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A Framework to Assess the Critical Success Factors for Cloud Enterprise Resource Planning Adoption in Small and Medium-sized Enterprises

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Abstract
Enterprise resource planning (ERP) is a well-known business management system used for improving effectiveness in organisations. In the current digital era, cloud ERP systems have evolved which are taking precedence over the traditional ERP due to convenience of remote information access in real-time with benefits of cost saving, flexibility and scalability. These systems are especially helpful to SMEs which usually are constrained in resources. However, there have not been many studies that look at the critical success factors for cloud ERP adoption in SMEs. This paper develops an integrative framework using technology-organisation-environment (TOE) and unified theory of acceptance and use of technology (UTAUT) models to investigate the individual, environmental, technological and organisational levels of cloud ERP adoption in SMEs for identifying factors for success. The findings will provide new insights on cloud ERP adoption and will help both academia and practitioners increase understanding for future research and implementation.

Keywords*: Enterprise resource planning (ERP), unified theory of acceptance and use of technology (UTAUT), technology-organisation-environment (TOE), cloud computing, small and medium-sized enterprises (SMEs).*

1. Introduction

Enterprise resource planning (ERP) systems include a set of integrated modules comprising functional areas such as finance and cost accounting, sales and distribution, materials management, human resources, production planning and manufacturing, customer management, and supply chain (Amalnick, Ansarinejad, Nargesi, & Taheri, 2011). An ERP system helps in organising, defining, and standardising the business processes essential to effectively plan and control an organisation so that the organisation "can use its internal knowledge to seek external advantage" (p. 38) (Blackstone & Cox, 2005). A traditional ERP system hosts an organisation's functional requirements and is required to access the organisation's information and communication technology (ICT) infrastructure. These traditional systems, however, become rather inconvenient for acquiring information when accessed remotely; in this case, they show less reliability and flexibility because the information system is not in real-time (Patel, Seyfi, Tew, & Jaradat, 2011). Additionally, the traditional ERP system tends to have a higher rate of failure (Chien & Tseng, 2009) and the system requires a sophisticated infrastructure to handle it because the companies have to have a full understanding of hardware and software (Chang, Cheung, Cheng, & Yeung, 2008). For this reason, the cloud ERP system, which is

based on cloud computing, has evolved from the traditional ERP system. The cloud computing model virtualizes the ICT resource that can share information with pooling of dynamically configurable resources (NIST-USA, 2014). Moreover, these systems are especially helpful in the small and medium-sized enterprises (SMEs), which lack resources compared to large enterprises (Gutierrez, Boukrami, & Lumsden, 2015).

The cloud ERP system has become more suitable since the traditional system needs to be purchased, implemented and maintained from company premises (AlBar & Hoque, 2019). Additionally, the cloud-based system can bring various advantages over the traditional system such as cost saving, flexibility, scalability, reliability, redundancy, collaboration, and accessibility. The cloud ERP system can be accessed remotely via a Web browser from anywhere as long as the organisation has access to the Internet. Furthermore, the cloud ERP system can facilitate fast update, seamless execution, and quick reconfiguration for customers ICT needs (Chaudhary, Hyde, & Rodger, 2015; Gutierrez et al., 2015) and requires fewer resources and infrastructure for implementation. Based on the features of the cloud ERP system and the way it is managed, the influence of critical success factors (CSFs) between the traditional ERP and cloud ERP system may change. For example, in the traditional ERP system a success factor would be requirement of expert IT staff to maintain the system whereas in a cloud ERP, the system is managed by the vendors.

At present, ICT is rapidly growing and playing a crucial part to support the cloud ERP adoption in digital enterprises. The cloud system can contribute to the economics of the enterprise making it more competitive in the global world. ICT adoption can be categorised into two main groups: individual and organisational (Rao, 2000). For the individual level, Venkatesh, Morris, Davis, and Davis (2003) developed the unified theory of acceptance and use of technology framework (UTAUT), which evolved from eight separate adoption frameworks: the motivational model, the theory of planned behaviour (TPB), the technology acceptance model (TAM), theory of reasoned action (TRA), a combined TPB/TAM, innovation diffusion theory (IDT), social cognitive theory (SCT), and the model of PC utilisation (Venkatesh et al., 2003). The UTAUT framework assumes to include complete and comprehensive information for the investigation of individual technology adoptions (Oliveira & Martins, 2011). In the case of organisational level, technology-organisation-environment (TOE) and diffusion of innovations (DOI) frameworks are broadly used to explain the ICT adoptions (Rogers, 1983; Tornatzky & Fleischer, 1990). However, the TOE is a more popular theoretical framework because it can identify the barriers of ICT adoption (Thong, 1999) and can help the growth of ICT field (Zhu, Kraemer, & Xu, 2003). Furthermore, the TOE is a multi-perspective framework that can investigate different aspects such as environment and technology while DOI theory focuses singly at the organisational level (Isma'ili & Zahir, 2017).

