

Article

An Approach to Sustainable Enterprise Resource Planning System Implementation in Small- and Medium-Sized Enterprises

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Abstract: The adoption of sustainable enterprise resource planning systems in small and medium-sized enterprises represents a strategic response to the evolving landscape of corporate responsibility and environmental stewardship. This study seeks to identify which factors determine the level of satisfaction when implementing a sustainable enterprise resource planning system in small- and medium-sized business. A survey was designed to measure managers' satisfaction with S-ERP implementation in their companies. A multivariate analysis was run to test the factors affecting the level of satisfaction with the implementation. The general results show that the type of module implemented positively and significantly affects the level of satisfaction with S-ERP. One specific result is that the more accounting modules implemented, the more complex the system is, and the more effort is needed to implement the new technology effectively and use it properly. Another result shows that the sales marketing module has an inverse impact on satisfaction with an S-ERP, possibly because this module is complex and difficult to manage. This study contributes significantly to the emerging body of knowledge on S-ERP implementation by seeking to fill the research gap on the interaction between the S-ERP system and user's satisfaction, focusing on small businesses. Future research directions should delve into the long-term impact of sustainable ERP adoption on SME performance and resilience. Additionally, investigating the effectiveness of government policies in supporting sustainable ERP adoption, along with exploring the actual environmental impact of ERP systems in SMEs, can contribute to advancing our understanding of this dynamic and evolving field.



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1. Introduction

Enterprise resource planning (ERP) systems have evolved into critical tools for enhancing operational efficiency and competitiveness across diverse industries. While the benefits of ERP adoption are well documented, the intersection of sustainability and ERP implementation, particularly within small- and medium-sized enterprises (SMEs), has emerged as a significant area of inquiry. Enterprise resource planning (ERP) systems play a pivotal role in streamlining business processes and supporting decision making. However, the implementation of ERP systems, especially in small- and medium-sized enterprises (SMEs), raises concerns regarding sustainability. Integrating green practices within ERP systems can contribute to environmental sustainability (Wang et al. 2011). This involves optimizing energy consumption, reducing paper usage, and promoting eco-friendly practices. Moreover, employing lifecycle assessment (LCA) methodologies during ERP implementation allows SMEs to assess and minimize the environmental impact of the system (Nasiri et al. 2016).

Companies are increasingly implementing enterprise resource planning (ERP) systems as business information management systems, due to their ability to automate and integrate business processes (Trigo et al. 2014; Gallardo and Escobar-Pérez 2006). Implementation can, however, be one of the most tedious phases of the system's entire lifecycle (Ahmad et al. 2012).



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Nowadays, in the sustainable context, companies have to make an effort to integrate all the processes of sustainable business functions, between its products, processes, and systems (Chofreh et al. 2018; Koren et al. 2018). The sustainable enterprise resource planning system (S-ERP) supports personnel to collect data and information through sustainable business functions (Chofreh et al. 2014), and it is a useful tool for managers to make better production decisions.

In recent years, small- and medium-sized companies (SMEs) have been making an effort to implement systems based on Information and Communication Technologies (ICTs) to improve management and organizational performance (Pérez Estébanez et al. 2016). SMEs, constituting a substantial portion of global business entities, face unique challenges and opportunities in adopting ERP systems. The traditional narrative of ERP implementation primarily focused on large enterprises, often leaving SMEs on the periphery. However, as digitalization becomes imperative for competitiveness, even smaller enterprises are compelled to navigate the complexities of ERP adoption to stay relevant in dynamic markets (Al-Mashari et al. 2012). ERP systems are becoming increasingly important to businesses as comprehensive information management systems (Gallardo and Escobar-Pérez 2006), and successful ERP implementation has played a vital role in organizational efficiency (Ahmed et al. 2017). Today's businesses need ERP software, even if that software is extremely complex (Bajaj and Ojha 2016). ERP systems' capability to integrate all business functions efficiently and effectively with a shared database have convinced organizations to adopt them. The main advantages of ERP systems are online access to data, ability to share data and disseminate knowledge throughout the organization, and capability to increase consistency between business strategy and operational decisions (Gupta and Kohli 2006), all actions with the potential to make businesses significantly more competitive.

Significant research has focused on ERP systems in general, but only limited research has examined the effects of ERP implementation on accounting (Granlund and Malmi 2002; Sutton 2006), yet the main IT project in accounting in recent years has been ERP system implementation (Kanellou and Spathis 2013). Sutton (2006), for example, addresses the need for more empirical research on whether ERP accounting systems have positive or negative effects.

Enterprises use advanced information systems such as ERP systems to manage their resources and improve their competitiveness. It can be challenging, however, to implement the right ERP system, especially for SMEs (Alpers et al. 2014). Moreover, the COVID-19 pandemic has severely and unequally shocked European economies, with smaller firms being affected much more strongly than others. In this context, supporting these types of firms becomes stronger, because the prevailing crisis may place these vulnerable firms in unparalleled difficulties (Coad et al. 2023), and the use of ICT was seen in these pandemic years to be even more necessary for all SME firms. Although SMEs have clearly opted for ERP systems to drive strategic improvements in their economic and business development (Pérez Estébanez et al. 2016), the successful implementation of an S-ERP system is expensive and complex and often registers high dissatisfaction rates due to poor fit with the business's needs. Most large businesses have been using ERP systems for a long time, but their use in SMEs is relatively new (Almajali et al. 2016). On the basis of data from EuroStat (2023) in the European Union, around a third of SMEs have an ERP software package to share data and information between functional areas.

In parallel, the global discourse on sustainability has gained momentum, influencing business practices across industries. SMEs, while contributing significantly to economic development, often encounter challenges in aligning their operations with sustainable practices due to resource constraints (Dey et al. 2017). Integrating sustainability into ERP systems becomes a crucial step in harmonizing operational efficiency with environmental and social responsibility.

