A Review of Cloud-Based ERP Systems in SMEs

Siti Aisyah Salim[1*], Syammon Jaffar[2]

[1]Faculty of Technology Management and Business, UTHM, Batu Pahat, Johor, MALAYSIA

[2]Tunku Abdul Rahman University College, Kuala Lumpur, MALAYSIA

*Corresponding author

Abstract: The adoption of Enterprise Resource Planning (ERP) system in small and medium enterprises (SMEs) could offer significant benefits in terms of managing the resources and support business function. However, the traditional ERP systems are quite expensive and have complex procedures for the adoption especially for SMEs. With the introduction of cloud-based ERP systems that have similar functionalities with traditional ERP, SMEs are now able to adopt this system. However, the adoption of cloud ERP remains low and question arise on how to encourage SMEs to adopt this system. Drawing from management and Information Systems literature, this study proposes and conceptual framework for cloud ERP adoption among SMEs. Using archival analysis approach and technology-push and demand-pull as the theoretical background, this research has come out with six main themes namely: firm qualities, internal pressure, external pressure, technology features, organizational readiness and external support. This paper will give significant benefits to ERP vendors to understand their potential buyer's behaviour towards the adoption of cloud ERP.

Keywords: ERP systems, cloud, SMEs, technology-push and demand-pull.

1. Introduction

Past studies on technology adoption has been extensively discussed since 1980s (e.g.[1];[2];[3]). Equally, studies on Enterprise Systems has been extensively discussed [4,5]. Nevertheless, the cloud-based ERP is not a smaller version of ERP that been adopted by smaller organization that also known as SMEs. SMEs is dissimilar from large organizations [6] and so to cloud ERP systems [7]. Thus, the purpose of this paper is to investigate factors that lead to cloud ERP adoption using archival analysis method. This study interested to answer the following question: What are factors that influence the adoption of cloud ERP among SMEs? To anwer this research question, this study will develop a conceptual model of cloud ERP adoption based on the theory of technology-push and demand-pull [8,9].

The process of conceptualisation of this model are based on six themes namely: firm qualities, internal pressure, external pressure, technology qualities, organizational readiness and external support. Based on these six themes will show the possible drivers that could influence the adoption of cloud ERP among SMEs. Thus, details on each themes will be discussed further and incorporated with theory of technology-push and demand-pull. This paper will be structured with following manner. It starts with providing the introduction of theoretical concepts of technology-push and demand-pull. Continue with research design which include: a brief discussion of the exploration phase, identifying factors of each theme, process of synthesizing to remove the repetitive factors, synonyms factors and mapping factors into the framework. The discussion will be proceeded with the elaboration of factors that influence cloud ERP adoption in SMEs and introducing the conceptual model. Finally, the paper concludes with future work and the impact of research towards academia and practice.

2. Technology-Push and Demand-Pull: Theoretical Underpinning

Several studies agreed SMEs will adopt new technology based on several factors [10,11] which will be discussed further in the next few paragraphs. For example, many technology adoption studies [12-14] believe that the adoption originally inborn from the organization. There are several theories have been used in explaining reasons for technology adoption.

This research will use technology-push and demand-pull as the theoretical background. The discussion on technology-push and demand-pull starts when economic scholars, Schumpeter and Backhaus [15] as well as Schmookler [16] enlighten entrepreneurs' innovative capabilities towards economic change. The discussion later been extended into IS and innovation studies [17]. In this study, technology-push and demand-pull will be used to explore and classify factors that lead to the adoption of cloud ERP among SMEs. To the best of our knowledge, technology-push and demand-pull framework has never been used to explain the adoption of cloud ERP among SMEs.

