Triggers of Cloud ERP Adoption in SMEs
Research-in-Progress

Introduction

Small and Medium Enterprises (SMEs) could benefit immensely with Enterprise Resource Planning (ERP) systems that can support their business functions and manage their organization’s information (Seethamraju and Seethamraju 2008). However, traditional ERP are highly resource intensive for its acquisition and maintenance (Light 2001), yet, most SMEs are unable to afford them (Fuller and McLaren 2010). Nonetheless, influence from the emergence of cloud computing (Armbrust et al. 2010), cloud ERP systems have been offered with a lower cost, specifically targeting SMEs. These systems (e.g. SAP’s ByDesign) purport to revolutionize SMEs. Cloud-based ERP systems are typically provided using the Software-as-a-Service (SaaS) architecture, where users rent the software rather than buy it (Ivanov 2012). By renting the software, organizations can minimize the cost of implementation and maintenance, yet gain access to an ERP over the internet (Seitz 2010) Thus, cloud ERP allows SMEs to focus more on their core mission, without having to devote substantial resources maintaining ERP software (DePompa 2003). Nonetheless, the adoption of cloud ERP among SMEs still remains low; raising questions on SMEs cloud ERP adoption.

Technology adoption studies date back to the 1980s (e.g., Kimberly and Evanisko 1981; Tornatzky and Klein 1982). Similarly, there is a wealth of ERP studies as well. However, cloud ERP adoption is simply not a ‘smaller’ traditional ERP system adopted by a ‘smaller’ large organization. SMEs are vastly different from larger counterparts (Smith et al. 1988) and so too are the cloud ERP systems (Jacobson et al. 2007). Our current understanding of cloud ERP is spars at best. This paper seeks to address this gap by exploring the antecedents of its adoption using archival analysis method. Key research question that motivate our work is: What factors trigger cloud ERP adoption in SMEs? To better understand these issues, we developed a conceptual model for cloud ERP adoption of SMEs based on the technology-push and demand-pull framework (Baker and Freeland 1972; Utterback 1974). We observe adoption using six adoption themes: firm attributes, organizational readiness, internal pressure, external pressure, technology attributes, external support. Factors aforementioned are to provide a glimpse of potential drivers for cloud ERP adoption, thus details for each of the constructs will be provided from multidisciplinary literatures point of view and integrates it into technology-push and demand-pull framework. The remainder of the paper is organized in the following manner.

The paper begins by explaining the theoretical concept of technology-push and demand-pull framework. Subsequently, research design which includes: brief discussion on exploratory phase, identify pool of adoption factors, mapping factors into push-pull framework and synthesis process to eliminate repetitive and synonym factors. The discussion will then continue with factors for cloud ERP adoption in SMEs, introduces conceptual model based on adoption factors. Lastly, the paper will be concluded with future work and research implication towards academics and practices.

Theoretical Background: Technology-push and Demand-pull

Past technology adoption studies suggest that SME’s get ‘pushed’ into technology innovation (Ariss et al. 2000; Cartman and Salazar 2011). Many of the past studies on technology adoption (e.g., Kuan and Chau 2001; L. et al. 1995; Looi 2005; Raymond and Uwizeyemungu 2007; Vega et al. 2008)\(^\text{1}\) assume that adoption is largely innate – mainly originates from the organization itself. However, many strategic, policy and market factors seem to push SMEs to technology innovations. The idea behind technology-push and demand-pull is borrowed from economic scholars Schmookler (1966) as well as Schumpeter and Backhaus (Schumpeter and Backhaus 2003; Schumpeter 1934) to enlighten the innovative ability of entrepreneur from economic change. Then, these ideas have been extended into innovation and IS studies (e.g., Chidamber and Kon 1994; Herstatt and Lettl 2004; Kendall and Kendall 1999; Shih 2006) to explain the essential motivations and driving forces behind innovation, sources of innovation. Thus, the technology-push and demand-pull framework originate from economic studies are ideal to

\(^{1}\) More references on adoption studies available in Table 1
investigate the cloud ERP adoption of SMEs. To our knowledge, there was no specific constructs discussed in technology-push and demand-pull framework (Chidamber and Kon 1994). Therefore, in classifying adoption factors into technology-push or demand-pull framework, we based our study on few push and pull prior studies (e.g., Beatty and Williams 2006; Chidamber and Kon 1994; Shih 2006; Utterback 1974; Zmud 1984)².

