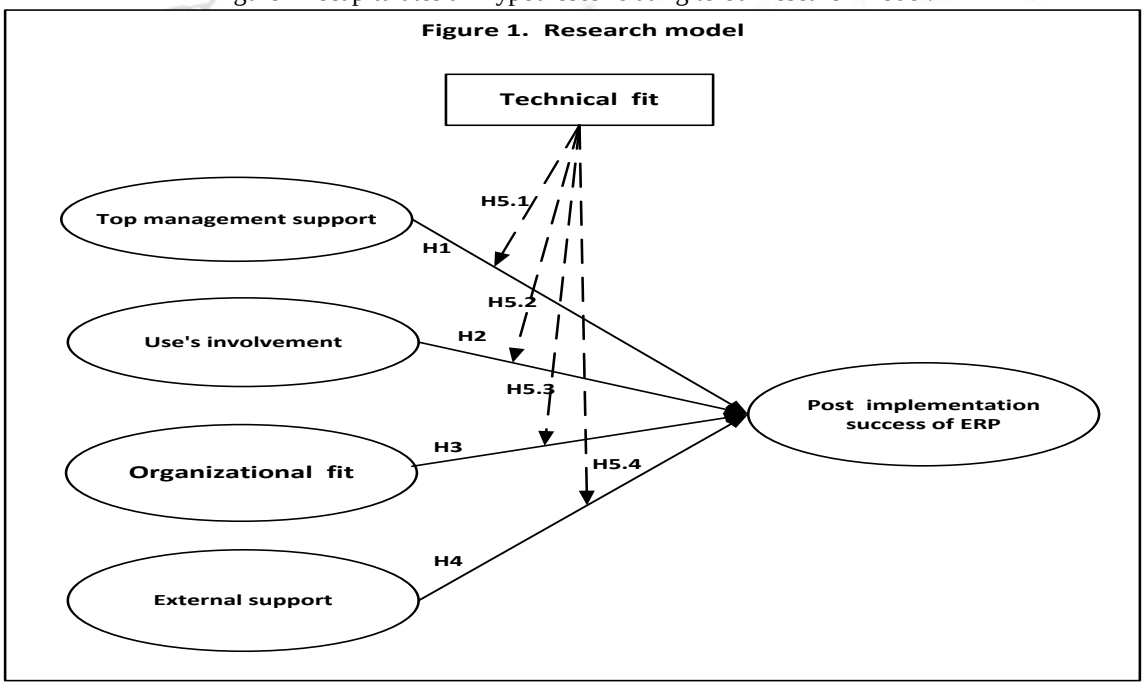
## Technical fit

Technical fit is the degree of the ERP system's compatibility with legacy applications and hardware used by the company (Delone and McLean, 1992). Bradford and Florin (2003) showed that technical fit is essential to maximize the chances of success of the ERP system. Similarly, Kumar et al. (2003) consider that the success of the ERP project depends on its degree of compatibility with older applications. The integration of legacy applications with the new ERP system is a both important and sensitive operation. It seems to affect the success of the post implementation phase of the ERP system. Thus, we get the following hypotheses:

H5: Technical fit moderates the relationship between critical success factors and PIS of ERP.
H5-1: Technical fit moderates the relationship between top management support and PIS of ERP.
H5-2: Technical fit moderates the relationship between user involvement and PIS of ERP.
H5-3: Technical fit moderates the relationship between organizational fit and PIS of ERP.
H5-4: Technical fit moderates the relationship between external support and PIS of ERP implementation success.

Figure 1 recapitulates all hypotheses relating to our research model.

**Figure 1. Research model**



## Research Methodology

In this section we successively present the sample, the survey instrument, and reliability and validity of measurement scales.

### Sample

To test our hypotheses, we conducted a survey of Tunisian companies that have already implemented an ERP system for at least two years. In the absence of an exhaustive list of these companies, we directly contacted the editors of ERP systems or indirectly through their websites to compile a list of their suppliers. Finally, we have provided a list of 65 companies.

