

User Acceptance of SaaS ERP Considering Perceived Risk, System Performance and Cost

Tong-Ming Lim, Angela Siew-Hoong Lee, Mun-Keong Yap
Department of Information Systems
Sunway University
Malaysia

tongmingl@sunway.edu.my, angelal@sunway.edu.my, yapmun@hotmail.com

Abstract. The use of cloud solution to support ERP system has become the priority of many organizations to stay competitive in the current global world. This research will be focusing on the user acceptance of SaaS ERP (SAP ByDesign) in a global construction tool provider considering perceived risk, cost and system performance. Due to many unique variables, the purpose of this research is to analyze and investigate issues related to acceptance of SaaS in the construction tool provider companies. The results of this research can help both organizations and researchers to build a fundamental level on understanding how these factors that can predict the user acceptance of SaaS ERP in a global construction tool provider company which significantly beneficial. 80 users ranging from executive and higher management level globally were targeted. SAS Enterprise Guide 5.1 was used to analyze respondents' data and SAS dataset was then run by SAS Enterprise Guide 5.1 to produce descriptive analysis, Cronbach alpha, factor analysis and PLS-SEM will be used to analyses the responses and each hypothesis will be tested based on the data consolidated. Lastly, Partial Least Square- SEM will be performed to summarize and give an analysis of the research model proposed.

1. Introduction

In this era of modernization, cloud computing has been attracting many interests from various organizations to gain benefits and improve productivity. Cloud computing is an innovative solution in the computing world which highlights the introduction of a new computing paradigm (Luis et al., 2008, Buyya et al., 2008). Since then, cloud computing has attracted a number of customers as the advanced development of cloud computing has significantly reduced the cost of use of computing infrastructures and mass storage capabilities as well as removing the heavy investments on Information Technology (IT) infrastructure (Shimba, 2010). Cloud computing has various types of services which can be categorized as infrastructure-as-a-service (IaaS), platform-as-a-service (PaaS) and software-as-a-Service (SaaS). Although cloud computing is widely adopted in many global organizations, there are a number of challenges or barriers which inhibit the effective process of adoption among the users. The researched company had chosen SAP BusinessByDesign as their SaaS after much consideration. SAP Business ByDesign is one of the SaaS ERP that supports their customers to run their daily business efficiently. This research studies on Construction Tools Provider which is located globally. Construction Tools Provider had implemented SAP BusinessByDesign to provide similar functionalities as the conventional SAP R/3 system into some of the smaller market organizations that don't need much complexity in terms of systems and processes. In return, this action able to save the cost of the other smaller subsidiaries as well as improving the performance and saving the cost of Construction Tools Provider and its customers. Nevertheless, Construction Tools Provider will be deploying SAP Business ByDesign into more market organizations that meet the requirements and don't need much system complexity. On the other hand, there are many exposures of risks during the implementation of SAP BusinessByDesign in terms of people risk, financial risk, operational risk and compliance risk. There are many researchers who focuses on the adoption of new technology system and the theory which has been commonly used by researchers is Technology Acceptance Model (TAM) which is proposed by Davis (1989) that perceived usefulness and perceived ease of use affect the user's attitude towards the usage of the system. Technology Acceptance Model (TAM) is applied and extended to determine the external variables of the intention to use SaaS ERP in Construction Tools Provider. Three key constructs which are related to perceived costs, perceived risks and perceived performance act as the external determinants to TAM will be used to determine the behavioral and acceptance among the users towards the system. This research will further examine the risk perception, cost perception and performance perception surrounding SaaS ERP that affects the system evaluation process by examining the moderating effect of perceived risk, perceived cost and perceived performance on TAM.

2. Related Work

2.1 Cloud Computing

Boilat & Legner (2013) has stated that cloud computing is “an emerging model that promotes the use of services through the network in order to provide companies with on-demand and scalable IT resources”. In simple terms, cloud computing can be defined as a new framework where it is not compulsory for the users to acquire the hardware and software physically they need in their daily business but rather they can just use them over the internet (Elragal and El Kommos, 2013). Figure 1 can illustrate better and represents the main types of clouds.

