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Challenges of Cloud-ERP Adoptions in SMEs

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Abstract

This research examines the challenges of cloud enterprise resource planning (ERP) system adoptions in Small- and Medium-sized Enterprises (SMEs) in literature. Cloud-ERP systems provide new opportunities for companies and make ERP systems more accessible to smaller companies beyond large enterprises (LEs). However, organizations are still experiencing challenges related to the adoption and implementation of cloud-based software and the use of new systems. Existing literature within this field of study mainly concentrates on the challenges of cloud-ERP adoptions in LEs. Relevant literature on the respective challenges experienced in SMEs is either relatively old or not addressing this topic exclusively. Hence, this research gap should be further studied to better understand and gain insight into the field. Based on the four phases of the Enterprise System Experience Cycle, we identify and classify the challenges addressing SMEs' cloud-ERP adoptions in extant literature.

Keywords: Cloud ERP; SMEs; Implementation; Adoptions; ERP Systems

1. Introduction

Cloud computing and cloud-based business processes are becoming increasingly common in business practices all over the world. Cloud-ERP is a web-based enterprise resource planning (ERP) software usually hosted in massive data centers, whereas the client companies subscribe to the software service through a service provider [1]. Legacy

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systems are becoming outdated and are being replaced by new innovative technologies. Companies today have numerous choices when choosing an ERP system [2], and more companies are also moving away from legacy systems, as they need real-time data insights to stay relevant and competitive in the market [3]. Much of the existing literature on cloud-ERP solutions focus on the benefits and barriers of cloud-ERP in large enterprises (LEs). Few research focus on the contrasts between Small- and Medium-sized Enterprises (SMEs) and LEs' ERP adoptions. A common claim is that SMEs usually reap more benefits from cloud-ERP systems, while LEs are those experiencing lags and issues. Thus, this literature review will focus on the challenges related to cloud-ERP adoptions for SMEs to investigate the viability of that claim. The paper aims to fill this research gap by reviewing extant literature focusing on cloud-ERP adoptions and implementations in SMEs to gain a deeper understanding of the respective topic. The identified literature in this paper is reviewed and classified into the four phases of the enterprise system experience cycle [4], a framework covering the phases of an ERP implementation from idea to application.

The rest of the paper is organized as follows. Section 2 illustrates the research methodology adopted in this research. Section 3 presents an overview of the respective articles, followed by a presentation of the findings in section 4. Section 5 discusses the observations and results. Finally, section 6 presents the research conclusions and provides suggestions for future research avenues.

2. Research Methodology

To adequately review the selected literature in this article, a systematic review approach [5] was adopted. This approach entails a systematic research strategy and synthesizes for comparing evidence from the articles reviewed. It also effectively uncovers what the evidence from the selection of studies reveals about the relevant research gap [6]. The literature review is concept-centric, as the respective research area's key concepts determine the review framework [5]. The selected articles for this review are published between the years 2013 and 2021. The search for articles was conducted via Google Scholar and EBSCOhost. The keywords included were cloud-ERP, implementing, implementation, cloud enterprise resource planning, SMEs, small and medium enterprises, challenges, issues, barriers, and cloud computing. When selecting the most relevant articles, the consideration was mainly based on the abstracts, aims of the studies, and findings. Furthermore, reference lists of interesting articles were browsed to find potentially relevant articles to include. For a more organized paper, this review's structure is based on the framework developed by Markus and Tanis [4] "Enterprise System Experience Cycle" (*see fig. 1*). The framework aims at describing how business value can be created through IT and on understanding and evaluating the success of enterprise systems [4]. The framework will, in this paper, be employed to organize the reviewed papers into the phases they target in cloud-ERP adoptions within the SME context. The cycle consists of four phases [4]: 1) Phase one is the chartering phase and concerns the decisions before an ERP implementation. This phase is where the vital decisions regarding the project are made, the business case is built, and approval of schedules, budgets, and other project details happens. 2) The second phase is the project configuration phase, entailing the processes and actions to get the new ERP system up and running. This phase includes integrating and configuring data and other technical processes related to the software's rollout. 3) The third phase is the shakedown phase, which involves getting to "normal" operations by fixing bugs and stabilizing the system. Operational managers gain control again, and the company adapts to using the new system. 4) Fourth, and finally, we have the onward and upward phase. This final phase is where the use, maintenance, support, performance, and upgrading of the ERP system happens. This phase continues until the company decides to change to another system. Additionally, a theory developed by Jeanne Ross [7] in 1999 is referred to in the discussion of performance dips related to