The aim of this study is to identify which critical success factors (CSFs) determine the satisfaction level when implementing an S-ERP system in Spanish SMEs. It focuses firstly on sociodemographic factors such as business size, sector, and number of years using an S-ERP

system, and secondly on whether the type and number of S-ERP modules implemented determine satisfaction, distinguishing between accounting and non-accounting modules. This study contributes significantly to the existing knowledge on S-ERP implementation among SMEs in the Spanish context by helping to fill the research gap on the interaction between an S-ERP system and user satisfaction, as proposed by Kanellou and Spathis (2013). Further, as more SMEs adopt ERP systems, more rigorous research is needed on the value of ERP systems (Ruivo et al. 2013). This study is grounded on the information systems (ISs) success model (DeLone and McLean's ISs success model), which seeks to provide a comprehensive understanding of ISs success by identifying, describing, and explaining the relationships among the most critical dimensions of success by which ISs are commonly evaluated (DeLone and McLean 1992, 2003). One of the three critical dimensions that they studied was user satisfaction and organizational impacts as variables that measure the effective success of an implementation of an IS, so we analyze user satisfaction with enterprise resource planning implementation by focusing on the aspects of higher system quality and higher user satisfaction. We try to explain that the higher the quality of an information system such as ERP, the higher the level of satisfaction of the user, which, as DeLone and McLean states (see Figure 1), leads to having an individual impact and finally a positive organizational impact, focusing on small organizations where the organizational change and its consequences can be enormous.

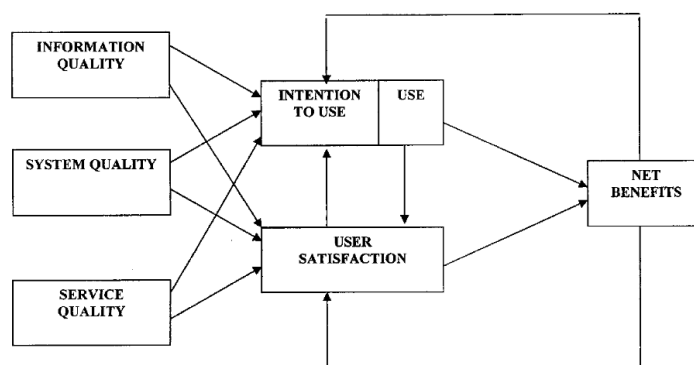


Figure 1. D&M ISs success model. Source: DeLone and McLean (2003).

2. State of the Art

ERP is a system used for integrating internal business data and processes (Gallardo and Escobar-Pérez 2006) that permit businesses to enhance their competitiveness, operational quality, and cost efficiency (Phaphoom et al. 2018). Because it also makes business processes more flexible among functional departments, it constitutes a critical investment that can improve SMEs' competitiveness and business performance considerably (Zeng et al. 2017). ERP systems are not being used efficiently, however. Most are used only to integrate internal processes, such as finance, accounting, or human resources, areas that do not usually collaborate significantly with suppliers or customers (Chuang and Shaw 2008). Moldavska and Welo (2016) define sustainability assessment as the structural information needed for decision making in the context of the sustainable development of a company, and according to it, ERP have to adapt to these new requisites by organizing and offering this information and being aligned with the principles of sustainability. Although the way business data are collected, stored, and distributed has changed primarily through the implementation of ERP and S-ERP systems, only a few empirical findings document the implications for the management control of companies' implementations of them as their technological platforms. Such evidence is even scarcer for SMEs (Teittinen et al. 2013).

Despite the growing recognition of the importance of sustainability in business operations, there is a dearth of comprehensive studies that specifically investigate the sustainable implementation of ERP systems in SMEs. Understanding how sustainability considerations intersect with the unique challenges faced by SMEs during ERP adoption is critical

for shaping informed strategies and policies. Financial constraints, resource limitations, and the delicate balance between customization and standardization represent critical hurdles (Jalilvand and Ramayah 2010). Navigating these challenges requires a nuanced understanding of the economic, human, and technological factors unique to SMEs.

The main challenges in sustainable ERP implementation are, firstly, that SMEs often face financial constraints that impact their ability to invest in advanced ERP systems (Al-Mashari et al. 2012). This financial challenge extends to the adoption of sustainable ERP solutions; secondly, limited human resources and expertise within SMEs pose challenges during ERP implementation (Esteves and Pastor 2000) because sustainable ERP implementation requires specialized knowledge, creating an additional hurdle. Finally, striking a balance between customization to meet specific SME needs and standardization for sustainability poses a significant challenge (Jalilvand and Ramayah 2010). Customization can enhance sustainability but might be economically challenging for SMEs. Within the challenges lie opportunities and strategies that can facilitate sustainable ERP adoption in SMEs. Cloud-based solutions, modular implementations, and collaborative learning platforms present avenues for overcoming resource limitations and promoting gradual, sustainable adoption (Li et al. 2017; Mabert et al. 2003a).

In studying the reasons behind enterprises' decision to replace traditional ISs with full ERP systems, Spathis and Constantinides (2004) explore the changes ERP systems involve for accounting applications. They show that the main reason to adopt an ERP system is the increasing desire to have real-time information. The main strategies for S-ERP implementation that the authors pose are capacity building, because providing training and capacity-building programs for SME employees can empower them to navigate sustainable ERP systems effectively (Hitt et al. 2002); the government support where government initiatives and policies can incentivize the adoption of sustainable technologies that significantly support SMEs (Dey et al. 2017); and, finally, collaborating with ERP vendors who prioritize sustainability in their solutions can be a strategic move for SMEs (Zhu and Sarkis 2016). This collaboration ensures that sustainability considerations are embedded in the ERP system from the outset.