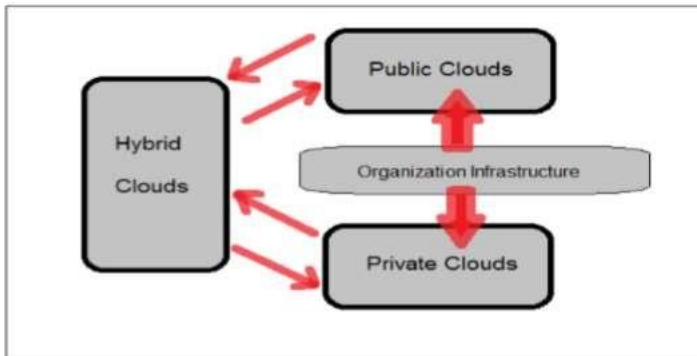


Figure 1. Types of Cloud Computing (Elragal and El Kommos, 2013)

Cloud computing can be also generally divided into 3 layers which represents the services (Saini et al., 2011):

- 1) Software as a Service (SaaS) is explained as a business model that allows the vendor to manage software and deliver applications as a service to end-users over the Internet. It is installed on cloud servers and provided ‘on demand’, rather than ‘on premise’.
- 2) Platform as a Service (PaaS) is, as SaaS, a type of cloud computing. This service allows a company to control applications available on an online platform that they can install, configure and use themselves. In that way, PaaS allows the company to host applications that are not supported by the SaaS model.
- 3) Infrastructure as a Service (IaaS) allows system administrators to rely on external processing time, network, storage and other fundamental computing resources. In this context, ERP software that is deployed into a cloud environment becomes "Cloud ERP Software".

SAP Business ByDesign is such a product/service by SAP. It offers an on-demand business planning and management software (ERP) designed for small and medium enterprises. Hence, SAP BBD is available on the cloud as a SaaS.

2.2 Technology Acceptance Model

Davis (1989) has developed the Technology Acceptance Model (TAM) to explain and predict adoption and use of technology which is a model based on the Theory of Reasoned Action built by Fishbein and Ajzen’s (1975). This well-accepted model, TAM has been commonly used by many researched to understand and predict the outcome of the user adoption and acceptance of new technology. TAM has two main factors which are perceived usefulness and perceived ease of use that consists 40% of the variance in intention to use and actual usage behavior. Furthermore, adoption of technology is strongly interconnected to a positive attitude toward the acceptance and behavioral to use the system (Martins & Kellermanns, 2004; Park, 2009; Tsai et al., 2013). A further extension of TAM is necessary to tailor it to SaaS ERP evaluation and adoption to understand and analyze different determinants that could possibly influence the acceptance and behavioral of usage among the users towards the system. For example, Martins and Kellermanns (2004) have modified the change implementation to TAM, which explains the motivators and enablers that affect perceived usefulness and ease of use as perceived incentive to use new technology, perceived

encouragement as well as awareness of capabilities of new technology and access to the system. There are many factors believed to explain these variances in this different context which are perceived risks, perceived performance and perceived costs due to adoption and usage of the system.

2.3 Perceived Risks

According to Bauer (1967), perceived risk (PR) is defined as “a combination of uncertainty with seriousness of result involved” and it is an uncertainty concerning possibilities of negative consequences of using products and services. Apart from that, Peter and Ryan (1976) defined PR as an expected loss on the subjects and Featherman and Pavlou (2003) also defined the possibility of losing when acquiring desired outcomes. Since the 1960s, perceived risk theory has commonly been used to explain user’s adoption behavior of the new system in information system contexts. Users are consciously and unconsciously perceiving risks when they are reviewing new products and services for adoption. Adoption of new system has been shown to create anxiety among the employees in an organization and additionally with the complexity of the user interfaces on the system (Igarria, M., 1993; Moore et al., 1991). Table 1 below shows the description for each type of risks that are discovered by Featherman and Pavlou (2003).

