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Factors Affecting Cloud ERP Adoption Decisions in Organizations

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Abstract

This paper summarizes research on the adoption of cloud enterprise resource planning (ERP) systems in small and medium-size organizations (SMEs) and large enterprises (LEs) that have employed the diffusion of innovation (DOI), and the theory and technology, organization, and environment (TOE) framework. Based on a systematic literature review, this paper concludes on 13 primary factors that are the most common influencers when adopting cloud ERP at the organizational level. These factors are categorized and discussed through the DOI, and the TOE framework. The perceived relative advantage, compatibility, complexity, trialability, and observability are identified as innovation characteristics influencing the decision to adopt cloud ERP. The technological factors are identified as system quality, security, vendor lock-in, and data accessibility, while the organizational factors are identified as a financial advantage and top management support. Finally, competitive and regulatory pressures and support are environmental factors affecting the adoption decisions. Out of the 13 factors identified, vendor lock-in, relative advantage, top management support, and competitive and regulatory environment were the most common factors affecting the decision to adopt cloud ERP. Finally, this review identifies a gap related to the lack of studies in the context of LEs, and a lack of differentiation between small and medium-size organizations, which may be fulfilled by future research.

Keywords: ERP Systems; Cloud computing; Adoption; Implementation; SMEs; LEs

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1. Introduction

Enterprise resource planning (ERP) systems are modular applications aiming at supporting and integrating the organization's business processes through one data repository [1]. Traditional ERP systems, also known as on-premise systems, are hosted and maintained internally. On-premises solutions can be time-consuming to implement and difficult to upgrade, and require high up-front investments [2]. In recent years, organizations have been eager to move their ERP system to the cloud as a way of solving these issues [3]. Cloud computing can be defined as *"a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction"* [4]. Cloud ERP systems can be fully hosted by a third-party vendor and accessed online without local installation [5]. This cloud solution is also known as software as a service (SaaS) and provides lower costs, time savings, higher scalability, and is easier to upgrade [5]. The 2020 ERP report conducted by the Panorama Consulting Group shows that more than half of the organizations they analyzed (62,70%) are choosing cloud ERP systems instead of on-premises ERP systems [6]. Furthermore, nearly 90% of the organizations selected SaaS ERP solutions. The report also states that lack of information or knowledge about cloud ERP was the most common reason for choosing on-premises systems.

Cloud ERP is a relatively young concept, and organizations are still learning about its advantages and limitations. The risk of data loss and security concerns are stated as additional barriers. Although security was the most common barrier in extant research, however, several studies found it to be the least common barrier for adoption decisions [6, 7]. These findings strengthen the importance of a literature review on the current body of knowledge on factors influencing the decision to adopt cloud ERP. After overviewing literature in the area, we found that, to our knowledge, no existing literature reviews were focusing on this specific topic. At the same time, many empirical studies concluded various outcomes related to it. This paper, therefore, attempts to summarize and discuss these outcomes by answering the following research question: *"What are the main factors affecting the decision to adopt cloud ERP at the organizational level in the extant literature?"*. A systematic literature review is performed, and the main factors identified across the studies are categorized considering the (DOI) theory and the (TOE) framework. The review includes studies employing the DOI theory or the TOE framework that have been conducted on small and medium-size organizations (SMEs) and large enterprise (LEs), to identify potential contrasts among them.

This paper is structured as follows: Section 2 introduces the research methodology, presents an overview of the articles, and informs about the classification framework. Section 3 presents the main findings categorized through the innovation characteristics of the DOI theory and the different contexts related to the TOE framework. A discussion of the findings and implications for future research are presented in section 4, followed by concluding remarks in section 5.

2. Research methodology

Literature reviews are considered as essential contributors to the academic field in light of theory development, identification of research gaps, and future research [8].The five steps of the systematic literature review developed by [9] are followed in this paper. First, the research question is formulated, followed by identifying literature and selecting and evaluating relevant literature. The remaining steps include analysis and synthesis, which are presented in section 2.1, followed by a presentation of findings, discussion, and conclusions (see table 1).