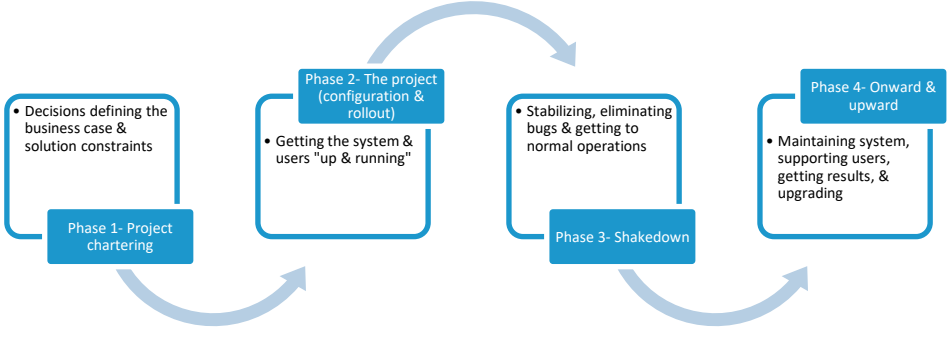

Fig. 1. Enterprise System Experience Cycle. Adapted from [4].

the shakedown phase of cloud-ERP implementations in section four. This theory builds upon the assumption that companies often experience decreased performance in the late shakedown/post-implementation phases of an ERP implementation [7].

3. Overview of Articles

This review consists of a total of twenty-six articles. The studies' methodologies were various, but the majority conducted interviews to collect their data. Fig. 2 and 3 below provide an overview of the selected articles per year of publication and the number of articles per phase/theme. It is important to note that an article may be classified into one or more phases, based on its focus.

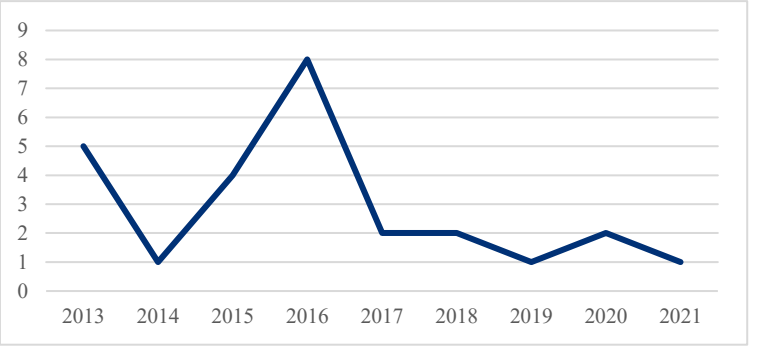

Fig. 2. Number of publications per year

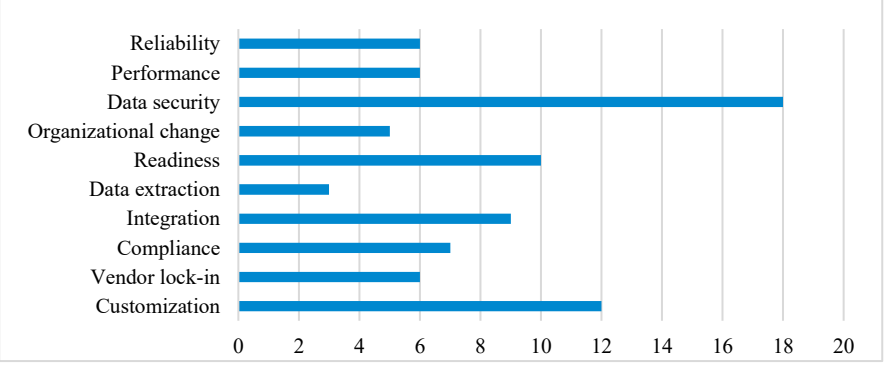

Fig. 3. Number of publications per year

4. Findings

As mentioned earlier, this section's structure is based on the Enterprise System Experience Cycle. As this is a concept-centered review, the articles are presented by topic-mapping to the four phases of the cycle.