**Research Design**

This study pursue research design method proposed by MacKenzie and House (1978) as well as Hsieh and Shannon (2005) which includes exploratory and confirmatory phase. The exploratory phase is used to explore potential adoption factors, and confirmatory phase is applied to test and map the factors identified into technology-push and demand-pull framework. In this research, the exploratory phase is qualitative in nature and employs archival analysis method. This analysis used to identify salient adoption factors and proposed suitable framework (Hsieh and Shannon 2005) from the perspective of cloud ERP systems and SMEs. Moreover, archival analysis was deployed to ensure factors categorized under selected framework provide meaningful argument at the same time being able to predict the potential salient factors for cloud ERP adoption. The confirmatory phase entails a testing the conceptual framework developed through the exploratory phase using a large survey of SMEs using cloud ERP systems. The confirmatory phase is in-progress at the time of publication.

**Exploratory Phase**

The guidelines used in this exploratory study are similar to those in prior studies (e.g., Claver et al. 2000; Gable 2010; Palvia et al. 2004). Ensuring comprehensiveness of our adoption framework, this study has reviewed and identified a wealth of technology adoption factors at firm level from past academic studies. Then, the gathered adoption factors are synthesized using archival analysis guidelines. The guidelines provided for archival analysis are similar to guidelines provided for content analysis, thus, for this study we have used steps presented in content analysis studies. Content analysis initially used by researchers as either qualitative or quantitative method in their studies (Berelson 1952). This technique becoming preferences among researchers subjective interpretation content of the text data through a systematic classification process of coding and identifying themes (Hsieh and Shannon 2005; Krippendorff 2004). There are three distinct approaches of content analysis techniques: conventional, directed and summative (Hsieh and Shannon 2005). Given the exploratory nature of our study, we employ conventional content analysis, described as inductive category development, generally used with study design by means of to describe a phenomenon. This type of design is usually appropriate when existing theory or research literature on a phenomenon is limited (Hsieh and Shannon 2005). Researchers avoid using fixed categories(Kondracki et al. 2002) instead allowing the categories and name for categories to flow from the data.

**Identifying a Pool of Technology Adoption Factors**

Novelty and validity of a research will require certain standards and processes. Therefore, the selection of prior studies for analysis is from top leading IS research journals including EJIS, ISJ, ISR, JAIS, JMIS, JSIS, JIT and MIS Quarterly. However searching has been extended to other outlets such as ISM Journal, Academy of Management Journal and AIS conference such as ICIS, AMCIS and ECIS that could provide very specific discussion related to our research topic. The studies selected were range from year 2001 and 2012. Main keywords used in the academic search were restricted to “ERP adoption”, “ERP innovation”, “organization innovation”, firm innovation, “technology innovation”, IT adoption, IS adoption, firm adoption and “innovation adoption”. Based on the keyword used, more than 400 academic studies yielded. However the elimination of irrelevant paper (such those that referring to individual level of adoption, theoretical adoption papers) had reduced our papers searched to 80 studies only. From the remaining of 80 studies (please refer Table 1 for the full reference list), we then examine the content of each of the papers to identify and extract adoption factors. Based on thorough review, 583 adoption factors statements has been yielded. The factors identified then need to be mapped with relevant adoption theory or framework. Thus, the next step of this study is to map the citations into selected framework for this study; technology-push and demand-pull framework.

²The page restriction in this submission prohibits us from including all citations. Citations are available from the contact author.
**Mapping the Citation into Technology-push and Demand-pull Framework**

Two objectives of this mapping exercise are: (1) to provide a theoretical underpinning for the intended research; and (2) to demonstrate the possible adequacies or inadequacies of existing adoption factors. Literatures suggested two main approaches in developing a conceptual framework including: (1) ‘bottom-up’, data driven, open coding approach or (2) ‘top-down’, structured coding, framework approach (Gable et al. 2008). Top-down approach uses induction, start with logical framework or model to classify the responses, whereas the bottom-up approach uses induction, start with raw data available in hand, then it is arranged into meaningful classification. Given the limitations of top-down approach, this study has adopted bottom-up approach for mapping pool of citation into selected framework; technology-push and demand-pull. The result from the mapping exercise yielded 321 technology-push and 262 pull-demand.