Each of the theoretical framework, listed in the individual or organisational levels might not broadly espouse on its own because each of them does not focus on all perspectives at both, individual or organisational levels (Al-Natour & Benbasat, 2009; Jacobsson & Linderoth, 2010). For example, the UTAUT framework can contribute to users in understanding the driver's acceptance of new information (Venkatesh et al., 2003). In the same way, the TOE framework is recommended to analyse the affecting variables of using Internet technologies and ICT adoption (Bordonaba-Juste, Lucia-Palacios, & Polo-Redondo, 2012; Palacios-Marqués, Soto-Acosta, & Merigó, 2015). Nevertheless, perfect information rarely comes from any traditional single theory such as UTAUT or TOE. Therefore, researchers have proposed an integrative model, which combines two adoption theoretical frameworks such as TOE and TAM (Gangwar, Date, & Raoot, 2014).

There is limited empirical research in the area of cloud ERP adoption, as previous limited studies have mainly identified factors on non-empirical studies such as conceptual or literature review based

(Nedbal & Stieninger, 2018). Thus, research still lacks empirical information on cloud ERP system and also in SMEs (Peng & Gala, 2014). This study aims to bridge this gap and looks at how different systems of ERP and enterprises would benefit from cloud ERP system using an integrated TOE with UTAUT framework for the investigation. One of the main reasons for combining the TOE and UTAUT is that TOE theory is multi-perspective that can investigate different aspects such as environment and technology and has validated the theoretical framework in Information Systems (IS) (Jacobsson & Linderoth, 2010). At the same time, the UTAUT model reflects the individual perspective and behaviour in technology adoption (Venkatesh et al., 2003). Therefore, the combined model would be able to explain technology adoption and would provide sufficient information on the various perspectives at both individual and organisational levels (Gangwar et al., 2014).

The research questions addressed in this study are: 1) what are the critical success factors for cloud ERP adoption in SMEs, and 2) what are the factors which influence the decision on cloud ERP adoption in SMEs?

Furthermore, this study will enhance the understanding of cloud ERP implementation and its adoption stages, which will provide guidance for implementation to an SME manager. To address these questions, this research will use an integrative model by combining the TOE and UTAUT theories which will examine the factors that influence cloud ERP adoption in SMEs. This study will empirically assess the proposed framework.

2. Literature review and theoretical frameworks

2.1. Cloud computing service

Cloud computing is a new technology which can be referred to as service applications delivered on the Internet, and the software and hardware in the centre of data which offer those services (Kinuthia & Chung, 2017). Furthermore, there are three models in cloud computing as services: Infrastructure as a Service-IaaS (hardware), Platform as a Service-PaaS (platform), and Software as a Service-SaaS (applications). IaaS refers to infrastructure resources which can be accessed by a user in a virtual computer as a service application along with data centre space and storage device to support an organisation's operations. The examples of IaaS are Mosso's Hosting Cloud and GoGrid's Cloud Servers and Amazon's Elastic Computer Cloud (EC2). Moreover, this infrastructure is normally offered by a third party which vigorously provides, reconfigures and configures servers (Hsu & Lin, 2016). For PaaS, the software is run and developed on cloud platform which includes a programming language execution environment, operating systems, Web servers, and databases. Some examples are Amazon Web services, Google's App engine and Microsoft's Azure. In the case of SaaS application, the user can access services through a Web-based software in the browser without installing or maintaining any software. The productivity applications and programs are provided by SaaS such as office software, customer relationship management (CRM) and ERP system. Salesforce automation and Google Docs are a part of the service application which is recognised as SaaS solutions (Hsu & Lin, 2016).