Table 1. Article mapping with Enterprise System Experience Cycle's Phases

Phase	Challenge areas	Articles
Phase 1- Project Chartering	Customization	[8], [9], [10], [11], [12], [13], [14], [15], [16], [17], [18], [19]
	Vendor lock-in	[9], [11],[13], [14], [17], [18]
Phase 2- The Project	Compliance	[11], [12], [14], [15], [20], [21], [22]
	Integration	[8], [11], [12], [13], [14], [16], [17], [18], [23]
	Data extraction	[9], [13], [24]
Phase 3- Shakedown	Readiness	[11], [12], [16], [24], [25], [26], [27], [19], [20], [23]

	Organizational change	[11], [12], [27], [28], [29]
Phase 4- Onward & Upward	Data security	[8], [9], [10], [13], [14], [15], [11], [16], [18], [19], [20], [22], [24], [27], [28], [30], [31], [32]
	Performance	[8], [13], [14], [18], [19], [27]
	Reliability	[9], [10], [11], [13], [14], [15]

Phase 1 - The Project Chartering Phase

Customization: is often considered as one of the most significant barriers for SMEs to adopt and implement cloud-ERP. The cloud-ERP packages are often standardized and can be difficult, costly, and timely to customize. Thus, both parties' flexibility is essential in the process of an ERP adoption, including the SME and the cloud service vendor [8-10, 33]. A case study conducted by [11] uncovered a division in SMEs perception of software as a service (SaaS) ERP, whereas two of the companies participating in the case study perceived this as a permanent solution. In contrast, another two organizations perceived it as an interim solution for a later implementation of a customized on-premises solution. The limitations of customizing cloud-ERP systems may thus restrain SMEs from implementing such a system if they plan on expansion requiring more complex ERP operations. Being negligent in selecting a cloud-ERP package affects the whole adoption process, entailing timeframes, budget, goals, and success. By choosing a package unfit for the SME's needs and requirements, the implementation is prone to heavy customizations [12]. Providing all SMEs with a standard cloud-ERP platform subjects a customization barrier for the system vendors [8]. As evident in [11]'s case study, limitations in customization opportunities caused tension between vendors and adopters, resulting in a need for the consultants to resolve these problems with the unsatisfied company managers. It is also important to mention that simple customizations are more accessible for the vendors than requests for more complex modifications [9]. While [13] and [18] agree that customization is a significant challenge in cloud-ERP with standardized applications for all the users, the authors argue that this challenge might not be as critical to SMEs as LEs. From a quantitative data analysis investigating the difference between SMEs and LEs concerning customization challenges, it was ascertained that lower complexity in SMEs' systems and processes reduces the implementation issues related to customization. It is a feature that is more critical to LEs that need higher integration options with their complex legacy systems. Hence, SMEs with a need for moderately complex integration with existing systems should be aware of the limitations of customizing cloud-ERP systems [14]. Some also argue that despite the recognized challenges of customization, the benefits of cloud-ERP systems provide to SMEs are significantly outweighing the challenges [9, 15]. **Vendor lock-in/switching-costs:** [13] draw upon a concern regarding the integrity of cloud-ERP vendors. As the vendors possess volumes of important data, trust is then a critical success factor. Moreover, due to the cloud-ERP vendor's possession of its users' information and data, it can be difficult for companies to change cloud-ERP providers if they are not satisfied with the software. If there is a foreseen risk of this being the case, negotiating a service level agreement (SLA) could help the two parties consolidate their expectations and understanding of the agreement. However, SLAs often omit confidentiality aspects, leaving the possibility of conflict open [14]. Additionally, the literature suggests that the subscription costs of a cloud-ERP system can impact SMEs' decisions on cloud-ERP vendors due to financial implications [13, 18]. Results of [11] suggested that the total cost of monthly cloud-ERP subscription costs will not be significantly cheaper than an on-premises ERP solution in the long run. Despite the pay-per-use monthly subscription models, a change of cloud-ERP vendor requires a lot of additional indirect costs of transferring data, systems, and processes to fit another vendor's cloud-ERP system. On the contrary, [9] emphasized that the total costs related to cloud-ERP implementations are significantly lower than on-premises implementations. The latter requires expenses in hardware and technical support teams and maintenance, among other costs.