3. Research Design

For the research design, this study has followed Hsieh and Shannon [18] as well as MacKenzie and House [19] which include exploratory and confirmatory phase. In the exploratory phase, all potential adoption factors will be explored through archival analysis method while for confirmatory phase, all identified factors will be mapped into theory technology-push and demand-pull. This study has adopted exploratory process with qualitative and archival analysis research method. The use of this method is to identify factors for cloud ERP adoption and later propose a suitable framework for it. Further, the use of archival analysis will ensure factors that been categorised will provide meaningful discussion as well as to forecast the significant factors for cloud ERP adoption. In confirmatory phase, validating the conceptual framework that has been developed in exploratory phase will be done. The testing process will be conducted in future using a survey at SMEs that have used the cloud ERP systems. At the point of publication, the confirmatory phase is in progress and will not be discussed in this paper.

3.1 Exploratory Phase

This study has used exploratory technique which similar to these prior studies (e.g. Palvia et al.[20]). In order to ensure the comprehensiveness of cloud ERP adoption framework, this study has identified technology adoption factors for organizational level. Further, there are few restriction criteria has been applied in selecting papers to be reviewed. Once the technology adoption factors have been gathered, the factors will be synthesized using the archival analysis guidelines. This study has adopted the content analysis guidelines as the guideline for archival analysis as both can be used interchangeably. The use of content analysis by prior researchers is either for quantitative or qualitative studies [21]. This method has been used extensively by many researchers as it provides systematic classification of coding [22]. This study has also employed conventional content analysis which can also be described as inductive research and normally suitable to describe a phenomenon. Inductive technique is used when the theory been applied in the study is limited in the literature [18]. This type of research also normally not fix the categories [23] but allow the categories to shape from the data gathered.

3.2 Filtering Technology Adoption Factors

To ensure the soundness and novelty of the research, certain procedures need to be applied. In this study, only top leading Information Systems and management journals have been selected including MIS Quarterly, European Journal of Information Systems, Information Systems Journal, Information Systems Research, Journal of AIS, Journal of Information Technology, Journal of MIS and Journal of Strategic Information Systems. The process of selection was also extended to several outlets including Academy of Management Journal, Information and Management Journal and IS conferences namely ECIS, PACIS, AMCIS, ICIS and ACIS that have provided current and specific topic related with cloud ERP adoption. Only papers that were published between 2001 until 2019 selected for this archival analysis. The process of selecting papers are based on specific keywords which include "ERP adoption", "ERP systems adoption", "ERP innovation", "organization innovation", "innovation adoption", "technology innovation", "firm innovation", "IT adoption", "firm adoption" and "IS adoption". From the above keywords, about 400 related studies have been retrieved. The process of elimination of papers that not relevant (e.g. papers that related with theoretical adoption and individual level of adoption) has condensed the final related papers to only 80 studies only. From all these 80 papers, we then extract the adoption factors. From a thorough reading, 583 adoption factors have been generated. All these 583 factors will then be mapped into theory of technology-push and demand-pull.

3.3 Citation Mapping Process: Technology-push or Demand-pull

The process of mapping adoption factors into framework has several objectives including (i) to find the suitable theoretical framework or theory for the research; and (ii) to illustrate the probable suitability or insufficiencies of the existing technology adoption factors. Prior research has proposed two methods in developing a research framework

namely: (i) 'top-down', structured coding, framework approach or (ii)'bottom-up', data driven [24]. Top-down means initiation and starts with model or framework to categorize the responses, while bottom-up uses induction that starts with raw data which then rearranged into a meaningful group. Bottom-up approach has been used in this study for mapping the factors into technology technology-push and demand-pull. The final result of factors are 321 technology-push factors and 262 pull-demand factors.

3.4 Process of Synthesizing Citation

In qualitative research, the process of synthesizing data into logical and practical require massive amount of time as the process of it is complex [25]. The objective of synthesize is to structure a meaningful framework that can be generalizable beyond current study yet simple and easy to understand. Synthesis also tried to eliminate overlapping factors in order to achieve mutual uniqueness and parsimony [26]. This study has followed three simple guidelines of synthesis which include: (i) in a situation when there are two statement share the same keywords, it will emerge into single statement; (ii) when two statement are identical, it will be merged into a single statement; (iii) a list of synonyms will be prepared, and two citations will be merged into single citation, when two citations use dissimilar keywords, but having alike meaning. From the discussion, six themes have been emerged from the mapping and synthesis process. The six themes are: firm features, internal pressure, external pressure, technology features, organizational readiness, external support. Further discussion on each of the themes will be discussed further in the next few sections.