The deployment models are of four kinds which are private, public, hybrid and community-based (Carutasu & Carutasu, 2016). In the public cloud model, the third party service provider provides the cloud which is based on sharing the resources with clients, but normally the clients cannot see each other. The cloud requires the users to access via a Web-based browser and pay only for "using time" (Wease, Boateng, Yu, Chan, & Barham, 2018). This is more suitable and the most cost-efficient model for SMEs (Wease et al., 2018). In the private cloud model, the users can control their server, and set their own level of security. However, this model is more expensive for the user, but provides most of the cloud benefits and is more secure (Wease et al., 2018). Hybrid cloud is a combination model

between public and private; thus, this model offers a balance between security and cost. Finally, the community cloud model is the same as the private cloud model, but this model is customised for certain company of entities which have concerns and requirements. This model is more prevalent in government units (Wease et al., 2018).

2.2. Technology-organisation-environment framework

ICT has driven enterprises towards the digital world. IS are a crucial tool for an enterprise to reduce their costs and improve their ability of the operational process. The TOE theory is widely used to investigate how a company implements a cloud ERP system (Gutierrez et al., 2015; Lian, Yen, & Wang, 2014). Tornatzky and Fleischer (1990) proposed the technology-organisation-environment adoption framework which is composed of a technological context, organisational context, and environmental context. The framework can be applied to large companies (Awa, Eze, Urieto, & Inyang, 2011) and SMEs (Kuan & Chau, 2001), and also provides beneficial information which is usually used to study in many ICT adoptions (Taylor, 2015). Moreover, this adoption framework is multi-perspective (technology, organisation and environment), and also has underpinned many IS inquiries (Jacobsson & Linderoth, 2010). This framework has been used to explain the critical success factors for ERP adoption in technology, organisation and environment domains, which are identified as relative advantage, uncertainty, compatibility, complexity, trialability, size of the organisation, top management support, innovation, prior IT experience, regulatory environment, competitive pressure, industry, market scope supplier efforts and external computing support (Tornatzky & Fleischer, 1990).

2.3. Unified theory of acceptance and use of technology framework

To investigate the adoption at an individual level, Venkatesh et al. (2003) proposed the UTAUT framework which has an effect on behavioural intention and ultimately behaviour (Williams, Rana, & Dwivedi, 2015). This framework consists of performance and effort expectancy, social influence and facilitating condition (Venkatesh et al., 2003). Conversely, this study will add subjective norms and hedonistic drives factors to the framework because the subjective norms can express the group cohesiveness and social status while hedonistic drives can determine innovation adoption with operating fun and pleasure, which emerge from employing particular technologies (Awa, Ojiabo, & Orokor, 2017; Awa, Ukoha, & Igwe, 2017). Furthermore, the UTAUT has been successfully utilised and widely used to study in diffusion and innovation technology adoption scenarios (Williams et al., 2015). Venkatesh et al. (2003) has revealed that the UTAUT framework is an outperformed model for investigating the individual perspective because this framework has evolved from eight models – the motivational model, TPB, TAM, TRA, a combined TPB/TAM, IDT, SCT, and the model of PC utilisation (Venkatesh et al., 2003). The success factors for the individual category have been well explained by UTAUT framework, which are defined as performance and effort expectancy, social influence, facilitating conditions, subjective norms and hedonistic drives (Venkatesh et al., 2003).

3. Research approach: the integrative model on cloud ERP adoption

As per the previous discussion, no single traditional framework provides comprehensive information about ICT adoption, since these frameworks can assess only the individual or organisational level adoptions such as UTAUT and TOE (Gangwar, Date, & Ramaswamy, 2015). The TOE framework has been extensively implemented for studying the adoption of cloud ERP system while the UTAUT has been comprehensively used to investigate only the traditional ERP system. The TOE framework is generally focused on the technology, organisational and environmental perspectives, and also has underpinned many IS inquiries (Jacobsson & Linderoth, 2010). On the other hand, the TOE is too generic (Al Nahian Riyadh, Akter, & Islam, 2009) and has the limitation of assessing only the individual perspective (Gangwar et al., 2015). Therefore, to receive a better perspective, the TOE framework needs to integrate with an individual framework such as UTAUT which is more comprehensive (Venkatesh et al., 2003). Thus, this study will consider the integrated TOE and UTAUT

adoption frameworks to evaluate the critical success factors for cloud ERP adoption in SMEs. This integrated model will investigate the individual, organisational, technological, and environmental aspects in SMEs, as shown in Figure 1.