**Synthesizing the Citations**

Synthesizing this wealth of qualitative data into a practical, significant and logical classification of adoption factors is a critical and complex stage of study. Thus, the objectives of this exercise were to develop a meaningful framework that is simple but yet can be generalizable beyond current study, besides being intuitive to the study respondents. Synthesis procedure attempted to remove overlapping adoption factors to achieve mutual uniqueness and parsimony. The process of synthesis was conducted by following three simple guidelines. The guidelines include: (1) when two citations are identical, they were emerged into a single statement, (2) when two citations employ the same keywords they were emerged into single statement (3) when two citations use different keywords, but provide similar meaning, a list of synonyms were considered using thesaurus and the two citation were then merged into single citation. The findings were then validated by two experts from IS and Innovation research area. From the discussion, they agreed six emergent themes were commonly emerging throughout the mapping. The six themes are: firm attributes, organizational readiness, internal pressure, external pressure, technology attributes, external support. The following sections will discuss further on each of the themes.

**Factors Influencing the Adoption**

**External Pressure**

External pressures had been recognized as adoption driver in innovation adoption literatures (e.g., Grover and Teng 1994; L. et al. 1995; Premkumar and Roberts 1999). SMEs typically being pressured not limited for competitiveness (Bose and Luo 2011; MacKay et al. 2004) but other pressures as well. Nevertheless, pressure from competitors provides more influential impact on technology adoption compared to other relational pressures. Oliveira and Martins (2010) suggested competitive pressure refers to level of pressure companies affected from competitors within the industry. Also, the nature of SMEs that typically rely on trading partners (Pan and Jang 2008) such as customers could provide major consideration for adopting cloud ERP. Few studies evidenced, the pressure exerted by large customers onto their small trading partners like SMEs resulted for technology adoption (Premkumar 2003). In another adoption study by Chan and Ngai (2007), it proved that the majority of organizations felt under pressure from partners and thus decided opt for technology adoption. The act for making adoption decision were also validated through institutional theory where organizations are deeply influenced by trading partner pressure (Chan and Ngai 2007). On one hand, pressure influences by suppliers (Caldeira and Ward 2002; Kuan and Chau 2001) provide similar scenario as customers. SMEs pressured to employ standard systems as being used by their counter partners in order to continue have business relationship. Therefore, new customize ERP systems that are affordable for SMEs could possibly maintain the trading relationship that SMEs already have before. Lastly, legislative pressure (Khounbatı et al. 2006; Melville and Ramirez 2008; Van den Ende and Dolsma 2005) or new policy enforcement could influence for technology innovation (Teo and Ranganathan 2004). Given US government as an example, through Salesforce.com, they have deployed cloud social network. This effort not only affects certain department in US government agencies but rather being tested across several other government agencies in US as well (McKeon 2012). Therefore, government provides immense pressure for new technology adoption.
Technology Attributes

Technology attributes discussed here are consistent with Rogers’ theoretical analysis (Rogers 1995). Therefore, Rogers’ innovation diffusion theory for organizations will be used as theoretical foundation for enlightening the impact of technology towards adoption cloud ERP in SMEs. The first technology attribute is relative advantage. Prior studies such as Benbasat and Zmud (1999) as well as Rogers (1995) define this attribute as the degree to which an innovation is perceived being better than it precursor. The benefits perceived by adopting cloud ERP systems are important to be recognized (Bapna et al. 2011; Mustonen-Ollila and Lyytinen 2003) as firms need to assure the benefits gain through the adoption. While technology complexity explains the level of difficulty perceived to understand, learn and use (Rogers 1995). Issue of complexity can be reduced by deploying cloud ERP systems as the systems will be managed and maintained by ERP vendors. In addition, cloud ERP systems does provide effortless upgrades, minimized end-user training, no-in-house datacenter and administration tasks for customers (Seitz 2010). This bring to next attributes compatibility, explicates to which extend technology adopted perceived to fit with adopter’s existing values and software policies, skills and current needs (Benbasat and Zmud 1999; Rogers 1995). Generally SMEs never deploy any complex enterprise system before. However, if in any situation they already adopted other traditional enterprise systems, the new cloud-based ERP systems could possibly customize into SMEs need and map into their current system. Given the flexibility of cloud ERP systems provided (Saeed et al. 2011) where user just need to pay as per-use, SMEs can simply change to another ERP vendors that could provide better service to their companies. Therefore, it gives the opportunity for SMEs to try and select the best ERP vendors suitable for their company needs and requirements. This brings the next technology attribute discuss in Rogers, trialability, brings the meaning degree to which an innovation may be experimented before the real adoption (Benbasat and Zmud 1999; Rogers 1995). Lastly is observability bring the meaning - results of an innovation are observable from others experience. In this study, traditional ERP systems could be used as an observed reference for SMEs before making decision to adopt cloud ERP systems. Although the numbers of SMEs already adopted ERP systems not very high, success story from large companies can also be used as guidance for SMEs to adopt cloud ERP systems. To provide success stories from other companies, this task will be offered by ERP vendors. The next two factors of technology attributes are not belonging to Rogers’s theory. However, we found these two attributes discussed immensenly in prior studies. Thus cost of implementation (Esteves 2009) incur at the beginning or during the system implementation, provide significant influence to cloud ERP adoption in SMEs. The last factor is about security concern. Security being worried especially in modern enterprise planning and management (Chang and Ho 2006). However, the necessary security infrastructure already embedded in all cloud technology products or systems (Seitz 2010). Hence security concern will not become a main issue in adopting cloud ERP system.