4. Factors Influencing The Adoption

4.1 External Pressure

Pressure from the external have been identified as one of the major factors in technology adoption studies [27-29]. The external pressures concentrated in this study are mainly for SMEs. In general, SMEs been pressured by their competitors [30-32] and few other pressures from different parties. The pressure given by competitors are more impactful rather than other pressures. According to Sin et al. [33], pressure from competitors refers as pressure that given by competitors within the same industry. Further, with the nature of SMEs that always depends on trading partners [34] has made competitors or customers as the major factors towards adopting cloud ERP. There are few studies have discussed that pressure given by large organisation into small trading partners like SMEs could triggered the adoption of new technology [33]. Further, a study by Chan and Ngai [35] has shown that the pressure given by partners in business could also make SMEs opt for new technology adoption. Through institutional theory, it is also predicted that organisations like SMEs are extremely influenced by their trading partners pressure towards making decision for technology adoption. Pressure could also come from SMEs suppliers [36] that provide similar pressure as customers. The type of pressure that commonly been exerted by SMEs would be having standard systems that also been used by their trading partners. Thus, in order to maintain the trading relationship that SMEs already have before, current revolutionize ERP systems that are reasonable for SMEs is required. Finally, governmental pressure [37] such as policy execution could also stimulus new technology adoption [38]. Consequently, government could also provide pressure for new technology adoption.

4.2 Technology Features

Technology features discussed here is in line with theoretical analysis made by Rogers [39]. To enlighten the influence factors of cloud ERP adoption among SMEs, Rogers diffusion of innovation theory will be adopted as the theoretical foundation. Relative advantage is the first feature that been discussed in Rogers theory. According to Rogers [39] relative advantage is describe as the new innovation is better than the antecedent. The goodness from the adoption of cloud ERP systems is essential to be known [40] as companies need to ensure benefits received from the adoption. The next feature is technology complexity. According to Rogers [39], complexity refers as the level of strain perceived to learn, understand and practice. By deploying ERP system, issues such as complexity, difficult to maintain can be reduced as the process of maintaining and managing the system will be handled by the vendor. Further, cloud ERP offers minimum end-user training, effortless upgrades, administration tasks for customers and no-in-house data centre and [41]. While the next feature is compatibility which means the extend to which adopters perceived the existing values, skills, current needs and software policies [42]. In general, SMES never adopt any complex enterprise system. With the flexibility that cloud ERP could offer [43], SMEs can change to another ERP vendors whenever they need to have better service for their company. Further, this will give the opportunities to SMEs to choose and try the best ERP vendor that suitable to their company's needs. The next technology feature that cloud ERP could provide is trialability. According to Rogers, trialability refers as the degree of innovation can be experimented before the real use happen [42]. The last feature of technology discussed here is observability that refers as the result of an innovation is observable through experience. In this study, observability can be used as a reference before the decision maker of SMEs make the decision whether to adopt or not the system. The number of SMEs adopted cloud ERP systems still very low at the point of writing this paper. However, the success stories from large organisation can be used and observed by SMEs. In order to disseminate and tell the success stories and advices, ERP vendors who offered ERP

systems could offer this service. Another two technology features; namely cost of implementation and security derive from Rogers' theory. However, we believe that these features need to be included in the discussion as these two features had been extensively discussed in past studies and important in cloud ERP adoption. The cost for implementing the ERP system [44] is also important aspect that need to be taken into consideration. Security is another technology feature that need to take into consideration. Security is important especially in current type of enterprise system where there are lots of information been delivered or transferred via the network [45]. Nevertheless, the new cloud-based ERP systems are embedded with security infrastructure [41], hence SMEs should not be worried with security issues.