Most ERP research has focused predominantly on large organizations, but gaps in the literature indicate the need for better understanding of both vendor and consumer perspectives of new technology offerings for SMEs (Venkatraman and Fahd 2016). ERP system developers are still working on S-ERP systems, but most of the solutions are still for large companies. SMEs do not know when they need an S-ERP system and which approach is most suitable for each specific business objective (Jituri et al. 2018). Hsu et al. (2017) studied using different methods which are the key performance factors for developing the sustainability of SMEs. Decisions become even more complex due to interrelationships between the variables involved in the process. Owner-related characteristics and perceptions and the environment-related constructs involved in adopting an IS must be taken into account to predict IT adoption by a small business (Peltier et al. 2012). Despite these difficulties, the implementation of ERP systems in SMEs drives changes in firms' business processes, structure, and communications (Wieder et al. 2006; Mabert et al. 2003b; Gattiker and Goodhue 2002; Spathis and Constantinides 2004; Snider et al. 2009). As a result of the continuing digital technology revolution, directors of SMEs face questions on how to optimize the alignment of a business strategy with ITs in order to leverage these technologies' full potential by seeking their development and longevity (Li et al. 2016). Because the readjustment and standardization of SME business processes lacks the support available in larger firms, incompatibility problems are the most important risk factors for SMEs (Bharathi et al. 2017).

Empirical evidence demonstrates how an ERP system can be implemented successfully for SMEs in Thailand (Phaphoom et al. 2018), Croatia (Nikitović and Strahonja 2016), France (Paquet and Paviot 2017), Portugal (Ruivo et al. 2014, 2015), Germany (Hörisch et al. 2015), Pakistan (Ahmed et al. 2017), China (Zeng et al. 2017), Jordan (Almajali et al. 2016), Australia (Venkatraman and Fahd 2016), India (Bansal and Agarwal 2015; Gupta et al. 2018), and

Taiwan (Chang et al. 2015). Other studies conclude that the introduction of ERP systems in SMEs drives changes in firms' business processes, structure, and communications (Snider et al. 2009; Wieder et al. 2006; Spathis and Constantinides 2004; Mabert et al. 2003b; Gattiker and Goodhue 2002). Overall, research suggests a positive relationship between ERP implementation and operational efficiencies (Nicolaou and Bhattacharya 2008; Matolcsy et al. 2005).

However, to implement a sustainable ERP requires more effort by small and medium enterprises, mainly because it needs to collect additional data (Patalas-Maliszewska and Kłos 2019), but, in other ways, they show interesting opportunities such as the advent of cloud-based ERP solutions that offer SMEs an opportunity for sustainable implementation by reducing infrastructure costs and energy consumption (Li et al. 2017); breaking down ERP implementation into manageable modules enables SMEs to adopt sustainable practices incrementally (Mabert et al. 2003a), and even collaborative initiatives and knowledge-sharing platforms facilitate the exchange of sustainable ERP implementation practices among SMEs (Motwani et al. 2002). Learning from peers can enhance the sustainability journey.

In this context, we formulate the following hypotheses:

H1. *The success of S-ERP implementation depends positively on sociodemographic factors.*

H2. *Satisfaction with S-ERP implementation depends on the modules implemented.*

H2a. *In terms of success, as more modules are implemented in an S-ERP system, there is a higher level of satisfaction.*

H2b. *In terms of success, as more accounting modules are implemented in an S-ERP system, there is a higher level of satisfaction.*

3. Sample and Methodology

A study was conducted to assess accountants' perceptions of the extent of S-ERP implementation within their respective companies. The survey included 175 managers representing Spanish businesses, with a significant portion being SMEs. Consistent with the demographic distribution of businesses in Spain, almost 99.8% of enterprises were categorized as small based on employee numbers (DIRCE 2023). Analysis by industry sector revealed a prevalence of businesses in the service sector, with most having utilized ERP systems for a duration ranging from six to ten years. The sample is categorized based on company size, with 53% representing medium-sized enterprises, 43% representing small businesses, and a mere 4% representing microbusinesses.

The survey comprised sociodemographic inquiries, followed by queries regarding managers' perspectives on the degree of S-ERP implementation in their organizations. The questionnaire underwent design and validation with input from multiple subject matter experts. Respondents, primarily accountants, invested approximately 10–15 min in completing the survey, providing responses to 44 items using a five-point Likert scale (1 = totally disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = totally agree). Additionally, an open-ended section was included for participants to provide comments.

Following the methodology of Anderson et al. (2004), the sample size was considered substantial, and the internal consistency of the survey was assessed using Cronbach's alpha (Cronbach 1951), a measure of scale reliability indicating the extent to which a set of items is closely related as a group. This coefficient, widely used in research (Hair et al. 2006), measures the internal consistency of the survey, indicating how closely related a set of items are as a group, and is considered to be a measure of scale reliability (Cronbach 1951). The Cronbach's alpha obtained was 0.836, indicating strong reliability according to George and Mallery (1995). The validity of a measurement scale indicates how error-free the measurement process is. To ensure content validity, a pretest of the questionnaire was conducted by five experts, including four researchers in accounting and an accountant. As

for external validity, the use of random sampling allows the results to be generalized to the population.

To conclude, the total number of responses was 174. The CSFs were divided into sociodemographic factors, sector, number of years with ERP, and business size, and the rest of the CSFs were the different modules in an ERP system. Finally, the survey included a variable for the number of modules implemented in SMEs. The descriptive statistics are shown in Table 1.

