Enterprise Resource Planning Adoption among Small Medium Enterprises (SME) in Malaysia

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ABSTRACT

The topic on enterprise resource planning (ERP) adoption among small medium enterprises (SMEs) have attracted the interest of many IS researchers. Through the use of ERP it can help organization manage business operations systematically. The adoption of ERP is known to be of interest among large organizations. Due to its great potential values, the adoption of ERP solution is progressively increasing within SMEs. Very limited studies have focused their attention towards understanding the determinants of ERP adoption among SMEs. This study fills in the gap by examining this topic using technological, organizational and environmental (TOE) framework. This is an establish theory used to examine IT adoption at organizational level. The main objective of this research in progress paper is to introduce a conceptualized research model that can be used to examine ERP adoption among SMEs. This paper also discusses about the methodology adopted; and describes its theoretical and practical contributions.

Keywords:ERP, SMEs, Technological-Organizational and Environmental Framework

I   INTRODUCTION

The topic on enterprise resource planning (ERP) adoption among small medium enterprises (SMEs) have attracted the interest of many IS researchers (Botta-Genoulaz, Millet, & Grabot, 2005; Haddara & Zack, 2012). Based on the literature, ERP is acknowledged as one of the most useful technologies that help to support business operations. ERP is known for its ability to improve data processing process, improve productivity and help better decision making (Helmut, Micheal & Guy, 2000).

ERP refers to a business solution technology that develops and creates shared databases across multiple business units (Leon, 2008). Through the use of ERP it can help organization manage business operations systematically. The adoption of ERP is known to be of interest among large organizations. Due to its great potential values, the

adoption of ERP solution is progressively increasing within SMEs (Jafari et al., 2006; Goni, Chofreh, Sahran, 2011; Olson, 2004; Rashid, Hossain & Patrick, 2002 Supramaniam & Kupusamy, 2010).

The adoption of new IT innovation (i.e., ERP) among SMEs requires great organizational, technological and business environmental commitments (Buonanno et al. 2005; Raymond & Uwizeyemungu, 2007). Examining how these factors influence SMEs decision to adopt ERP is interesting, as it can help explains SME's readiness, the influence of external pressures to adopt and to access perceived benefits from using ERP (Pan & Jang, 2008).

In order to understand the influence of the above-mentioned factors, this study adopts Technology-Organization and Environment (TOE) framework (Tornatzky & Fleischer, 1990). TOE posits that new IT innovation is determined by three important dimensions – technology, organization and environment. For instance, by examining organization's technological ability, it can provide the limits, scope and pace of technology change that a company can undertake during the adoption phase (Baker, 2012).

Based on the literature analysis, this theory has been used to examine the adoption of wide varieties of new IT innovation such as RFID, knowledge management systems and ERP (Lee, Wang, Lim& Peng, 2009; Pan& Jang, 2008). Although TOE has been used to examine ERP adoption; it is not examined within SMEs context. It was used to examine ERP adoption within large Telco companies (Pan & Jang, 2008).

Using TOE within SMEs context might give different results as SMEs companies do not have the same ability to afford failures and budget overruns as large companies when it comes to adopting new IT innovation. The SMEs setting is particularly different because these companies are severely constrained by lack of resources (e.g., expertise, financial, technology) to carry out company-wide IT projects (Buonanno et al. 2005).

Within Malaysia context, there are not many studies being conducted to examine the determining factors of ERP adoption among SMEs. Most of previous

studies have given attentions towards examining the critical success factors of ERP implementation (Jafari et al., 2006; Goni, Chofreh, Sahran, 2011; Supramaniam & Kupusamy, 2010), and the influence of cultural effect on ERP adoption (Rajapakse & Seddon, 2005).To the best of our knowledge, this is among the first empirical study that examines the determinants of ERP adoption using TOE within SMEs context in Malaysia. This study hopes to fill in the gap by answering the following research questions.