4.3 External Support

Past studies on technology adoption suggest that external support is one of main factors that influence SMEs to adopt new technology (e.g. Ramdani et al. [46]). In this study, external support refers as external factors that beyond the control of the organisation [47]. This factor will also give the awareness to SMEs on the importance of new technology rather than give pressures [47]. The manufacturer of the technology or vendor are among the agent that normally hold these responsibilities [48]. According to Swanson and Wang [49], among well-known ERP vendors (i.e. technical diffusion agency) are like Oracle, SAP, J.D. Edwards, PeopleSoft and Baan. The type of support that could be given by these vendors could be in term of advice, consultation about ERP systems. External support could also come in term of industry affiliation including advice and sharing experience from partners within the same industry [50]. Government could also provide support to SMEs especially in term of financial support. Thus, the next example of external support would be subsidy. Through different kind of monetary support such as tax exemption, incentive and subsidy, it could be support SMEs to manage their company as well support their financial scarcity.

4.4 Firm Features

The adoption of cloud ERP will be in organization level, therefore firm features such as structure of the firm will be considered as influencing factor towards the adoption new technology [27]. Example of firm features could be structure of the firm, number of business lines, firm size, correlation between firm and market return and ownership information [51]. In this study, only few features will be discussed due to limitation of this study focus. The first important firm feature will be industry type. According to Myers [52], industry type is a capital structure of a firm. For example, enterprise system will be very important for service type of industry. Further, the size of the firm will also contribute towards the organizational factors of technology adoption [53]. Another firm feature will be firm structure which considered as the main factor towards the adoption of new technology. Firm with higher ability to adjust and adapt with new technology will have less trouble in implementing and accepting new change [54]. Firm strategy in another firm feature that we believe will be important in adopting new technology. For SMEs, having an owner or decision maker towards technology driven or technology savvy will provide more likely towards the adoption of new technology [55] Firm strategy will also be successful if the owner of SMEs is a technology driven and proactive person; thus, lead to the adoption of new technology [56]. The last firm feature that will be discussed is the year of establishment of the firm. By having more years of establishment, firm will learn from their past mistakes and have more methods and approaches in dealing with unexpected occurrence [57]. Thus, year of establishment will also contribute towards the adoption of new technology.

4.5 Firm Readiness

Another theme discovered for the adoption of new technology through the archival analysis is firm readiness [58]. According to Ramdani and Kawalek [58], firm will has less tendency towards the adoption of new technology if the organisation is not ready or lack of readiness. Further, firm readiness could also come in term of availability of human resources with certain competencies and capabilities for delivering new information and ideas [59]. There are huge number of studies that highlighted the importance of human resources towards the adoption of new technologies (e.g., [36]; [60]; [61]). Another factor that could also categorised under firm readiness would be financial availability. Though financial resources is crucial in any new technology adoption, for cloud ERP financial availability is not as crucial as other availability [62]. A decision maker who are knowledgeable is more important [62] rather than the availability of the financial resources. This again emphasize the importance to have a manager or decision maker with financial knowledge competency [59] towards the adoption of cloud ERP systems. Another type of firm readiness would be the technology infrastructure available in the company that would like to adopt new technology [61]. The availability of technology infrastructure in SMEs is important as the company could rapidly adjust and facilitate the organizational change [62]. Firms need to have flexible and innovative technology infrastructure in a rapid changing environment [63]. Finally, the existent of a champion in organization will also essential towards the adoption of new technology [64]. According to Weidman et al. [65], champion is important in technology adoption and the person who become the champion could be the employee or the owner of the firm. While according to Beath [66] champion could be someone who are dynamically strive for the company and personal vision to use new technology as well as push around the approval and implementation hurdle of the project.