Table 1: Overview of the systematic literature review. Adapted from [10]

Research question	*"What are the main factors affecting the decision to adopt cloud ERP at the organizational level in the extant literature?"*
Literature identification	Search keywords: "cloud" OR "cloud-based" OR "software as a service" AND "ERP" OR "enterprise resource planning", AND "DOI" OR "TBP" Database and number of articles: Oria (40 articles)
Literature evaluation & selection	Inclusion criteria: 1) Peer reviewed journal articles 2) Written in English Selection method: 1) Scanning titles 2) Reading abstracts 3) Reading methodology and main results 4) Choosing relevant articles and reading them in full Overview of databases and number of articles selected: ProQuest (1), Sage Premier (1), Emerald Insight (3), Taylor & Francis (2), Google Scholar (2)
Analysis & synthesis	Section 2.1
Results & conclusions	Sections 3, 4 and 5

We did not find it necessary to identify a specific timeframe for the publication years of the articles, as cloud ERP is a relatively young concept. When the inclusion criteria were applied, a total of 40 articles appeared. The articles were selected by scanning

relevant titles and reading abstracts, followed by reading the methodology and main results. The selected articles were then verified by reading them in full. Articles focusing on topics related to cloud ERP adoption decision were included, while articles solely focusing on cloud ERP's implementation phase and other related phases were excluded. In addition, articles that did not disclose the size of the organization(s) studied were excluded from this review. Through Oria, one article was selected from the database ProQuest, three were selected from Emerald Insight, two were selected from Taylor & Francis, and two were selected from Google Scholar. The literature review methodology resulted in nine articles.

2.1. Overview of the articles

This section contains a brief overview of the nine articles discovered through the literature review process (see table 2). [11] integrated the two-factor theory with the TOE framework to investigate the enablers and inhibitors related to switching to cloud ERP systems at the organizational level. The enablers were considered the switching benefits organized through the TOE framework. The inhibitors were costs related to existing ERP systems and cloud ERP based on the two-factor theory. Data was collected from top managers in small organizations operating in Taiwan [11]. [12] conducted a qualitative study to investigate the benefits and barriers related to cloud ERP adoption by interviewing employees of an Indian consultant company that had provided cloud ERP solutions to companies operating in Asia, Europe, and the US. The study did not differentiate between SMEs and LEs. [13] conducted a quantitative study to explore the factors affecting cloud ERP adoption in multinational companies (MNCs) in India. The researchers used the analytic hierarchy process, which is a tool for decision making consisting of goals, criteria, and alternatives, and asked ERP professionals to rate each factor. [14] drew on the TOE framework and the DOI theory to explore the factors influencing the adoption intention of cloud ERP systems in SMEs and LEs in Saudi Arabia. Data was collected from CEOs, IS managers and managing directors. [15] drew on the theory of planned behaviour (TPB) to investigate the benefits and disadvantages toward cloud ERP systems and measured the attitudes of IT executives across Norwegian SMEs and LEs [15]. [16] uncovered the main factors influencing the decision to adopt cloud ERP by SMEs in the context of developing economies by conducting a qualitative study based on the DOI theory and TOE framework. Data was collected from senior executives and IT managers across different developing countries. [17] conducted an empirical study on decision-makers working across different Korean organizations consisting of SMEs and LEs. The purpose of their study was to investigate the factors affecting the intention to adopt cloud ERP systems based on the DOI theory, the TOE framework, and the model of innovation resistance (MIR). [18] developed a sociotechnical framework considering the DOI theory, task-technology fit, the resource-based view (RBV) and the extended technology acceptance model (TAM) based on a qualitative study of enablers and inhibitors of cloud ERP selection and adoption in higher educational institutions in India. Data was collected through interviews with members and IT executives of the ERP committees. The researchers suggest that their findings can be helpful for other SMEs operating in developing economies [18]. [19] collected data from SME owners in Malaysia to study the factors influencing the adoption intention of cloud ERP systems through the TPB.