In the first step, the questionnaire was addressed to these companies by email. Because of the reluctance of some companies, we tried to directly contact them. Only 47 companies have participated in our survey and have properly completed the questionnaire. Respondents are senior executives who were part of the team responsible for the implementation of the ERP system. Table 1 presents the profile of the companies surveyed. Our sample includes companies from various sectors. There is a very varied range of ERP systems adopted by these companies.

### Survey instrument

The aim of this research is to first identify the relationship between determinants of success and the PIS of ERP and second to test the moderating effect of technical fit on the determinants of PIS of ERP. The questionnaire for this study consists of two parts. The first part is devoted to the characteristics of the company surveyed (ERP vendor, industry). The second focuses on the five variables of the research model (Figure 1). We tested the questionnaire with five companies. Some corrections were made and the final version was administered to the entire sample. In our study we have adopted items that are used and tested in previous research and whose psychometric properties are good.

The items on the PIS of ERP were developed from Zhu Y (2009) and Shang and Seddon (2003). Items measuring top management support were developed from Bradford and Florin (2003), Kamhawi (2007), and Ifinedo (2008). To measure user involvement, we used the scale of Kamhawi (2007). Items measuring organizational fit were developed from Hong and Kim (2002), and Kamhawi (2007). Items measuring external support were developed from Kamhawi (2007) and Ifinedo (2008).

To measure the variable technical fit we asked whether the ERP system is compatible or not with older applications and hardware. This variable is binary and has two terms: the ERP system is not compatible with older applications and hardware or ERP system is compatible with older applications and hardware. All items related to building our conceptual model were measured using a 5-point Likert-type scale ranging from 1 = Strongly disagree to 5 = strongly agree.

### Reliability and validity Estimates

Before testing our research hypotheses, we had to conduct a reliability and validity analysis. Internal consistency was assessed by calculating Cronbach's alpha. The dimensionality of the measurement scales was assessed through a principal component factor analysis (PCA), using a Varimax orthogonal rotation to better visualize the factors proposed. Table 2 shows that the PCA is appropriate (KMO> 0.7 and Bartlet test = 0.000) and all constructs are unidimensional. The measurement scales of the constructs of our model are reliable as Cronbach's alpha is greater than 0.816.

## Results and Analysis

In order to test our research hypotheses, we used two types of analysis: first, a simple regression to determine the impact of the different determinants on the PIS and then, a regression subgroup to investigate the moderating effect of technical fit on this relationship.

**Table 1 Characteristics of the sample (N = 47).**

| Characteristics | Frequency | Percent (%) |
|---|---|---|
| **Type of industry** | | |
| • Food | 15 | 32 |
| • Electrical & Electronics | 12 | 26 |
| • Chemical & Pharmaceuticals | 10 | 21 |
| • Bank &Insurance | 05 | 11 |
| • Automotive | 03 | 06 |
| • Distribution | 02 | 04 |
| **Software provider** | | |
| • Sage | 13 | 28 |
| • SAP | 12 | 26 |
| • Oracle applications | 10 | 21 |
| • JD Edwards | 06 | 13 |
| • Navision | 06 | 13 |
| **Role in project** | | |
| • Project managers | 21 | 45 |
| • Finance managers | 16 | 34 |
| • Sales manager | 10 | 21 |

**Table 2 : Reliability and validity analysis**

| Construits | Items | Gronbach's α | KMO | % of variance |
|---|---|---|---|---|
| Top management support | 4 | 0,846 | 0,729 | 68,972 % |
| User's involvement | 3 | 0,835 | 0,723 | 75,261 % |
| Organizational fit | 3 | 0,816 | 0,710 | 73,177 % |
| External support | 3 | 0,852 | 0,721 | 77,262 % |
| PISof ERP | 5 | 0,869 | 0,801 | 66,289 % |