Phase 2 - The Project Phase

Compliance: how the cloud-ERP software complies and fits the adopting organization is a significant success factor. The system needs to create value for the company and support the business processes seamlessly [11]. The data migrated from legacy systems or business functions must be of high quality, meaning that it should be of a consistent format, be timely and accurate [12]. Compliance to jurisdictions and regulations needs to be also identified by SMEs,

based on their geographical location [13]. As regulations (e.g. GDPR) and jurisdiction standards vary and may be somewhat abstruse, companies may face a regulation violation risk with cloud-ERP, if they weren't appropriately addressed beforehand [12, 15, 20]. In addition, some studies highlight concerns of complying with environmental regulations and energy standards in relation to cloud-based operations [14]. On the other hand, other research discuss the challenges faced by SMEs due to the governmental pressures imposed on them to adopt ERP systems to comply with certain regulations (e.g. Sarbanes-Oxley Act) [21, 22]. **Integration:** several existing research papers suggest that data integration is considered one of the significant challenges in cloud-ERP adoptions in SMEs, as it may cause implementation difficulties and delays [8, 13]. When discussing challenges related to customization, [14] point out the related integration issues affecting both the cloud-ERP vendor and the adopting organization. For example, a study on Indian SMEs that planned heavy customizations, lead to a complex project situiation resulting in the ERP package being a software misfit for the companies [12]. Not only customization challenges depend on the complexity of the company's existing infrastructure, it also depends on the organizational culture [14]. This problem was exemplified by a company participating in [11]'s case study where a two-and-a-half-year-long delay of cloud-ERP integration could be explained by change management issues related to the organization's culture. Furthermore, [13] suggested that some applications in cloud-ERP are challenging to integrate with on-premise ERP systems and that an integration of a new cloud-ERP system with an old on-premise ERP system might escalate the implementation costs of the transition project significantly. **Data extraction:** data extraction and migration were rarely addressed in Cloud-ERP literature in general [34]. In cases where information and data with common names are extracted from a cloud, SMEs might experience a mismatch of data as it might be difficult for the users to know which data to select for extraction, which may lead user uncertainty in the data extraction process [13]. Hence, data extraction can be a critical challenge in the adoption of cloud-ERP in SMEs. In addition, security and speed of data extraction may be an issue for SMEs, as they are for the most part, limited to using public clouds that might slow down the connectivity. Thus, the extraction processes might become more cumbersome to public cloud users than private cloud ones [9, 13, 24].

Phase 3 - The Shakedown Phase

Readiness: a case study conducted by [11] shows that, the technological and business process readiness of ERP-adopting organizations may impact the decision whether to implement a cloud or a traditional on-premises ERP system. Some companies are using old legacy systems to handle ERP operations, constraining them from growth due to inefficient business processes and technological quality issues related to their inefficient ERP operations. Insufficient implementation preparations concerning the technology and process-understanding might lead to time delays in implementations [24, 26]. Moreover, if a cloud-ERP implementation is ineffective because the vendor is inadequately prepared in terms of process-analyses and support, the shakedown phase will most likely be prolonged [25]. ERP consultants should identify the potential problems they are prone to meet throughout the adoption project, in order for the systems to operate as "normal" in the shakedown phase of the project and onward [12]. **Organizational change**: for a company to be ready for a cloud-ERP implementation, the change management should be considerate of necessary modifications to company culture, decision-making processes, top management support, the staff's attitudes to the change, and other elements that need potential changes to proceed with an effective and successful adoption [12, 29]. Studies have identified change management as a critical factor for a successful cloud-ERP implementation as there are several pitfalls throughout such projects. Project and change management are vital parts of an implementation process. The pursuance of defined objectives and goals is required for the company to manage the change properly throughout the organization and prepare and train staff for changes in business proceedings [11, 27]. Inadequate system education and technical training of staff can be a failure factor for implementations, as the cloud-ERP system will not be functioning to the extent of its abilities and purposes. Poorly managed projects have shown to be more prone to fail, despite the proper technical preparations [12]. Poor change management will make the shakedown phase of the project more challenging, as the operational managers gain control from vendor consultants and are supposed to be able to drift the systems and users to operate in a casual manner [4]. For the latter part of the implementation and the post-implementation phases, all the organizations who participated in the study conducted by [11] dealt with inadequate change management challenges to secure a successful ERP adoption. Following a cloud-ERP implementation, the organizational changes entail, amongst other things, user education and training, process understanding, and acquiring the necessary capabilities and skills for utilizing the system's features

and applications. In these cases, the understanding and utilization of the systems improved with time. This may be explained by earlier research by [4], explaining how there is a dip in ERP productivity during the shakedown phase, whereas productivity slowly but steadily stabilizes and improves over time.