Table 2: Overview of the articles

Article	Year	Context	Theoretical lens
[11]	2020	Small organizations in Taiwan	Two-factor theory and TOE framework
[12]	2015	Consultant company in India	Previous literature
[13]	2018	MNCs in India	Analytical hierarchy process
[14]	2019	SMEs and LEs in Saudi Arabia	DOI theory and TOE framework
[15]	2015	SMEs and LEs in Norway	TPB
[16]	2018	SMEs in developing economies	DOI theory and TOE framework
[17]	2020	SMEs and LEs in Korea	DOI theory, TOE framework and MIR
[18]	2016	Higher educational institutions in India	DOI theory, task-technology fit (TTF), extended TAM model, the resource-based view (RBV)
[19]	2015	SMEs in Malaysia	TPB and Ettie's technology adoption process

2.2. Classification frameworks

After viewing the articles, we found it advantageous to organize the findings through different sub-chapters to see the similarities and differences . This paper, therefore, is based on two related adoption theories frequently used in IT and IS literature: the DOI theory presented by [20] and the TOE framework represented by [21]. These are preferred theories when explaining the adoption process at the organizational level. In contrast, adoption models like the technology acceptance model (TAM) and the theory of planned behaviour (TPB) are preferred when referring to the individual level [22] [23]. Previous literature shows that the DOI theory and the TOE framework have been successful as theoretical lenses in the context of ERP, cloud computing and cloud ERP [14]. DOI theory was developed by Rogers in 2003. He identified the perceived relative advantage, compatibility, complexity, trialability, and observability as the five innovation characteristics affecting whether or not a new technology is adopted by the organization [20]. These factors are explained further in section 3 below. According to the developers of the TOE framework [24], there are three contexts relevant to the organization which influences the decision to adopt new technology. The technological context includes both internal and external technologies relevant to the organization. The organizational context involves the organization´s characteristics, and the environmental context involves the market arena the organization operates within. The specific factors within each context may vary across different studies. The five factors of the DOI theory are consistent with the TOE framework's technological and organizational context, and some previous research is therefore based on an integration between them. The TOE framework adds the environmental context, which often contains critical enablers or inhibitors of adoption.

3. Findings

This section presents the main findings of the studies included in the literature review based on the methodology and classification framework.

3.1. DOI theory

Out of the nine articles included in this review, [14], [16], [17], and [18] adopted the DOI theory as part of their theoretical lenses. The innovation characteristics they identified are presented in this section.

Relative advantage: evaluates to what degree the innovation is perceived as more advantageous than the concept it replaces [20]. [14] found that relative advantage significantly affected cloud ERP adoption intention in SMEs and LEs in Saudi Arabia. The participants believed cloud ERP would be more efficient, improve performance, and enhance decision making. [17] found that decision-makers in SMEs and LEs in Korea perceived cloud ERP as more advantageous than existing systems. [18] found that cloud ERP had a relative advantage in the educational sector in India as it was perceived as highly accessible, convenient, cost-effective, reliable and standardized compared to on-premise systems. On the contrary, the relative advantage did not constitute a significant, influential factor for SMEs in developing economies. The study implicated that the relative advantage was realized, yet not serving as a sufficient influencer for SMEs choosing whether or not to adopt. The switching costs were perceived as more important than the relative advantage [16]. *Compatibility:* represents how compatible the innovation is regarding the existing values and needs of the organization [20]. [18] found that cloud ERP was perceived as compatible with existing systems and, therefore, positively affected cloud ERP adoption and selection in the Indian educational sector. Furthermore, [16] found compatibility to be a significant and influential factor in developing economies, while [14] uncovered no effect on SMEs and LEs in Saudi Arabia. *Complexity:* describes the difficulty of learning, using, and understanding the innovation [20]. The SMEs and LEs studied in Saudi Arabia perceived cloud ERP as complex systems, which had a negative effect on their adoption intention [14]. Complexity was also a significant inhibitor of cloud ERP adoption in higher educational institutions [18], while it was an insignificant factor in Korean SMEs and LEs [17] and SMEs in developing economies [16]. *Trialability:* involves to what extent it is possible to try out the innovation for a limited time before adopting it [20]. The ability to try out the cloud ERP application before adoption had a positive effect in the Indian educational sector [18] and in Korean SMEs and LEs [17], while it was not perceived as an influential factor in SMEs and LEs operating in Saudi Arabia [14]. *Observability:* explains to what degree the innovation is visible to others after adoption [20]. [14] revealed that cloud ERP had easily observed benefits and that the participants had observed partners using cloud ERP and thereby acknowledged the beneficial outcomes. Educational institutions in India were influenced by observing success stories from other institutions which had already adopted the technology [18]. Observability had no significant effect on Korean SMEs and LEs [17].