Table 1. Descriptive statistics.

| | Description of Variable | Values | Mean | Std. Deviation |
|---------|---|---|--------|----------------|
| LEV_sat | Level of satisfaction with ERP | Likert 1–5 | 3.23 | 1.381 |
| SEC | Activity sector | 0 = Manufacturing 1 = Services 2 = Primary | 0.60 | 1.083 |
| YEA | Number of years with ERP | 0 = 0–5 years 1 = 6–10 years 2 = more than 10 years | 1.89 | 1.815 |
| B_siz | Business size | 0 = 0–10 employees 1 = 1–49 employees 2 = 50–249 employees | 1.50 | 0.577 |
| NUM_m | Number of modules implemented | 0–11 | 5.4682 | 1.34050 |
| TYP_m | Type of modules implemented: Financial Accounting, Stock Purchases, Fixed Assets Register, Costs, Management Accounting, Payroll, Sales Marketing, Production, Logistics, Quality Management, and e-commerce. | 1 = more accounting than other modules 2 = equal accounting and other modules 3 = fewer accounting than other modules | 5.2023 | 1.49012 |

Source: the authors.

The variable type of each module was divided into two types. There were Accounting modules: Financial Accounting, Stock Purchases, Fixed Assets Register, Costs, Management Accounting, and Payroll, and Other modules: Sales Marketing, Production, Logistics, Quality Management, and e-commerce (see Table 2).

Table 2. Type of modules implemented.

| Modules | Variables | Codes | Values |
|--------------------|-----------------------|-------|-----------------|
| Accounting modules | Financial Accounting | AM_fa | 0 = yes; 1 = no |
| | Stock Purchases | AM_sp | |
| | Fixed Assets Register | AM_fa | |
| | Costs | AM_c | |
| | Management Accounting | AM_ma | |
| | Payroll | AM_p | |
| Other modules | Sales Marketing | OM_sm | 0 = yes; 1 = no |
| | Production | OM_p | |
| | Logistics | OM_l | |
| | Quality Management | OM_qm | |
| | e-commerce | OM_ec | |

Source: the authors.

A stepwise backward regression was then run to test whether the level of satisfaction with S-ERP implementation depended on these factors. We tested to determine whether the modules that can be implemented in an ERP system (Financial Accounting, Stock Purchases, Fixed Assets Register, Costs, Management Accounting, Payroll, Sales Marketing, Production, Logistics, and Quality Management), type of module (the number of accounting

modules greater than, equal to, or less than the number of other modules), and number of modules implemented influenced level of satisfaction.

4. Results

Studies consistently highlight the challenge of financial constraints for SMEs when implementing sustainable ERP systems (Al-Mashari et al. 2012). Balancing the desire for sustainability with the need for cost-effectiveness remains a complex and critical issue. The literature consistently points out the resource limitations faced by SMEs during sustainable ERP implementation (Esteves and Pastor 2000). Limited skilled personnel capable of managing the complexities of sustainable ERP systems, coupled with technological infrastructure challenges, emerge as recurring themes. These constraints demand innovative strategies for overcoming resource shortages.

Several studies (Al-Mashari et al. 2012; Esteves and Pastor 2000) suggest that the financial implications of sustainable ERP implementation can be more pronounced for smaller businesses. SMEs, typically operating with tighter budgets, might face heightened challenges in allocating resources for the adoption of sustainable ERP systems. In contrast to Stevenson et al. (2005), the results of our analysis show no causal relation between business size and level of satisfaction with an S-ERP. However, the availability of resources, both in terms of skilled personnel and technological infrastructure, emerges as a key factor (Jalilvand and Ramayah 2010). Larger enterprises often have more abundant internal resources and capabilities, making it comparatively easier for them to manage the complexities associated with the integration of sustainability features into ERP systems. SMEs may find resource limitations more acute, influencing the pace and scope of sustainable ERP implementation.

Satisfaction level depends instead on other sociodemographic variables, such as sector of activity and number of years using an ERP. Studies (Al-Mashari et al. 2012; Esteves and Pastor 2000) suggest that the sector of activity plays a crucial role in influencing the nature and extent of sustainable ERP implementation in SMEs. Industries with more stringent environmental regulations or a greater emphasis on corporate social responsibility may exhibit a more pronounced focus on integrating sustainability into ERP systems. The environmental impact and resource intensity of the sector can significantly shape sustainable ERP adoption (Wang et al. 2011; Nasiri et al. 2016). Sectors with high resource intensity, such as manufacturing, may face unique challenges and opportunities in aligning their operations with sustainability goals through ERP systems. On the other hand, service-oriented sectors might have different priorities and challenges. The “Beta Coefficient” column in Table 3 shows that the beta for sector is positive (0.229) and almost statistically significant ($p = 0.005$). The same is observed for number of years ($B = 0.380$, $p = 0.000$). A positive beta indicates that sector and number of years are directly related to the level of satisfaction. Studies suggest that the number of years a business has been active may influence its adaptability to sustainable ERP systems (Li et al. 2017; Mabert et al. 2003a). Businesses with more years of experience might demonstrate greater adaptability to change, including the adoption of sustainable practices. However, this adaptability can vary based on the industry and the specific challenges the business has faced over its history. The number of years in business can contribute to organizational learning and knowledge (Motwani et al. 2002). Businesses that have accumulated knowledge over the years might find it easier to understand and implement sustainable ERP practices. Organizational learning can facilitate a smoother transition to new technologies and methodologies.

Modular implementations and collaborative learning platforms emerge as strategic approaches (Mabert et al. 2003b; Motwani et al. 2002). Breaking down ERP implementation into manageable modules allows SMEs to adopt sustainability features incrementally, mitigating both financial and resource pressures. Collaborative learning platforms facilitate knowledge-sharing, enabling SMEs to learn from the experiences of their peers. As to the second hypothesis—the higher the number of accounting modules implemented, the greater the success of S-ERP implementation—the results show that the type of module

implemented is also significant ($B = 0.685, p = 0.007$), in line with the findings of Barki and Pinsonneault (2005). Thus, the fewer accounting modules implemented, the greater the satisfaction level with ERP implementation, leading us to reject the second hypothesis. The results also show an inverse relationship between the Sales Marketing module ($B = -0.567, p = 0.000$) and satisfaction level.