## Impact of critical success factors on the PIS of ERP

As a first step, we conducted several simple linear regressions to determine the impact of: top management, user involvement, organizational fit and external support, on the PIS of ERP system. Table 3 indicates that the regression models proposed by SPSS 18 software are significant only with the following variables: top management support ($R^2 = 0.415$, $p = 0.000$), organizational fit ($R^2 = 0.266$, $p = 0.000$) and external support ($R^2 = 0.483$, $p = 0.000$). These variables explain respectively 41.5%, 26.6% and 48.3% of the variance in PIS of ERP. All these variables: top management support ($B = 0.644$, $p = 0.000$), organizational fit ($B = 0.516$, $p = 0.000$) and external support ($B = 0.695$, $p = 0.000$) had a positive impact on the PIS of ERP. However, user involvement model is not significant ($R^2 = 0.023$, $p = 0.304$). It has no statistically significant effect on the dependent variable ($B = 0.153$, $p = 0.304$). While user involvement is crucial in explaining the implementation success of the ERP project, yet it is not significant during the post implementation phase. This variable has serious effect on the post implementation phase of the ERP system.

For the Tunisian companies which participated in our survey, the post implementation phase depends on three determinants: top management, organizational fit and external support. The results provide support for H1, H3, H4, however they fail to support H2.

**Table 3: Simple regressions results**

| | Post implementation success of ERP | | | |
|---|---|---|---|---|
| | **p** | **F** | **R2** | **Beta** |
| Top management support | 0.000 | 31.870 | 0.415 | 0.644 |
| User involvement | 0.304 | 1.079 | 0.023 | 0.153 |
| Organizational fit | 0.000 | 16.341 | 0.266 | 0.516 |
| External support | 0.000 | 41.992 | 0.483 | 0.695 |

## Moderating Effect of the technical fit on the relationship between determinants factors of success and PIS of ERP

As a second step, we conducted a regression analysis in subgroups to study the moderating effect of technical fit on the relationship between the determinants of success and post implementation of the ERP system. The results in Table 4 show that in the Tunisian companies that have chosen PIS of an ERP system that is not compatible with older software applications and hardware (first subgroup). This is explained positively by the variables top management support (B = 0.791, p = 0000), organizational fit (B = 0.703, p = 0.000) and external support (B = 0.893, p = 0.000). Regression coefficients show that the effect of these three variables on the PIS of ERP becomes more important (respectively a change of + 0.147, + 0187, + 0198). The analysis of correlation coefficients shows that the percentage of explained variance is higher (respectively a change of + 0.210, + 0228, 0315). Thus, there is a significant moderating effect. The variable user involvement is still not significant (B = 0.190, p = 0.410). Similarly, Table 4 summarizes the results of the regression performed on the Tunisian companies that have chosen an ERP system compatible with the old software applications and hardware (second subgroup). It indicates that the post implementation success of ERP is positively explained by the variables top management support (B = 0.499, p = 0.009), organizational fit (B = 0.422, p = 0.032) and external media (B = 0.535, p = 0.005).

**Table 4: Simple regressions results on Post implementation success of ERP**

| | subgroup 1 (ERP not compatible) | | | | subgroup 2(ERP compatible) | | | |
|---|---|---|---|---|---|---|---|---|
| | **p** | **F** | **R2** | **Beta** | **p** | **F** | **R2** | **Beta** |
| Top management support | 0.000 | 31.709 | 0.625 | 0.791 | 0.000 | 7.970 | 0.249 | 0.499 |
| User involvement | 0.410 | 0.710 | 0.036 | 0.190 | 0.554 | 0.361 | 0.015 | 0.153 |
| Organizational fit | 0.000 | 18.518 | 0.494 | 0.703 | 0.032 | 16.341 | 0.266 | 0.122 |
| External support | 0.000 | 74.906 | 0.798 | 0.893 | 0.005 | 9.599 | 0.286 | 0.535 |

Regression coefficients indicate that the effect of these three variables on the PIS of ERP becomes less important (respectively a change of - 0145, - 0094, -0160). The analysis of correlation coefficients shows that the percentage of explained variance is lower (respectively a change - 0.166, - 0.088, -0.197).