Phase 4 - The Onward and Upward Phase

Data security: in cloud-ERP systems, data and sensitive information are controlled by the cloud service vendor, which may be by many conceived as a threat to SMEs' privacy, confidentiality, and security. Therefore, data security risks are often identified among the top factors of concern related to a cloud-ERP implementation [8, 9, 13, 24, 31]. When implementing a cloud-ERP system, the company trusts the software vendor with sensitive business data such as customer information, financial data, and other operational information. As the cloud-ERP vendors are solely administrating all maintenance, updates, and application developments, monitoring and securing this data become a major concern for SMEs [13]. Concerns related to the vendor's internal infrastructure, or other companies using the same infrastructure, hacking, and vendors' privileged control over sensitive data are central in cloud-ERP implementation security, as cloud-based services are often considered appropriate for operations where privacy concerns and data security are of less importance [10]. On the contrary, [15] and [17] suggest that security issues related to cloud-ERP implementations in SMEs are not as much of a big problem compared to LEs and explain how cloud-ERP systems may improve SMEs data security through the high levels of security offered from the vendors that the SMEs themselves cannot implement. Likewise, [14] argue that security risks are lower for SMEs, though they should still be considered. While the company managers involved in [11]'s case study were also in line with this perception, as they did not consider security issues as major concerns for their cloud-ERP implementations, however, security has been acknowledged as the number one challenge for Cloud-ERP adoptions in the reviewed literature in this study. **Performance:** unpredictable system performance during deployment was considered a significant concern by [8]. Unstable performance may result from an unstable or slow internet connection, unsatisfactory service from the cloud vendor, or down-time of the cloud servers, diminishing the system's reliability. Likewise, [13] also found that, the SMEs' network dependency impacts their performance when implementing a cloud-ERP system due to their limited access to high speed connections in many cases. They argue that multi-tenancy may lead to increased delays in data downloading and upgrading. Furthermore, it is pointed out that limited functionality related to vendors' restrictive application provision and integration beyond core ERP modules may also impact SMEs' performance through confined collaboration with other departments of the organization. Research by [14] argues that, SMEs' performance is closely linked to and threatened by the risks of limited network reliability and connectivity, outage, and pressure on data processing and transfer. **Reliability**: literature has identified that the business complexity of SMEs is a challenge when implementing cloud-ERP systems. The handling of large data sets is regarded as a concern based on SMEs' limited access to the highest-speed Internet connection necessary for processing such large data sets, potentially resulting in system lags and reduced system reliability [9]. This system instability may result in extra pressure and delays on other parallel activities [13]. Typically, the performance decreases when the number of cloud-ERP users increases due to escalated amounts of data exchange and processing [14, 15]. As [10] emphasized via a case study on South-African SMEs, poor connectivity and reduced reliability were associated with the risks related to critical business operations affecting the company's core operations. Additionally, company managers have expressed trust issues and concerns about their reliance and dependency on the cloud-ERP vendors, and the lack of control over their data handling. The concern was rooted to the uncertainties of the company's performance, as it will be determined by the quality of the vendor's service, staff, and control [10]. In contrast, [15] state that, reliability and bandwidth concerns are especially profound for companies that expect smooth application performance and high technical proficiency, and that this applies to LEs to a higher extent than to SMEs. Nonetheless, the emphasis on poor performance as an implementation-related issue is explained by reduced network reliability resulting in limited connection speed. This issue was epitomized by one of the SMEs participating in a case study that experienced some challenges of limited bandwidth in remote locations [11]; however, this was not viewed a severe issue on a general basis.

5. Results and Discussion

Based on the existing literature on cloud-based ERP systems in SMEs, there is no or little doubt that cloud-ERP provides much benefits for SMEs. However, it is still important to thoroughly assess the challenges and threats of a cloud-ERP implementation in SMEs, even though literature often concludes that implementation-related cloud-ERP challenges are more ubiquitous in LEs than in SMEs. As portrayed in section four, there are disagreements as to what extent some of the identified challenges faced by LEs apply to SMEs. The selected literature in the review recognizes issues of cloud-ERP implementation for SMEs; however, there is a tendency to marginalize these challenges when comparing them to the challenges faced by the LEs counterparts. By placing SMEs in such a juxtaposition, there are chances that SMEs' issues or pitfalls related to cloud-ERP implementations fade. Among the most discussed challenges in the existing literature studied in this research, limitations of customization, security risks, and reliability and their impact on SMEs stand out as elements where the literature seems to conflict the most. Below, the most common challenges identified in literature are mapped to their respective lifecycle phases.