1) How TOE framework can be applied to ERP adoption among SMEs in Malaysia?

2) To what extent TOE factors influence ERP adoption among SMEs in Malaysia?

3) Which of TOE factors significantly influence ERP adoption among SMEs in Malaysia?

This paper is organized as follows: This section describes the motivation of this study. It is followed by sections that discuss about ERP, SMEs and ERP adoption among SMEs. The following sections discuss about research hypotheses development and research methodology. This paper ends with a section that describes the contributions and significance of this study.

II   ERP

ERP is a software package that provides enterprise-wide generic solutions to many organizations (Helmut, Michael & Gable, 2000; Rajapakse & Seddon, 2005). The use of ERP is usually associated with improved organization's competitive advantages (Goni, Chofreh, Sahran, 2011; Rajapakse & Seddon, 2005), increase the quality of goods and increase consumer's satisfaction over offered services (Gupta, 2000). The main objective of ERP implementation is to "coordinate all the resources, information, and activities needed to complete business processes" (Goni, Chofreh, Sahran, 2011 pg. 200). With the use of ERP organization are able to replace their existing information systems and provide standardize information flow (Yusuf, Gunasekaran, & Abthorpe, 2004).

Within SME context, the adoption of ERP is not easy and it is a challenging task (Goni, Chofreh, Sahran, 2011). According to these authors, adopting ERP within SMEs requires "modifying existing applications and redesigning current business processes to facilitate ERP system implementation" (pg. 200). These authors also highlight that ERP implementation can be unsuccessful if the organization is unable to address employee readiness and financial constraints. ERP adoption among SMEs requires overall assessment on SME internal and external commitments. These internal

and external factors can be categorized into organizational, technological and environmental dimensions.

III   SME IN MALAYSIA

In Malaysia, SMEs are defined by two categories: (i) total amount of annual sales turnover and (ii) number of full time employees (Bank Negara Malaysia, 2013).   In general, SMEs can be categorized into three main categories, namely: - micro, small and medium. Table 1. lays out the definition of SMEs in Malaysia.

Table 1. Definition of SMEs in Malaysia.

Category	Manufacturing	Services & Other Sectors
Micro	Sales turn over not exceeding RM300,000 or full-time employees not exceeding 5	
Small	Sales turnover fromRM300,000 to less than RM15 million or full-time employees from 5 to less than 75	Sales turnover fromRM300,000 to less than RM3 million or full-time employees from 5 to less than 30
Medium	Sales turnover fromRM15 million to not exceeding RM50million or full-time employees from 75 to not exceeding 200	Sales turnover fromRM3 million to not exceeding RM20million or full-time employees from 30 to not exceeding 75

IV   ERP ADOPTION AMONG SMES

Table 2 describes previous works that have been conducted to examine the determinants of ERP adoption.

Table 2. Previous Research on ERP Adoption.

	Author	Focus of study	Theory used	Empirical
1	Bradford & Florin (2003)	Examine the success factor of ERP adoption	Diffusion of Innovation (DOI) Theory	Yes
2	Amoako-Gyampah, Kwasi & Salam (2004)	Tested the extended TAM model in ERP adoption	Technology Acceptance Model (TAM)	Yes
3	Kwahk & Lee (2008)	Examine the readiness for change in ERP adoption	TAM & Theory of Planned Behavior (TPB)	Yes
4	Morton & Hu (2008)	To gauge the degree of fit between organizational structure and	Contingency Theory	Theoretical & previous case evidence

		ERP characteristic		
5	Hsu, Lai & Weng (2008)	Understanding the effect of user satisfaction and impact of ERP adoption	DOI Theory	Yes
6	Shiau, Hsu & Wang (2009)	Assessment on ERP adoption decision in SMEs	Behavioral Decision Theory	Yes
7	Ruivo, Oliveira Johansson & Neto (2014)	Determinants of ERP adoption among European SMEs	DOI Theory	Yes

Based on the literature analysis, it shows that there are limited studies conducted to examine the determinants of ERP adoption among SMEs. Majority of the studies focused on ERP adoption within large organization.