External Support

A number of empirical studies (e.g., Kamal 2006; Moon and Norris 2005; Ramdani et al. 2009; Zhu et al. 2004) agreed support from external will be another salient factors for new technology adoption. External support can be defined as factors outside the control of an organization (Quaddus and Hofmeyer 2007). These factors provide awareness about the important of new technology that are going to be adopted (Quaddus and Hofmeyer 2007) rather than to pressure. Technical diffusion agency or innovation manufacturers or innovation vendors have the role to disperse new technology products or services (Von Hippel 2007). Swanson and Wang (2005) in their study found that major ERP vendors such as SAP, Oracle, PeopleSoft, Baan, and J.D. Edwards identified as the technical diffusion agency for ERP systems. The support provided by technical diffusion agency can be in term of consultation, advice about enterprise systems especially for companies that do not have any knowledge about the system. Another variety of support could be in term of industry association. Support from industry association could be in term of advice and experience from another industry association (Kole 1983) to provide better understanding on business environment that they are working together. Another example of support could influence adoption new technology is through subsidy. By providing incentive, tax exemption will be meaningful for SMEs in managing their financial scarcity.

Firm Attributes

Cloud ERP adoption will be implemented in organization level, thus firms attributes will greatly influence technology adoption (Premkumar 2003). information on ownership, structure of the firm, firm size, return variability of the firm, number of business lines of the firm and the correlation between firm’s and market return (Blushan 1989) can be classified as firm attributes, however considering the restriction of this study focus, only few attributes
will discussed here. Industry type, been suggested as the determinant of capital structure in which firms are operate (Myers 1977). For example, in service industry type, the nature of the business requires the firm to use enterprise system to facilitate firm need. Similar to firm size, as been proposed by earlier studies (e.g., Bayo-Moriones and Lera-López 2007; Sawang and Unsworth 2011; Swanson and Wang 2005) as an important organizational factors for technology adoption. Firm size does provide positive relationship to technology adoption also (Kimberly and Evanisko 1981). In addition firm structure also considered as salient adoption factor. Prior studies suggested, the more innovative and more flexible the firms, the greater ability to adapt and improve and has less difficulty in accepting and implementing change (Damanpour 1991). On the on hand, firm strategy also provides significant influence on innovation adoption. In the example of SMEs, possess a owner with venture driven and know to seek technological opportunities likely achieve their organizational goal (Badrinarayanan and West 2010). Therefore the important driver in assuring firm strategy is successful, a proactive and technology driven owner are more expected adopting new technology (Hart and Saunders 1997). Finally, year of establishment make firm learn from previous mistakes and find new method to deal with unexpected occurrence. (Lu and Beamish 2001). Thus, firm attributes grant significant pull factor for cloud ERP adoption particularly in SMEs.

Organizational Readiness

Firm readiness provides considerable influence for innovation adoption (Ramdan and Kawalek 2007). As supported by Ramdan and Kawalek (2007) organizations with lack of readiness, has less tendency to adopt new technology. Furthermore, availability of human resources or personnel with competency for delivering new ideas is a salient factor in IT innovation adoption also (Mohr 1969). Immense studies have highlighted about the importance of availability of human resource (e.g., Caldeira and Ward 2003; Kamal 2006; Ndubisi and Kahraman 2005). However, by adopting cloud ERP systems, manpower inside the firm possible spend more time on their core business work as most of implementation and maintaining the system will be handled and managed by vendors. On the other hand, financial availability does not provide constraint for technology adoption (Caldeira and Ward 2002). Knowledgeable managers in handling financial situation (Caldeira and Ward 2002) in their firm are more concern rather than the financial availability. Therefore, competence in financial knowledge provide significant predictors in innovation (Mohr 1969). Besides, the availability of technology infrastructure will reflect the readiness and realistic towards technology adoption (Ndubisi and Kahraman 2005). The adequacy of technology infrastructure will allow SMEs quickly adjust towards environmental change contingencies and facilitate the organizational learning process (Hsu et al. 2012). Particularly in rapid changing environment, firms need to be flexible and innovative (Sher and Lee 2004) in technology infrastructure. Lastly, IT champion availability to commit and introducing new IT technology to the organization (Kamal 2006). The person to be selected as a champion can be employee or the owner of the firm itself. As suggested by Beath (1991) IT champions should be someone who are actively and dynamically promote their personal vision for using information technology, pushing project over or around approval and implementation hurdle.