Table 3. Variables of successful ERP implementation.

| Variables | Standardized Coefficients | | |
|------------|---------------------------|--------|-------|
| | Beta | t | Sig. |
| (Constant) | | 2.202 | 0.029 |
| SEC | 0.179 | 2.861 | 0.005 |
| YEA | 0.499 | 7.902 | 0.000 |
| TYP_m | 0.739 | 2.73 | 0.007 |
| OM_sm | -1.019 | -3.754 | 0.000 |

R square = 0.390

The full model includes the following variables: LEV_sat, SEC, YEA, B_siz, NUM_m, TYP_m, AM_fa, AM_sp, AM_fa, AM_c, AM_ma, AM_p, OM_sm, OM_p, OM_l, OM_qm, and OM_ec.

The number of modules implemented can impact the speed of adoption (Motwani et al. 2002). SMEs with a faster adoption pace might demonstrate a more extensive implementation of modules. Organizational learning, facilitated by the implementation process, contributes to a smoother and quicker integration of sustainability-focused modules. Contrary to our expectations, the analysis showed that the number of modules implemented and the other modules (Financial Accounting, Costs, Payroll, Stock Purchases, Management Accounting, Production, Logistics, Quality Management, and e-commerce) were not significant as separate modules. The literature indicates that financial considerations play a crucial role in determining the number of modules adopted (Al-Mashari et al. 2012). SMEs may strategically choose modules based on their immediate financial capacity and the perceived benefits of specific sustainability features. This selective approach ensures a more targeted and feasible implementation.

5. Results Discussion and Conclusions

The literature suggests that sustainable ERP implementation in SMEs is a complex but necessary journey. Challenges related to finances, resources, and customization must be carefully navigated. However, opportunities lie in cloud-based solutions, modular implementations, and collaborative learning. Strategies involving capacity building, government support, and vendor collaboration can enhance the sustainability quotient. Moreover, integrating environmental sustainability into ERP practices aligns with global concerns and future-proofs SMEs against evolving environmental regulations.

The challenges identified in the literature underscore the complexity of sustainable ERP adoption in SMEs. Financial constraints, a perennial issue for SMEs, present a substantial hurdle (Al-Mashari et al. 2012). This limitation not only affects the initial investment in ERP systems but also impacts the ability to embrace sustainable features that may come at an additional cost.

The literature also reveals several opportunities and strategies that SMEs can leverage to navigate the challenges of sustainable ERP implementation. Cloud-based solutions emerge as a transformative opportunity, offering SMEs cost-effective and energy-efficient options (Li et al. 2017). This aligns with the resource limitations often faced by SMEs and presents a scalable model for sustainable ERP adoption.

Modular implementations, as suggested by Mabert et al. (2003b), represent a strategic approach. Breaking down ERP implementation into manageable modules allows SMEs to adopt sustainability features incrementally. This not only mitigates the financial strain but also aligns with the gradual, adaptive nature of SMEs.

Collaborative learning platforms and knowledge-sharing initiatives play a pivotal role in overcoming resource limitations and enhancing sustainability understanding among SMEs (Motwani et al. 2002). Learning from the experiences of peer enterprises can significantly contribute to effective ERP implementation.

Resource constraints emerge as a common theme (Esteves and Pastor 2000). The shortage of skilled personnel capable of managing the complexities of sustainable ERP systems poses a significant challenge. Moreover, the delicate balance between customization and standardization remains a struggle (Jalilvand and Ramayah 2010). While customization may enhance sustainability, the associated costs and complexities might be particularly burdensome for SMEs.

The results show no difference in SME size and satisfaction with S-ERP implementation. This finding contrasts with that of Paquet and Paviot (2017), who did find a relationship between size and ERP implementation. One reason for these divergent results may be that our research focuses only on SMEs and does not compare large and small enterprises. Satisfaction does differ by activity sector, as the businesses most satisfied with their implementation of an ERP system were from the service sector. Finally, the older an SME, the greater the level of satisfaction.

Curiously, and in contrast with Kanellou and Spathis (2013) but in line with other previous studies (Barki and Pinsonneault 2005), we find that the type of module implemented affects managers' level of satisfaction with their S-ERP positively and significantly. This finding is important. It may indicate that implementing more accounting modules establishes a more complex system and thus requires greater effort to implement the new technology effectively and use it properly.

Finally, we wish to highlight that the Sales Marketing module has an inverse impact on satisfaction with the ERP, possibly indicating that this module is complex and difficult to manage.

As suggested in Kanellou and Spathis (2013), further research is needed on the interaction between ERP systems and ERP user satisfaction. The present study contributes to filling this gap by analyzing this item using a sample of SMEs in the Spanish context. As more SMEs adopt S-ERP systems, more rigorous research is needed to answer questions on the value of these systems (Ruivo et al. 2013).

The main limitation of this study—a limitation common in this type of research—is that the sample was relatively small due to the study's questionnaire-based method of quantitative analysis. The response rate was average, however. Another limitation is the study's focus on Spanish SMEs because it could limit the applicability to a more global audience, but this focus also contributes to previous studies, since this is the first study to explore this topic in Spanish companies.

Our investigation is generally valuable in helping both academics and practitioners (SMEs) to deepen the analysis of the impact of S-ERP implementation in other countries. Moreover, information system consultants will find our results important when considering whether to implement an S-ERP system in a small business. Future research in this domain should delve deeper into the long-term impact of sustainable ERP adoption on the overall performance and resilience of SMEs trying to advance more detailed knowledge of the positive and/or negative effects of implementing an S-ERP system, especially in SMEs. Additionally, investigating the effectiveness of government policies in supporting sustainable ERP adoption, especially in terms of financial incentives and capacity-building programs, could provide valuable insights.