Furthermore, most of previous works adopted theoretical lenses that focus on adoption at individual level (Botta-Genoulaz, Millet & Grabot, 2005). For instance, previous works used theoretical lens such as: Technology Acceptance Model (TAM), Theory of Planned Behavior (TPB), Contingency theory, and Behavioral Decision theory. Hence, this is among the first approach taken to examine ERP adoption among SMEs using TOE framework. In addition, the literature analysis also shows that most of previous studies on ERP adoption focused on large and medium scale organizations (Ramdani, Kawalek & Lorenzo, 2009). Very few studies examined ERP adoption within SMEs.

V   TOE FRAMEWORK

A TOE framework is developed by Tornatzky and Fleischer (1990) to study the factors that may affect the adoption of technological innovation. This framework is adopted to examine technology adoption from organization point of view. It is proven to be relevant and consistent as a measurement scale for technology adoption studies in which it covers all contexts that need to be evaluated for technology adoption factors (Hossain, Patrick, & Rashid, 2002; Tornatzky & Fleischer, 1990).

According Tornatzky and Fleischer (1990), this framework is divided into three main dimensions – technology, organization and environment. Technological dimension comprises both the

internal and external technologies in relation to its availability and characteristics that are relevant to the organization.

Meanwhile, the Organizational dimension refers to descriptive measures in terms of the (1) company's size, (2) extent of centralization, formalization, and managerial structure, (3) quality of its human resources, (4) amount of slack resources, and (5) connection among employees. The environmental context, subsequently, involves with the industry sector, the organization's competitors and the regulatory environment. The following sub-sections describe how TOE dimensions influence ERP adoption among SMEs.

A. Organizational dimension

This dimension focuses on how organization's characteristics and resources influence their decision to adopt technology innovation. Based on previous studies, organization dimension has a strong influence on organization to adopt technology (Laukkanen, Sarpola, Hallikainen, 2007).

ERP is aenterprise-wide generic solutions, thus during implementation phase it requires vendors to customize the software according to SME's requirements. When customizing the software, the SME is left with two options (Laukkanen, Sarpola, Hallikainen, 2007), which are: 1) ERP system is tailored to meet SME's needs and requirements; or 2) SME's business process is required to change and adjust to what is being offered by the ERP system. Usually, most of SME refuse the latter option; hence, understanding how SME's characteristics can suits ERP system is very important in order to examine organization's decision to adopt new IT innovation.

Within the context of this study, SME characteristic is represented by the SME's level of business. Level of business is defined by the number of employees and its annual turnover. Based on the literature, level of business has been identified to influence SME decision to adopt technology. For instance, SME with a maximum of two employees along with low annual turnover (less than USD 36,000) is less likely to adopt ERP (Shiels, McIvor & O'Reilly, 2003). Thus this study hypothesizes:

H1: Level of business influence ERP adoption among SMEs in Malaysia.

B. Technological dimension

SMEs in different industries operate with different procedures where each enterprise has their own information system that is sometimes not compatible with an ERP package (Buonanno & et al. 2005). Thus these require knowledge of the

system and, to some extend modifications, which will lead to technology complexity issues.

Within SME context, ERP adoption is said to be influenced by ICT usage level (Shiels, McIvor & O'Reilly, 2003) and technological level of transformation (Taylor & Murphy, 2004; Shiels, McIvor & O'Reilly, 2003). Implementing ERP requires the most basic level of understanding on howto use the software. ERP is known for its complexity. Hence, in making ERP adoption successful, the SME should provide employee with sufficient knowledge about the software (Shiels, McIvor & O'Reilly, 2003). SME with better ICT knowledge would perceived ERP as beneficial and will be more likely to adopt ERP. Thus this study hypothesizes:

H2: ICT usage level influence ERP adoption among SMEs in Malaysia.