3.2. TOE framework

Out of the nine selected articles, four of them relied on the TOE framework as part of their theoretical foundation [11] [14] [16] [17]. Although the remaining articles draw on other theories to explore the positive and negative factors influencing the decision to adopt cloud ERP (see table 3) in different types of organizations, the findings are all categorized through the technological, organizational, and environmental contexts of this section the TOE framework.

Technological context: system quality, referring to the performance characteristics of the cloud ERP system drawn from the IS success model [25], was established by [11] as a switching benefit in small organizations in Taiwan. [12] found the quality of cloud ERP is better than on-premise solutions because of better support, better system performance, effective system upgrades, and enhanced ERP mobility. This may strengthen the perceived relative advantage of cloud ERP discussed in the previous section. Furthermore, integration was found to be a barrier by [12]. The interviewed IT consultants in the study thought that the integration challenge was a more significant issue with cloud ERP than on-premise ERP. Organizations have decreased control over the system, and vendors might not allow seamless integration. Furthermore, security concerns are common in the cloud environment. However, it was not considered as a significant adoption factor in Norway [15], nor in developing economies [16], or Korean SMEs and LEs [17]. The study conducted in Norway [15] revealed that data security was the most insignificant factor in Norwegian SMEs and LEs, although it was hypothesized to be the most significant. On the contrary, the Indian consultant company interviewed by [12]identified data security and data privacy as barriers. [11] found perceived risk related to data security, the satisfaction of existing ERP systems, and breath of use related to the time and effort spent learning existing ERP systems to be the inhibitors affecting switching costs. Vendor lock-in, involving high costs related to the switching of cloud vendor, was by [17] and [12] found to be a barrier. Haddara additionally found vendor dependency and vendor lock-in, [15] to be the most disadvantageous factors related to cloud ERP adoption in Norwegian SMEs and LEs. [16] identified technology readiness, involving technological infrastructure and the technical capabilities needed for the adoption to be successful, and technical barriers such as portability, interoperability, and vendor lock-in, as critical factors related to SMEs in developing economies. Furthermore, [14] identified ICT infrastructure and the ICT skill of employees as factors considered by SMEs and LEs in Saudi Arabia when deciding whether or not to adopt. Inconsistent with this, ICT skill was not a critical factor in the context of Korean SMEs and LEs [17]. [18] identified production timeliness, suggesting that cloud ERP systems are more capable of running on schedule than on-premise ERP systems as enablers of adoption in the Indian educational sector. System reliability involving the trustworthiness of the technology, and training of users, were additional enablers. HL [13] found that the level of user-friendliness, data availability for end-users, and data accessibility providing the correct information at the right time without interruption, was the most influential factors perceived by Indian MNCs. [15] also found that data accessibility was the most beneficial factor perceived by Norwegian SMEs and LEs.