The integration of environmental sustainability into ERP practices should also be explored further. Studies that assess the actual environmental impact of ERP systems in SMEs, along with the development of standardized frameworks for such assessments, can contribute to the evolving field of sustainable ERP implementation in SMEs. As future directions, we could continue investigating using larger samples, and we could also focus on other EU countries to try and strengthen our conclusions. Also, to avoid biases and limitations in the data collection derived from the use of a questionnaire-based method

of quantitative analysis, we could further incorporate complementary research methods, such as interviews or case studies, for a better comprehensive identification of the research topic. Furthermore, derived from the limitations of this research, the findings obtained in this study could become outdated relatively quickly, so we would need to run ongoing research to validate and update the present study as a consequence of different issues, such as the rapid pace of technological advancements and changes in business practices, the industry-specific challenges that SMEs could face in implementing sustainable ERP systems attending to the different requirements that different industries may have, and finally, as the present study focuses primarily on the perspectives of managers, we could try to focus on other stakeholders in order to not lose sight of their different viewpoints (e.g., end-users, customers, or external consultants).

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Institutional Review Board Statement: This study was conducted in accordance with the Declaration of Helsinki. The Royal Decree 53/2023, of January 31, which approves the Regulations of the Spanish Research Ethics Committee establish that opinion surveys do not require approval by the Ethics and Human Research Committee. If an opinion survey is to be carried out, on any topic or question, professional situation, satisfaction with certain issues, etc., provided that it does not include psychological or health information, the authorization of the Ethics Committee is not required. This study meets this condition.

Informed Consent Statement: The present research is a non-interventional study where all the participants were fully informed about the research, how it was conducted, how the data was going to be used, that there were no risks associated and overall that it was completely anonymous and voluntary to answer it.

Data Availability Statement: Data could be available as request to raperez@ucm.es.

Conflicts of Interest: The author declares no conflict of interest.

References

- Ahmed, Naeem, A. A. Shaikh, and Muhammad Sarim. 2017. Critical Success Factors Plays a Vital Role in ERP Implementation in Developing Countries: An Exploratory Study in Pakistan. *International Journal of Advanced Computer Science and Applications* 8: 21–29. [CrossRef]
- Ahmad, Naim, Abid Haleem, and Asif Ali Syed. 2012. Compilation of Critical Success Factors in Implementation of Enterprise Systems: A Study on Indian Organisations. *Global Journal of Flexible Systems Management* 13: 217–32. [CrossRef]
- Almajali, Dmaithan Abdelkarim, Ra'ed Masa'deh, and Ali Tarhini. 2016. Antecedents of ERP systems implementation success: A study on Jordanian healthcare sector. *Journal of Enterprise Information Management* 29: 549–65. [CrossRef]
- Al-Mashari, Majed, Abdullah Al-Mudimigh, and Mohamed Zairi. 2012. Enterprise resource planning: A taxonomy of critical factors. *European Journal of Operational Research* 146: 352–64. [CrossRef]
- Alpers, Sascha, Christoph Becker, Esmahan Eryilmaz, and Thomas Schuster. 2014. A systematic approach for evaluation and selection of ERP systems. *Lecture Notes in Business Information Processing* 193: 36–48. [CrossRef]
- Anderson, David, Dennis Sweeney, and Thomas Williams. 2004. *Estadística para Administración y Economía*. Mexico City: Thomson.
- Bajaj, Swati, and Sanjay Ojha. 2016. Comparative Analysis of Open Source ERP Softwares for Small and Medium Enterprises. Paper presented at the 10th Indiacom—2016 3RD International Conference on Computing for Sustainable Global Development, New Delhi, India, March 16–18; pp. 1047–50.
- Bansal, Veena, and Ankit Agarwal. 2015. Enterprise resource planning: Identifying relationships among critical success factors. *Business Process Management Journal* 21: 1337–52. [CrossRef]
- Barki, Henri, and Alain Pinsonneault. 2005. A model of organizational integration, implementation effort and performance. *Organization Science* 16: 165–79. [CrossRef]
- Bharathi, S. Vijayakumar, Dhanya Pramod, and Raman Ramakrishnan. 2017. Risks Assessment using Fuzzy Petri Nets for ERP Extension in Small and Medium Enterprises. *Information Resources Management Journal* 30: 1–23. [CrossRef]
- Chang, Betty, Chin Kuo, Chih-Hung Wu, and Gwo-Hshiung Tzeng. 2015. Using Fuzzy Analytic Network Process to assess the risks in enterprise resource planning system implementation. *Applied Soft Computing* 28: 196–207. [CrossRef]
- Chofreh, Abdoulmohammad Gholamzadeh, Feybi Ariani Goni, and Jiří Jaromír Klemeš. 2018. Sustainable enterprise resource planning systems implementation: A framework development. *Journal of Cleaner Production* 198: 1345–54. [CrossRef]
- Chofreh, Abdoulmohammad Gholamzadeh, Feybi Ariani Goni, Awaluddin Mohamed Shaharoun, Syuhaida Ismail, and Jiří Jaromír Klemeš. 2014. Sustainable enterprise resource planning: Imperatives and research directions. *Journal of Cleaner Production* 71: 139–47. [CrossRef]