Not limited only to ICT knowledge, SMEs adoption of technology is also influenced by organization level of technology transformation. Technological transformation refers to an SME's plan to integrate technology use in its organization's daily operations. Hence, SMEs with high level of technology transformation is more likely to adopt ERP. Thus this study hypothesizes:

H3: Technological transformation level influence ERP adoption among SMEs in Malaysia.

C. Environmental dimension

SMEs decision to adopt ERP is not limited only to internal factors (organization and technology dimensions) but also influence by external factors. Tornatzky and Fleischer (1990) explained that environmental dimension deals with industry segment, organization's competitors and the regulatory environment. In this study, environmental dimension is represented by external classification. This construct refers to the external factors that will affect SMEs decision to adopt ERP.

In Malaysia, SMEs operation is influenced by initiatives introduced by the government. For instance, in order to encourage SMEs to use ICT in their operations, Malaysian government has introduced financial initiatives to support ICT usage. SMECorp is one of the government agencies established to provide loans as well as guidance to assist Malaysia SMEs(Bank Negara Malaysia, 2013). This initiative is important to introduce new SMEs with ERP and at the same time encourage existing SMEs to adopt ERP. Not only that, SME's decision to adopt ERP is also influenced by the suitable ERP software available in the market and also influenced by the level of competitive advantages

H4: External classification influence ERP adoption among SMEs in Malaysia.

VI   RESEARCH MODEL

Figure 1 demonstrates the proposed research model for this study. Based on the research model, ERP adoption is influence positively by level of business type, ICT usage level, technological transformation level and external classification.
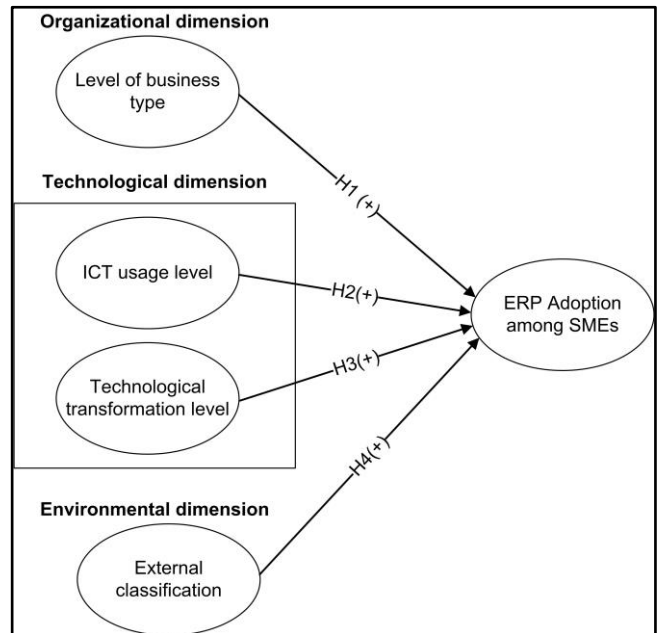

Figure 1. Proposed Research Model

VII   RESEARCH METHODOLOGY

Overall, this study employs a quantitative methodology during the data collection phase. This approach is selected as it can help further extend current understanding on how TOE can be used to determine SME's decision to adopt ERP. The unit of analysis for this study is SMEs that have adopted ERP. The questionnaires will be distributed to SMEs owners. The list of SME owners is gathered from SMECorp. Random sampling technique is used to select the sample from the sampling frame acquired from SMECorp.

This study adopts the IS validity and reliability guidelines proposed by Straub et al. (2004). The following steps will be conducted in this study to establish validity and reliability of the research instrument:

1. Select existing measurement scales from literature.

2. Establish content validity through discussions with IS experts.

3. Establish face validity by distributing the questionnaire to postgraduate students that have experience with research methodology.