Phase 1 – The Project Chartering Phase: customization limitations for cloud-ERP implementation are often recognized as one of the critical barriers in the Project Chartering phase as it defines the solution constraints and extension limitations. Results from several studies show that, the concrete limitations in themselves might not become the problem, but the unclarity and expectations associated with customization may raise conflicts between the system vendor and the SMEs. Regardless of whether customization limitations apply more to LEs than SMEs, SMEs should be aware of the constraints if they plan to undertake complicated modifications to the cloud-ERP packages.

Phase 2 – The Project Phase: the project phase revealed challenges related to the compliance of the cloud-ERP system and the SME implementing it. This entails the quality of the SMEs' existing data and systems and how this fits the new cloud-ERP systems. This will impact the whole implementation process, such as time schedules, effectiveness, quality, and accuracy. Data integration difficulties and delays were critical in cloud-ERP implementations that might escalate the project's costs. Furthermore, the articles regarded the importance of being aware of jurisdiction and regulation compliance of cloud systems vary and depend on where the business is operating.

Phase 3 – The Shakedown Phase: our results show that a cloud-ERP implementation depends on proper project and change management. As suggested by the literature, the staff and managers need to use the system effectively; thus, staff training and education are essential in order to minimize the risk of adoption failures. Even if the cloud-ERP vendor is well prepared and skilled for successful system implementation, the ERP system and business process change still relies on its ability to utilize its applications and functionality to the fullest. However, as previously discussed, a cloud-ERP implementation might experience a performance dip during the post-implementation phase. This was addressed as potentially caused by a decline in business performance in the shakedown phase of the adoption lifecycle, followed by a relatively steady growth with time [4].

Phase 4 – The Onward and Upward Phase: data security has also proven to be one of the top concerns for SMEs in cloud-ERP adoptions, as companies want to protect and control their data containing sensitive information. However, there are disagreements in the literature on which data security issues apply to SMEs. Two of the articles in this review argue that data security risks, in most cases apply to LEs, whereas four articles regard data security risks to be a threat and concern to SMEs as well. Conclusively, this challenge appears to depend on the SMEs size, resources, and type of business, and should be considered in a cloud-ERP adoption in all cases. Likewise, the literature also disagreed on the risks related to network reliability and dependency of cloud-ERP systems, and the vendors' ability to provide smooth connections and applications that bring value to the business processes. As most of the articles argued that poor connectivity and deficient performance are prone to present SMEs with operational issues affecting the overall business performance. Hence, reliability issues seem to be an essential aspect when evaluating cloud-ERP system for SMEs' adoptions.

6. Conclusion

Cloud-ERP systems are becoming increasingly popular among companies, as such solutions are accessible and more affordable to smaller enterprises. By reviewing extant literature within the scope of this research, this paper sheds light on the challenges related to the adoption of cloud-ERP systems in SMEs. Throughout this literature review, we have examined various challenges, issues, and difficulties related to cloud-ERP adoptions in SMEs, entailing the processes from the planning phase to where the software is used, structured by the enterprise system experience cycle [4]. This structure facilitated an organized understanding of the focus area based on the highlights from the respective literature review. Based on our findings, SMEs should consider the challenges primarily related to the limitations of customization, reliability issues, data security risks, and the importance of high-

quality change management. Although much literature suggests that cloud-ERP systems are beneficial for SMEs, the adopting enterprises must be aware of the related challenges and issues that might arise from such an implementation and to succeed in the long run. Despite disagreements in the applicability of customization and data security-related issues within SMEs' context, the findings suggest that this should at least be considered in the pre-implementation phase, as several studies still regard it as a critical factor that might affect the implementation process and its outcome. Hence, change management needs to be thoroughly conducted, particularly before, during, and post the implementation stages. Furthermore, managers need to make sure that the existing data and legacy systems are of sufficient quality to implement the new cloud-ERP system.

There is limited literature focusing on SMEs' challenges in cloud-ERP implementations and the technicalities in particular; thus, this should be further studied to better understand the issues and effects. As cloud-ERP systems continuously develop, improve, and advance, the research area is thus highly relevant and interesting for practitioners and scholars. Research comprising case studies, comparative analyses, and primary data collection will enhance our understanding and expertise in the field. Furthermore, future studies should aim at creating a proper framework for the cloud-ERP lifecycle in SMEs considering the implementation challenges that are most experienced by SMEs in cloud-ERP implementations, helping the prevention of such challenges in future adoption processes.

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