- Chuang, Ming-Ling, and Wade H. Shaw. 2008. An empirical study of enterprise resource management systems implementation. From ERP to RFID. *Business Process Management Journal* 14: 675–93. [CrossRef]
- Coad, Alex, Sofia Amaral-Garcia, Peter Bauer, Clemens Domnick, Peter Harasztosi, Rozália Pál, and Mercedes Teruel. 2023. Investment expectations by vulnerable European firms in times of COVID. *Eurasian Business Review* 13: 193–220. [CrossRef]
- Cronbach, Lee J. 1951. Coefficient alpha and the internal structure of tests. *Psychometrika* 16: 297–334. [CrossRef]
- DeLone, William H., and Ephraim R. McLean. 1992. Information systems success: The quest for the dependent variable. *Information Systems Research* 3: 60–95. [CrossRef]
- DeLone, William H., and Ephraim R. McLean. 2003. The DeLone and McLean model of information systems success: A ten-year update. *Journal of Management Information Systems* 19: 9–30.
- Dey, A., P. LaGuardia, and K. Kang. 2017. Policy support for green IT adoption in small and medium-sized enterprises. *International Journal of Information Management* 37: 405–12.
- DIRCE. 2023. Directorio Central de Empresas. Available online: <http://www.ine.es/jaxi/menu.do?type=pcaxis&path=/t37/p201/&file=inebase> (accessed on 15 February 2024).
- Esteves, José, and Joan Pastor. 2000. Enterprise resource planning systems research: An annotated bibliography. *Communication of AIS* 4: 1–52. [CrossRef]
- Gallardo, Antonio Lobo, and Bernabé Escobar-Pérez. 2006. Factores de éxito para la implantación de sistemas ERP. Evidencia empírica. *Partida Doble* 183: 80–95.
- Gattiker, Thomas F., and Dale L. Goodhue. 2002. Software-driven changes to business processes: An empirical study of impacts of Enterprise Resource Planning (ERP) systems at the local level. *International Journal of Production Research* 40: 4799–814. [CrossRef]
- George, Darren, and Paul Mallery. 1995. *SPSS/PC+ Step by Step. A Simple Guide and Reference*. Belmont: Wadsworth Publishing.
- Granlund, Markus, and Teemu Malmi. 2002. Moderate impact of ERPs on management accounting: A lag or permanent outcome? *Management Accounting Research* 13: 299–321. [CrossRef]
- Gupta, Mahesh, and Amarpreet Kohli. 2006. Enterprise resource planning systems and its implications for operations function. *Technovation* 26: 687–96. [CrossRef]
- Gupta, Shivam, Subhas C. Misra, Ned Kock, and David Roubaud. 2018. Organizational, technological and extrinsic factors in the implementation of cloud ERP in SMEs. *Journal of Organizational Change Management* 31: 83–102. [CrossRef]
- Hair, Joseph F., William C. Black, Barry J. Babin, Rolph E. Anderson, and Ronald L. Tatham. 2006. *Multivariate Data Analysis*. Upper Saddle River: Pearson-Prentice Hall, vol. 6.
- Hitt, Lorin M., D. J. Wu, and Xiaoge Zhou. 2002. Investment in enterprise resource planning: Business impact and productivity measures. *Journal of Management Information Systems* 19: 71–98. [CrossRef]
- Hörisch, Jacob, Matthew P. Johnson, and Stefan Schaltegger. 2015. Implementation of Sustainability Management and Company Size: A Knowledge-Based View. *Business Strategy and the Environment* 24: 765–79. [CrossRef]
- Hsu, Chih-Hung, An-Yuan Chang, and Wei Luo. 2017. Identifying key performance factors for sustainability development of SMEs e integrating QFD and fuzzy MADM methods. *Journal of Cleaner Production* 161: 629–45. [CrossRef]
- Jalilvand, A., and T. Ramayah. 2010. Web usage and academic performance: A sense-making perspective. *Computers & Education* 55: 1694–707.
- Jituri, Saraswati, Brian Fleck, and Rafiq Ahmad. 2018. Lean OR ERP—A Decision Support System to Satisfy Business Objectives. Paper presented at 28th CIRP Design Conference 2018, Procedia CIRP, 28th CIRP Design Conference, Nantes, France, May 23–25.
- Kanellou, Alexandra, and Charalambos Spathis. 2013. Accounting benefits and satisfaction in an ERP environment. *International Journal of Accounting Information Systems* 14: 209–34. [CrossRef]
- Koren, Yoram, Xi Gu, Fazleena Badurdeen, and Ibrahim S. Jawahir. 2018. Sustainable Living Factories for Next Generation Manufacturing. *Procedia Manufacturing* 21: 26–36. [CrossRef]
- Li, D., D. Zhang, and H. Cai. 2017. A cloud-based system for cost-effective and energy-efficient large-scale enterprise resource planning. *Computers, Materials & Continua* 53: 233–53.
- Li, Weizi, Kecheng Liu, Maksim Belitski, Abby Ghobadian, and Nicholas O'Regan. 2016. e-Leadership through strategic alignment: An empirical study of small- and medium-sized enterprises in the digital age. *Journal of Information Technology* 31: 185–206. [CrossRef]
- Mabert, Vincent A., Ashok Soni, and M. A. Venkataramanan. 2003a. Enterprise resource planning: Managing the implementation process. *European Journal of Operational Research* 146: 302–14. [CrossRef]
- Mabert, Vincent A., Ashok Soni, and Munirpallam A. Venkataramanan. 2003b. The impact of organization size on enterprise resource planning (ERP) implementations in the US manufacturing sector. *International Journal of Management Science* 31: 235–46. [CrossRef]
- Matolcsy, Zoltan P., Peter Booth, and Bernhard Wieder. 2005. Economic benefits of enterprise resource planning systems: Some empirical evidence. *Accounting and Finance* 45: 439–56. [CrossRef]
- Moldavska, Anastasiia, and Torgeir Welø. 2016. Development of manufacturing sustainability assessment using systems thinking. *Sustainability* 8: 5. [CrossRef]
- Motwani, Jaideep, Dinesh Mirchandani, Manu Madan, and Angappa Gunasekaran. 2002. Successful implementation of ERP projects: Evidence from two case studies. *International Journal of Production Economics* 75: 83–96. [CrossRef]
- Nasiri, M. M., A. Bagheri, and A. Khorram. 2016. Green ERP systems implementation: An empirical study in the Iranian manufacturing firms. *Computers in Human Behavior* 55: 732–48.