Organizational context: The financial advantage of a pay-per-use model like cloud ERP systems was a significant switching benefit for small organizations in Taiwan [11]. [12] also found lower costs to be one of the benefits of cloud ERP. The cost of maintenance (COM) did not affect the adoption decision in MNCs in India, which may indicate that large enterprises are less willing to compromise on costs because the quality of the ERP system is perceived as more critical [13]. Lower up-front costs and investments related to cloud ERP compared with on-premise systems were not perceived as a high benefit by Norwegian SMEs and LEs [15]. Furthermore, [17] found that organizational culture played an important role in Korean SMEs and LEs. An open and shared culture was needed for cloud ERP to be adopted. [14] imagined organizational culture as either an inhibitor or enabler of cloud ERP adoption. Nevertheless, it was not significant in their study on SMEs and LEs in Saudi Arabia. [12] found organizational challenges such as poor internal communication, lack of top management support (TMS), poor change management and poor business process redesign to be barriers perceived by IT consultants in India. TMS, which involves managerial enabling of necessary resources when adopting new technology, was also an essential factor by [14] and [16]. [16] also found that enterprise readiness- and size were relevant for SMEs in developing economies. The study implies that larger organizations are more prepared to adopt cloud ERP systems as they have more resources and can take more risks than small organizations [16]. [18] adopted strategic value from the RBV, which explains how rare, inimitable, valuable, and non-substitutable resources can enhance competitive advantage. Cloud ERP was neither considered a differentiating tool nor a source of competitive advantage in their study, which concluded that the technology has low strategic value.

Table 3: Concept matrix of findings

Categorization	Influential factors	SMEs	LEs	SMEs & LEs	No. of articles
Innovation characteristics	Relative advantage	[18]		[14, 17]	3
	Compatability	[16, 18]			2
	Complexity	[18]		[14]	2
	Trialability	[18]		[17]	2
	Oberservability	[18]		[14]	2
	System quality	[11]		[12]	2
	Integration			[12]	1
Technological context	Security	[11]		[12]	2
	Vendor lock-in	[16]		[12, 15, 17]	4
	Technology readiness and technical barriers (portability and interoperability)	[16]			1
	ICT skill and infrastructure			[14]	1
	Production timeliness, system reliability and training	[18]			1
	User friendliness, data availability		[13]		1
	Data accessibility		[13]	[15]	2
	Financial advantage	[11]		[12]	2
Organizational context	Organizational culture			[17]	1
	Change Management and business process redesign			[12]	1
	Top management support	[16]		[12, 14]	3
	Enterprise readiness and size	[16]			1
	Strategic value			[18]	1
Environmental context	Competitive environment	[11, 16]		[14]	3
	Regulatory environment	[19]		[14, 17]	3

Environmental context: [11] found that industry pressure, such as pressure from competitors and partners, enhanced switching benefits, while government support involving policies and funding of cloud ERP systems was not. Similarly, [16] found that competitive pressure affected the decisions of SMEs in developing economies, while government pressure did not. [14] revealed that both competitive and regulatory environment was significant, influential factors. Furthermore, the regulatory environment positively influenced Taiwan SMEs and LEs [17]. [19] found that government pressure, considering the subjective norm of the theory of planned behaviour (TPB) model, was a decisive influential factor for SME owners in Malaysia. The concept of subjective norms concerns the social pressure to behave or not behave in a specific way. Because the subjective norm was so strong, The SME owners intended to adopt cloud ERP systems even though they did not possess the necessary resources and capabilities, at which point the perceived behavioural control had no effect. On the contrary, [18] did not find evidence supporting the effect of subjective norms in the Indian educational sector.

4. Discussion and future research

Table 3 presents a concept matrix summarizing the identified factors affecting the adoption decision in section 3.0. The findings are categorized within the DOI theory and TOE framework, based on organizational size, and allocated scores based on the number of articles that had consistent findings. First of all, this categorization identifies a gap related to organizational size. Most of the articles found through the literature review were focused on SMEs, and many did not specify the organisation's size or had a methodical sampling, including both SMEs and LEs. By reading methodical approaches and comparing them to standardized definitions of SMEs and LEs within different countries, we categorized some of the articles. Only [13] targeted LEs alone. As