4. Establish research instrument validities and reliabilities. Component based structural equation modelling (PLS-SEM) technique is used to evaluate structural and measurement models of this study. In this study, PLS-SEM is selected as the technique for data analysis because:

  a. The focus of this study does not involve the measuring of model invariance. The focus of this study is on prediction factors related to ERP adoption among SMEs in Malaysia.

  b. The focus of this study is to test the relationships according to prior theoretical knowledge. The ability of PLS-SEM to estimate the correlations between the residuals and assesses their impact on the model make this technique as the appropriate approach.

The actual data collection for this study will be collected using web survey using Qualtrics web survey package. The collected data are then analyzed using Smart PLS 2.0 software.

VIII CONCLUSION

As conclusion, this study is designed to understand the determinants of ERP adoption among SMEs in Malaysia. This study contributes to the body of knowledge by: 1) extending current understanding of ERP adoption within SME context. Previous research that examined ERP adoption usually focused their attention to large organizations; and 2) extending the used of TOE framework within ERP adoption among SMEs. This framework is proven to be relevant and consistent as a measurement scale for technology adoption. Hence, using this framework can provide better understanding of what influence ERP adoption among SMEs.

Practically, this study contributes by giving guidelines to SMEs owner on what to consider when making decision to adopt ERP based on TOE framework. Overall, this study is important as it can help SMEs to achieve competitive advantages through the adoption of ERP. With the current economic situation being able to systematically manage business operations are vital in sustaining competitive advantage.

REFERENCES

Amoako-Gyampah, K., & Salam, A. F. (2004). An extension of the technology acceptance model in an ERP implementation environment. *Information & Management*, *41*(6), 731-745.

Ramdani, B., Kawalek, P., & Lorenzo, O. (2009). Predicting SMEs' adoption of enterprise systems. *Journal of Enterprise Information Management*, *22*(1/2), 10-24.

Bank Negara Malaysia. (2013). Small and medium enterprise (SME) annual report 2012/13. *Website: http://www.smecorp.gov.my/vn2/node/717 (Accessed 19 April 2014).*

Baker, J. (2012). The technology–organization–environment framework. In *Information Systems Theory* (pp. 231-245). Springer New York.

Buonanno, G., Faverio, P., Pigni, F., Ravarini, A., Sciuto, D., & Tagliavini, M. (2005). Factors affecting ERP system adoption: a comparative analysis between SMEs and large companies. *Journal of Enterprise Information Management*, *18*(4), 384-426.

Botta-Genoulaz, V., Millet, P. A., & Grabot, B. (2005). A survey on the recent research literature on ERP systems. *Computers in Industry*, *56*(6), 510-522.

Bradford, M., & Florin, J. (2003). Examining the role of innovation diffusion factors on the implementation success of enterprise resource planning systems. *International Journal of Accounting Information Systems*, *4*(3), 205-225.

Gupta, A. (2000) "Enterprise resource planning: the emerging organizational value systems," Industrial Management & Data Systems, 100(3), 114-118.

Goni, F. A., Chofreh, A. G., & Sahran, S. (2011). Critical Success Factors for Enterprise Resource Planning System Implementation: A Case Study in Malaysian SME. *International Journal on Advanced Science, Engineering and Information Technology*, *1*(2), 200-205.

Haddara, M., & Zach, O. (2012). ERP systems in SMEs: An extended literature review. *International Journal of Information Science*, *2*(6), 106-116.

Helmut, K., Michael, R., & Gable, G. (2000). "What is ERP?", Journal of Information Systems Frontiers 2:2, Springer Netherlands, Australia, August. 141-162.

Hossain,L., Patrick, J.D., & Rashid, M.A. (2002). Enterprise Resource Planning: Global Opportunities & Challenges, Idea Group Publishing.

Hsu, L. L., Lai, R. S., & Weng, Y. T. (2008). Understanding the critical factors effect user satisfaction and impact of ERP through innovation of diffusion theory.*International Journal of Technology Management*, *43*(1), 30-47.