4.6 Internal Pressure

Internal pressure could happen as a result of firm performance gap [67]. Firm will realise on the performance gap in uncertainty condition where they need to be innovative as well as competitive. In a normal circumstances, SMEs will grow by mobilising assets that possessed by other firms [68]. Consequently, the process of maintaining and upgrading the infrastructure of the firm is important to enhance this gap. As this study exploring factors that influence the adoption of cloud ERP; hence, this system will be right solution to breach this gap. Another feature of internal pressure would be the operational requirement from the employee [69] which naturally ignored by top management [70]. To prevent this scenario to happen, several initiatives need to be done such as training, workshop to all employees in the company. By having these initiatives, it will lead to increase the awareness and performance of the employees. The adoption of cloud-based ERP systems that mostly maintained by the vendor could also encourage the employees to better in their job as well as minimise the clerical and manual job.

5. Conceptual Framework - Technology-Push And Demand-Pull

From the six themes that we have discussed above, a conceptual model of cloud ERP adoption based on technology-push and demand-pull is illustrated in Figure 1. The development of the model is based on formative model guidelines by Petter et al. [71] which include: (i) need not co-vary, (ii) are not interchangeable, (iii) cause the core-construct as opposed to being caused by it (arrows point in), and (iv) may have different antecedents and consequences in potentially quite different nomological nets. The process of deriving the adoption factors as well as the themes has been discussed in Research Design section. Technology adoption factors that have been derived from 80 papers are grouped into six themes which illustrated in Fig. 1.
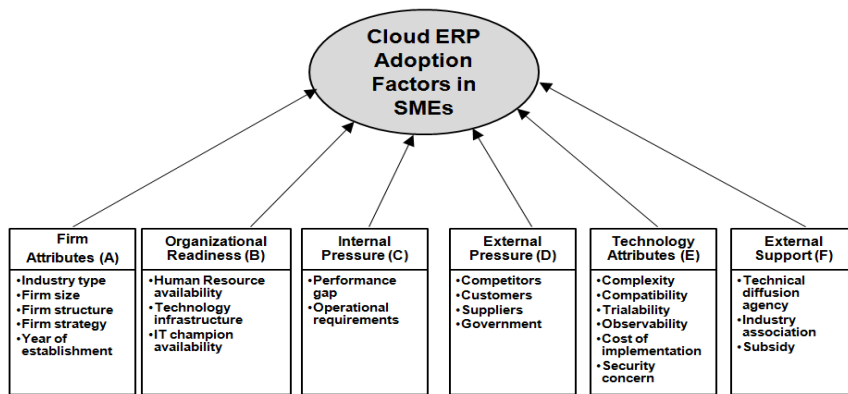

Fig. 1 - Conceptual Framework for Cloud ERP Adoption

6. Conclusion

This paper aims to explore a list of cloud ERP adoption factors for SMEs as well as discuss the preliminary findings classify each of these factors into technology-push and demand-pull framework. Factors that have been derived could be from internal factors (e.g. organisational) as well as external factors (e.g. external pressure). However, the aims of this research are to have valid, robust, simple and applicable to cloud ERP adoption within small-medium enterprises (SMEs). This research has adopted two interrelated phases namely: exploratory, with the aim to come up with conceptual model cloud ERP adoption in SMEs (i.e. Figure 1) and confirmatory which at the point of publication, the phase is in progress and will not be discussed in this paper. We do realise with some of limitation of this research. For example, there is not much research in IS research domain has discussed and categorising technology adoption factors into push-pull framework. Nevertheless, through archival analysis exercise that has been used in this research could provide understandings on the relationship between technology-push and demand-pull factors. Further, findings from this research is merely from secondary data which are from prior studies; thus, the adoption factors are limited from identified past literatures. This study could provide benefits to future researchers to get an overview of potential factors that influence SMEs to adopt cloud ERP. From practitioner perspective, this study could be used as guidance to understand the potential reasons for SMEs to opt to cloud-based ERP as this system are getting prominent and will increase up to 15% of highest outsourcing players' profits.

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