- Nicolaou, Anders, and Somnath Bhattacharya. 2008. Sustainability of ERPs performance outcomes: The role of post-implementation review quality. *International Journal of Accounting Information Systems* 9: 43–60. [[CrossRef](#)]
- Nikitović, Milorad, and Vjeran Strahonja. 2016. The Analysis of CSFs in stages of ERP Implementation Case Study in small and medium sized (SME) companies in Croatia. Paper presented at 39th International Convention on Information and Communication Technology, Electronics and Microelectronics (MIPRO), Opatija, Croatia, May 30–June 3.
- Paquet, Philippe, and Genevieve Paviot. 2017. The adoption of an on-line ERP by SME: Between concern and necessity. *Revue Internationale PME* 30: 261–88. [[CrossRef](#)]
- Patalas-Maliszewska, Justyna, and Sławomir Kłos. 2019. The methodology of the S-ERP system employment for small and medium manufacturing companies. *IFAC-PapersOnLine* 52: 85–90. [[CrossRef](#)]
- Peltier, James W., Yushan Zhao, and John A. Schibrowsky. 2012. Technology adoption by small businesses: An exploratory study of the interrelationships of owner and environmental factors. *International Small Business Journal* 30: 406–31. [[CrossRef](#)]
- Pérez Estébanez, Raquel, António Trigo, and Fernando Belfo. 2016. ERP Systems Adoption Evolution in Iberian Companies during the Global Financial and Economic Crisis and Recession (2007–2014). Paper presented at 2016 2nd International Conference on Information Management (ICIM), London, UK, May 7–8. [[CrossRef](#)]
- Phaphoom, Nattakarn, Wongduan Saelee, Tunyawat Somjaitaweeporn, Sumeth Yuenyong, and Jian Qu. 2018. A Combined Method for Analysing Critical Success Factors on ERP Implementation. Paper presented at 15th International Joint Conference on Computer Science and Software Engineering (JCSSE), Nakhonpathom, Thailand, July 11–13; pp. 299–304.
- Ruivo, Pedro, Tiago Oliveira, and Miguel Neto. 2013. Enterprise resource planning post-adoption value: A literature review amongst small and medium enterprises. Paper presented at 2013 8th Iberian Conference on Information Systems and Technologies (CISTI), Lisboa, Portugal, June 19–22.
- Ruivo, Pedro, Tiago Oliveira, and Miguel Neto. 2014. Examine ERP post-implementation stages of use and value: Empirical evidence from Portuguese SMEs. *International Journal of Accounting Information Systems* 15: 166–84. [[CrossRef](#)]
- Ruivo, Pedro, Tiago Oliveira, and Miguel Neto. 2015. Using resource-based view theory to assess the value of ERP commercial-packages in SMEs. *Computers in Industry* 73: 105–16. [[CrossRef](#)]
- Snider, Brent, Giovani J. C. da Silveira, and Jaydeep Balakrishnan. 2009. ERP implementation at SMEs: Analysis of five Canadian cases. *International Journal of Operations & Production Management* 29: 4–29.
- Spathis, Charalambos, and Sylvia Constantinides. 2004. Enterprise resource planning systems' impact on accounting processes. *Business Process Management Journal* 10: 234–47. [[CrossRef](#)]
- Stevenson, Mark, Linda C. Hendry, and Brian G. Kingsman. 2005. A review of production planning and control: The applicability of key concepts to the make-to-order industry. *International Journal of Production Research* 43: 869–98. [[CrossRef](#)]
- Sutton, Steve G. 2006. Enterprise systems and the re-shaping of accounting systems: A call of research. *International Journal of Accounting and Information Systems* 7: 1–6. [[CrossRef](#)]
- Teittinen, Henri, Jukka Pellinen, and Marko Järvenpää. 2013. ERP in action—Challenges and benefits for management control in SME context. *International Journal of Accounting Information Systems* 14: 278–96. [[CrossRef](#)]
- Trigo, António, Fernando Belfo, and Raquel Pérez Estébanez. 2014. Accounting Information Systems: The Challenge of the Real-Time Reporting. *Procedia Technology* 16: 118–27. [[CrossRef](#)]
- Venkatraman, Sitalakshmi, and Kiran Fahd. 2016. Challenges and Success Factors of ERP Systems in Australian SMEs. *Systems* 4: 20. [[CrossRef](#)]
- Wang, E. T., B. Lin, and S. Hsu. 2011. The impact of green supply chain management practices on performance: A case study of Taiwan manufacturing industries. *Decision Support Systems* 50: 186–95.
- Wieder, Bernhard, Peter Booth, Zoltan P. Matolcsy, and Maria-Luise Ossimitz. 2006. The impact of ERP systems on firm and business process performance. *Journal of Enterprise Information Management* 19: 13–29. [[CrossRef](#)]
- Zeng, Yu-Rong, Lin Wang, and Xian-Hao Xu. 2017. An integrated model to select an ERP system for chinese Small- and Medium-sized Enterprise under uncertainty. *Technological and Economic Development of Economy* 23: 38–58. [[CrossRef](#)]
- Zhu, Qingyun, and Joseph Sarkis. 2016. Green marketing and consumerism as social change in China: Analyzing the literature. *International Journal of Production Economics* 181: 289–300. [[CrossRef](#)]

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