organizations with different sizes contain different resources and capabilities, it is highly believable that the adoption decision's main factors vary between them. Researchers have been focused on SMEs as they often have limited resources and might be more tempted by lower costs and a pay-per-use model. Nevertheless, now that cloud solutions are moving toward a possible takeover in the ERP area, it may be essential to conduct more research on LEs [13], [16], [6]. [16] found a link between enterprise readiness and size where larger SMEs were more ready to adopt than smaller SMEs. Distinguishing between small and medium-size organizations might therefore also be of relevance for future research. Because of the gap related to organizational size, it is difficult to take it into account when answering the research question of this paper. The concept matrix shows that the factors which only appeared in LEs were data availability and user-friendliness. Simultaneous, this result cannot be considered as expected because of the lack of studies on LEs in this review. Furthermore, the concept matrix shows that compatibility, technology readiness, portability and interoperability, production timeliness, system reliability, training and lower enterprise readiness seem to affect the adoption decision for SMEs solely. Based on the literature review, this paper implies that the main factors affecting the decision to adopt cloud ERP systems at the organizational level are system quality, security, vendor lock-in, data accessibility, financial advantage, top management support, competitive and regulatory environment, relative advantage, compatibility, complexity, trialability, and observability.
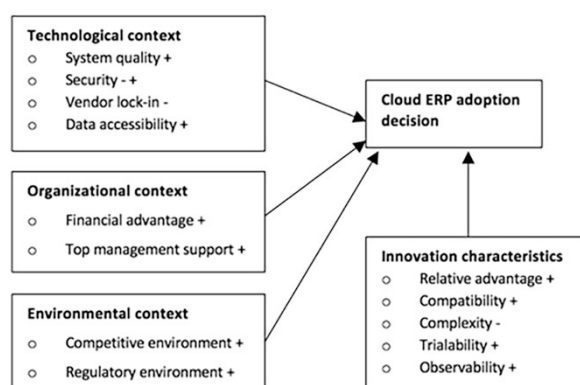

Fig. 1. Summary of the main factors affecting the decision to adopt cloud ERP

The plus and minus signs reflect whether it is a positive or negative influencer on cloud ERP adoption. Vendor lock-in was the overall most critical factor related to the adoption decision, which strengthens the importance for managers and IT executives to be cautious when choosing cloud vendors. Furthermore, the relative advantage serves as one of the most frequent innovation characteristics. Cloud ERP is, by three studies, found to be more advantageable than on-premise systems, which in turn affects the adoption decision [18], [14]. [17]. The environmental context was also found to be highly relevant. Highly competitive pressure and regulatory support or pressure enforce cloud ERP adoption. (Cloud) Security has negative and positive signs, as it was perceived as both a barrier by some small organizations (e.g. [11], [12]), and a motivator by others (e.g.[15], [17]). This implicates that the perceived level of security concern is dependent on the context and that security no longer is the most dominating frequent concern. This is consistent with the 2020 ERP report published by Panorama Consulting Group, which stated that security had a lower level of concern in 2019 compared to 2018 [6]. Top management support also stands out as one of the most critical factors related to the organizational context. It strengthens the importance of facilitating resources for the possible implementation of cloud ERP.

5. Conclusions

This paper aimed at contributing to the body of knowledge on cloud ERP adoption through systematically reviewing the existing literature and identifying the existing gaps and areas for future research. Nine studies were identified and deemed as relevant within the scope of this research. The findings were categorized through the DOI theory and TOE framework resulting in 13 different main factors affecting the adoption decision related to cloud ERP at the organizational level. Out of these factors, vendor lock-in, relative advantage, top management support and competitive and regulatory environment was the most common factors affecting the decision to adopt cloud ERP. Because of an identified gap related to lack of studies on LEs, and a lack of differentiation between SMEs and LEs, the research question was concluded without considering contextual differences. This review suggests future research on cloud ERP adoption in LEs and research, distinguishing between small and medium-sized

organizations. A concept matrix summarizing all the findings discussed through the literature review was presented. This may be helpful for future researchers who intend to investigate the adoption of cloud ERP as it provides an overview of variables that can be measured related to those variables. Finally, both the concept matrix and the main factors identified can be helpful for managers and vendors to obtain an overview of the enablers and inhibitors of cloud ERP adoption.

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