4. Research method

This study will use a multi-method research design which will be executed in two stages. In the first stage, the study will employ a qualitative approach for collecting data through semi-structured interviews with ERP vendors who are involved in the implementation of cloud-based systems to better understand the impact of critical success factors from a vendor's perspective. The interviews will help with the explanations on the study phenomena, which may not be captured in a questionnaire. Additionally, the interview data will be received from vendors who are experts in this field and possess a lot of knowledge in these systems. Questions will be posed to understand what factors influence the success of cloud ERP systems adoption in SMEs. Suitable data analytical tools will be employed for the analysis of the interviews to develop results of the study. The condensation approach will be applied to analyse the data collected. This method will summarise the data into multiple groups based on the constructs of the integrated framework.

In the second stage, both qualitative and quantitative methodologies will be used. First, interviews will be conducted with practitioners and company managers who are involved in cloud ERP implementation in companies. Second, a survey questionnaire will be distributed amongst industrial employees to get a first-hand information on the success factors from a client's perspective. The qualitative data and statistical analysis of the quantitative research will be analysed to finalise the results and recommendations of the study.

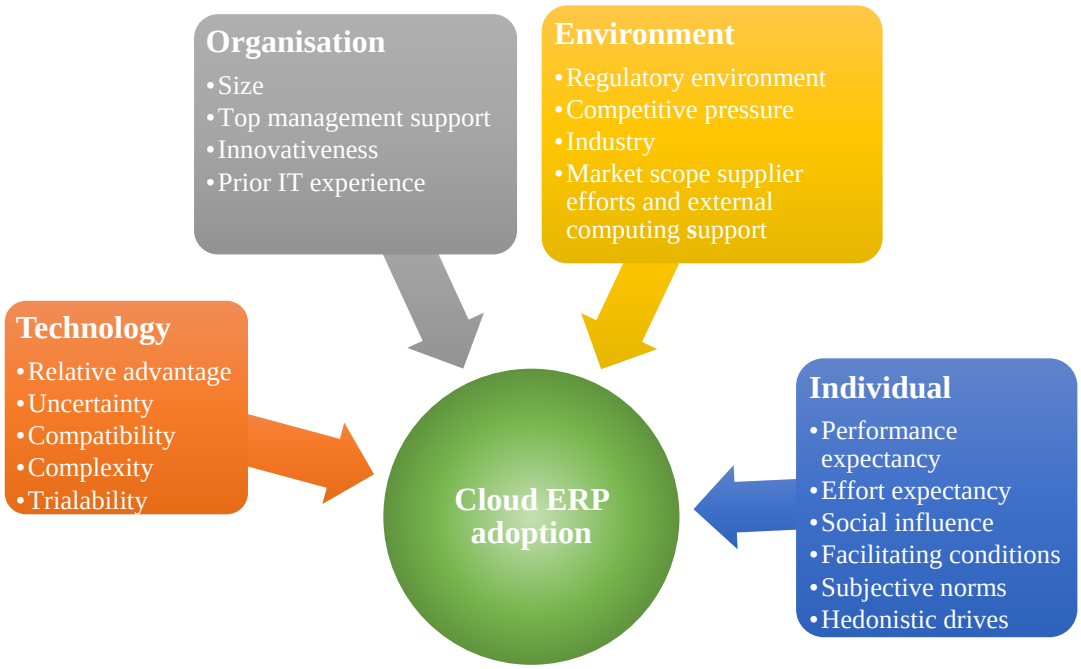

Figure 1: A proposed CSF model for cloud ERP adoption (Adapted from UTAUT (Venkatesh et al., 2003) and TOE (Tornatzky and Fleischer, 1990) models).

5. Significance of the research

This study will provide several contributions to IT research societies, academia and industry practitioners. Firstly, the findings will provide new insights that will increase the understanding of cloud ERP adoption in SMEs. Secondly, it will provide more clarity to IT practitioners around why cloud ERP system is a suitable system for them to implement in their firm. Finally, for ERP vendor,

this study will help create an understanding on the factors that could support the implementation of their cloud ERP system.

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