**Table 5 : hypothesis testing results**

| | Number | Support |
|---|---|---|
| Top management support | H1 | Yes |
| User involvement | H2 | No |
| Organizational fit | H3 | Yes |
| External support | H4 | Yes |
| Technical fit / Top management support-PIS | H5-1 | Yes |
| Technical fit / User involvement-PIS | H5-2 | No |
| Technical fit / Organizational fit-PIS | H5-3 | Yes |
| Technical fit / External support-PIS | H5-4 | Yes |

The variable user involvement is still not significant (B = 0.122, p = 0.554). Thus, there is a significant moderating effect. We can then conclude that our hypothesis H5, which assumes that technical fit moderates the relationship between the determinants of success and the PIS of ERP is generally confirmed. Sub hypotheses H5.1, H5.3, H5.4 are supported while H5.2 is not. Table 5 summarizes the results of tests on all the variables in our research model.

## Discussion, Conclusions and Limitations:

The aim of our study is to identify the key determinants associated with post implementation success. The analysis of the literature identified four main determinants of success related to the post implementation phase of the ERP system. Then, we conducted a survey of 47 Tunisian companies to determine, first, the relative importance of these factors in the Tunisian context and study, second, the moderating effect of technical fit. The first result of our study indicates that there is a positive and significant relationship between top management support and PIS of ERP. This allows for concluding that the success of the post implementation phase of the ERP system is closely related to the degree of commitment and enthusiasm of top management to the project. Top management is expected to support the ERP project during all phases of its life cycle and particularly in the post implementation phase. This is consistent with the view of Davenport (1998), Kamhawi (2007) Ifinedo (2008), and Zhu et al (2009.).

Top management support is more important when the ERP system is not compatible with older software applications. Keeping the work habits, learned over the years, improves the relationship between top management support and PIS of ERP. The second interesting empirical result is that unlike many studies like that of Kamhawi (2008), user involvement has no influence on the PIS of ERP. The relationship between user involvement and PIS remains insignificant even when introducing the moderating variable "technical fit". After implementing an ERP system, gaps may emerge during its use. Organizational adjustments are then required to bring the new ERP system with user expectations. Our study confirms the positive and significant relationship between organizational fit and PIS of ERP. This result is consistent with Hong & Kim's (2002). The importance of organizational fit intensifies when the ERP system is not compatible with older applications. The success of the post implementation phase is related to the support of external consultants and the vendor of ERP system. This result is consistent with the work of Ko et al (2005) and Gafen (2004). External support is becoming increasingly important in the absence of specialist and qualified personnel. The choice of an ERP system, not-compatible with older software applications, increases the need of companies for external expertise. PIS of ERP greatly depends on the quality of external expertise. The test of the effect of technical fit on the relationship between the determinants and PIS shows a difference between the two subgroups in favor of companies which have chosen an ERP system that integrates legacy applications.

This study shows the importance of leadership commitment, the need for organizational change and the contribution of external support (suppliers and consultants) in the success of the post implementation phase. The relationship between these three factors and the PIS is largely influenced by technical fit: ERP compatible / not compatible with old software applications and hardware. Thus, fitting the old software applications and ERP system is an operation that seems to contribute to the success of the post implementation phase and consequently to the whole project. In other words, in the Tunisian context the success of the post implementation phase depends on the ability of the ERP system to integrate the old software applications. We can conclude that the more the ERP system integrates legacy applications, the higher the chances of success of the post implementation phase are. Similarly, a break with old applications increases the risk of failure of the whole system during the post implementation phase. For a successful post implementation phase of the ERP system, managers should support the project from beginning to end. They should include all organizational changes even after the implementation of the ERP system. During the post implementation phase of the ERP system, external support is very important. Managers should therefore choose carefully the vendor and consultants to ensure a better chance of success of the new project. The choice of an ERP system compatible with older applications greatly facilitates the success of PIS phase.

This study is the first to explore the determinants of success of the post implementation stage in the Tunisian context. However, we point to one limitation of our study; the relatively small sample size. However, our survey results should be validated by a larger sample of firms to gain relevance. It should also be noted that our sample includes companies operating in different sectors. It is therefore very important to take into consideration the specificities of each sector. Similarly, the diversity of ERP systems (Oracle, Sage ...) makes our sample heterogeneous. The data collected by the questionnaire are often about perception. It may be that there is a gap between rhetoric and reality for the determinants of the PIS factors. The results of this study are to be treated with caution. The implementation of an ERP system involves, probably, changes in methods and work habits. Future research can be directed towards the study of the change and its impact on the behavior of the end user.

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