Internal Pressure

Pressure from internal could happen as a result of gap in firm performance. Performance gap will be realized as a result of market uncertainty that need firm to innovate in order to be competitive. Thus, for SMEs characteristically will only be able to grow by leveraging and mobilizing assets owned by other enterprises (Hagel 2002). Therefore to breach the gap, process for upgrading and maintaining of technology infrastructure needs to be implemented. Again, financial crisis became an issue; therefore cloud ERP is the right solution to overcome this gap. In relation to internal pressure, operational requirement can be another factor for innovation. Issues such as employee alienation (Vega et al. 2008) typically ignored, thus lead to increase expenses in long run (Gargeya and Brady 2005). Therefore to prevent becoming worst, operational requirements such as workshop, training need to provided to all subordinates inside the company. This training and workshop will therefore lead to awareness and increase their individual performance. Also, adopting instant enterprise system like cloud ERP could stimulate subordinates to perform better in their job and minimize manual and clerical job.

Conceptual Model based on Technology-push and Demand-pull

Based on steps aforementioned, we proposed a conceptual model for cloud ERP adoption, shown in Figure 1 as a formative model. As per the Petter et al. (2007) guidelines for identifying formative variables and measures of cloud
ERP adoption; (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. Figure 1 also depicts findings that are derived from Table 1 (list of technology adoption studies and findings). Process of deriving the factors, themes been discussed in Research Design section.

Table 1 illustrates list of eighty studies and the adoption factors discussed in their papers. However, the factors derived from studies been grouped according to appropriate themes as shown in Figure 1. Besides findings depicted in Table 1 give a glimpse idea factors discussed in each of the studies. Given the example of authors Dholakia and Kshetri (2004) in first cell of Table 1, these authors have discussed factors that underlie themes A (Firm Attributes), B (Organizational Readiness) and D (External Pressure). However, not all constructs listed under each of the themes discussed by authors Dholakia and Kshetri. Some studies might only describe one construct (e.g., industry type) from the theme and some might discuss all the constructs (e.g., industry type, firm size, firm structure, firm strategy and year of establishment).

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3 List of eighty studies used for archiving 583 adoption factors.
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| Theme indicators |
| A= Firm Attributes; B= Organizational Readiness; C=Internal Pressure; D=External Pressure; E=Technology Attributes; F=External Support |

Conclusion and outlook

This paper explores a list of factors that lead to cloud ERP adoption in SMEs, and discusses the preliminary findings of research attempting to identify and categorized each of the factors extracted into technology-push and demand-pull framework. Considering the factors identified could be from internalize (organizational factors) or externalize (external factors), the goals is to derive a robust, valid, simple but yet applicable to cloud ERP adoption in with targeting small-medium enterprises (SMEs). In a research design we employ two interrelated phases, exploratory with the objective come out with conceptual model cloud ERP adoption in SMEs (Figure 1). We do acknowledge some limitation while doing this research. A lack of well-defined and examples provided of push-pull framework from IS research perspective has been a problematic issue in categorizing and analyzing technology adoption factors. However, this archival analysis activity provide useful insights into the relationship between technology-push and demand-pull factors, findings or result from this study are solely based on secondary data which are from past literatures, therefore the motivational factors are limited to range that has been identified in the literatures. Then a series of focus groups are planned to further improve findings result of this study. The final adoption factors will then be tested using quantitative survey. This study not only provide implication to academic research by providing potential complete set of cloud ERP adoption factors but will also provide insight ideas on this research topic area. This study will provide implications for practice as cloud ERP systems are getting prominent as it is predicted by year 2015, low-cost cloud services will cannibalize up to 15% of top outsourcing players’ revenue (Plummer et al. 2011). This study will provide significant implication to vendors, consultants and ERP clients in several ways. For ERP vendors, this study can be a pilot study for them to understand factors that could be emphasize towards their client in persuading to adopt cloud ERP product. From client point of view, this study could at least provide a general picture on what they can expect from ERP vendors before making decision whether to adopt or not cloud ERP.

References

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