Jafari, S. M., Osman, M. R., Yusuff, R. M., & Tang, S. H. (2006). ERP systems implementation in Malaysia: the importance of critical success factors.*International Journal of Engineering and Technology*, *3*(1), 125-131.

Kwahk, K. Y., & Lee, J. N. (2008). The role of readiness for change in ERP implementation: Theoretical bases and empirical validation. *Information & Management*, *45*(7), 474-481.

Laukkanen, S., Sarpola, S., & Hallikainen, P. (2007). Enterprise size matters: objectives and constraints of ERP adoption. *Journal of Enterprise Information Management*, *20*(3), 319-334.

Leon, A. (2008). *Enterprise resource planning*. Tata McGraw-Hill Education.

Lee, O. K., Wang, M., Lim, K. H., & Peng, Z. (2009). Knowledge management systems diffusion in Chinese enterprises: A multistage approach using the technology-organization-environment framework. *Journal of Global Information Management (JGIM)*, *17*(1), 70-84.

Malhotra, R., & Temponi, C. (2010). Critical decisions for ERP integration: Small business issues. *International Journal of Information Management*, *30*(1), 28-37.

Morton, N. A., & Hu, Q. (2008). Implications of the fit between organizational structure and ERP: A structural contingency theory perspective. *International Journal of Information Management*, *28*(5), 391-402.

Olson, D. L. (2004). *Managerial issues of enterprise resource planning systems*. McGraw-Hill, Inc.

Rajapakse, J., & Seddon, P. (2005, August). ERP adoption in developing countries in Asia: a cultural misfit. In *28th Information Systems Seminar in Scandinavia, Kirstiansand* (pp. 6-9).

Rashid, M. A., Hossain, L., & Patrick, J. D. (2002). The evolution of ERP Systems: A historical perspective. *Enterprise Resource Planning: Global opportunities & challenges*, 1-16.

Raymond, L., & Uwizeyemungu, S. (2007). A profile of ERP adoption in manufacturing SMEs. *Journal of Enterprise Information Management*, *20*(4), 487-502.

Rogers, E. M. (2010). *Diffusion of innovations*. Simon and Schuster.

Ruivo, P., Oliveira, T., Johansson, B., & Neto, M. (2014). Empirical Study on Differences and Similarities in ERP Usage Amongst European SMEs. In*Information Systems for Small and Medium-sized Enterprises* (pp. 199-212). Springer Berlin Heidelberg.

Pan, M. J., & Jang, W. Y. (2008). Determinants of the adoptiong of enterprise resource planning within the technology-organization-environment framework: Taiwan's communication industry. *Journal of Computer information systems*,*48*(3).

Shiau, W. L., Hsu, P. Y., & Wang, J. Z. (2009). Development of measures to assess the ERP adoption of small and medium enterprises. *Journal of Enterprise Information Management*, *22*(1/2), 99-118.

Shiels, H., McIvor, R., & O'Reilly, D. (2003). Understanding the implications of ICT adoption: insights from SMEs. *Logistics Information Management*, *16*(5), 312-326.

Straub, D., Boudreau, M. C., & Gefen, D. (2004). Validation guidelines for IS positivist research. *Communications of the Association for Information systems*, *13*.

Supramaniam, M. & Kuppusamy, M. (2010). ERP system implementation: a Malaysian perspective. *Journal of Information Technology Management*, *21*(1), 35-48.

Taylor, M., & Murphy, A. (2004). SMEs and e-business. *Journal of small business and enterprise development*, *11*(3), 280-289.

Tornatzky, L.G., & Fleischer, M. (1990). Processes of technological innovation. MA, Lexington Books.

Yusuf, Y., A. Gunasekaran, and M.S. Abthorpe. (2004). "Enterprise information systems project implementation: A case study of ERP in Rolls-Royce," *International Journal of Production Economics,* 87(3). 251-266.