Perceived Risk Facet	Description - Definition
1) Performance Risk	“The possibility of the product malfunctioning and not performing as it was designed and advertised and therefore failing to deliver the desired benefits.” (Grewal et al., 1994)
2) Financial Risk	“The potential monetary outlay associated with the initial purchase price as well as the subsequent maintenance cost of the product” (ibid). The current financial services research context expands this facet to include the recurring potential for financial loss due to fraud.
3) Time Risk	Consumers may lose time when making a bad purchasing decision by wasting time researching and making the purchase, learning how to use a product or service only to have to replace it if it does not perform to expectations.
4) Psychological Risk	Potential loss of self-esteem (ego loss) and ego frustration based on feelings about oneself. Consumers feel unwise if they experience a non-performing product and may experience feelings of harm to their self-image from the frustration of not achieving their buying goals.
5) Social Risk	Potential loss of status in one’s social group as a result of adopting a product or service, looking foolish or untrendy.
6) Privacy Risk	Potential loss of control over personal information, such as when information about you is used without your knowledge or permission. The extreme case is where a consumer is “spoofed” meaning a criminal uses their identity to perform fraudulent transactions.
7) Overall Risk	A measure of perceived risk when all criteria are evaluated together.

Table 1: Description and Definition of Perceived Risk Facets. (Featherman and Pavlou, 2003)

2.4 Perceived Costs

There are various studies that are focusing on the variables like perceived enjoyment (Davis, Bagozzi, and Warshaw 1992), technology readiness and anxiety (Parasuraman 2000). However, this research will involve perceived costs as one of the variable to be measured. Perceived costs such as implementation, training and support costs are important elements to be measured.

According to Chen (2003), the author has proven that the transaction costs influence the using intention among the users. Through a preliminary investigation, we found that the researched company are using SAP ByDesign due to lower costs compared to SAP R/3 system. For example, the overall costs including implementation, training and supports costs in SAP ByDesign is comparatively lower compared to the overall costs to set up SAP R/3 in an organization. This is because ByDesign system is designed for small and middle size of market organizations which requires a less complex system but still provide basic functionalities that are able to support the organization’s productivity on a daily basis.

2.5 Perceived System Performance

Based on Liu and Ma (2006), they have stated that perceived system performance refers to whether the system performance is reliable and responsive during the working hours of the organization that enable to perform responsive business tasks. Liu and Ma (2006) have found that the perceived system performance is a more direct predictor for behavioral intention to adopt the system rather than perceived ease of use. Thus, it is interesting to measure the perceived system performance in this research concerning the researched company are concern on the reliability of SAP ByDesign which now operating in 20 organizations globally. Nevertheless, Bailey and Pearson (1983) also mentioned that service quality of the system such as system availability, reliability, flexibility and response time can be related to the concept of perceived performance. It is important for an organization to adopt a vendor that has vast experience in providing and managing the system from the backend side which ensure the users do not face any business interruptions while using it. For example, the researched company have chosen SAP ByDesign as their cloud ERP solution based on various factors, of which one of them is due to the experiences SAP in handling ERP solutions.

3.0 Problem statements

Preliminary investigation has been conducted among five project managers who were involved in the implementation of SAP ByDesign system in this tool construction provider company. Open ended questions have been provided to the participants during the interview session. In summary, these are issues and concerns that have been raised during the adoption of SAP ByDesign:

1. Trust is viewed as an issue as the users are lacking of confidence to use are doubting themselves on using the correct processes on the new system.
2. Security is also considered as a barrier to adopt SAP ByDesign as the transactional, customers' information that are recorded are stored in SAP servers which leads doubts among the users on data and privacy concerns.
3. Change management in terms of changes to new system has made some of the employees reluctant to use the system due to its competence on the old system which eventually lead them to resign from the organizations.
4. Risks in terms of people risk, financial risk, operational risk and compliance risk are viewed as barriers for some Construction Tools Provider's managements to adopt SAP ByDesign in their organizations.
5. Costs in terms of hidden costs, implementation costs, and maintenance and training costs are considered as barriers for the organizations to adopt SAP ByDesign.
6. System performance is viewed as an issue as errors on the system will interrupt the business operations of the organizations and sometimes failure which cause the organization unable to proceed with their daily work and affect customer's satisfactions.

All the issues are equally interesting to be investigated to solve the adoption problem of SAP ByDesign. However, this research will be focusing on risks, costs and system performance as these variables are the major issues based on the feedbacks provided from preliminary investigations. In summary, these are the questions that will be answered for the outcomes of this research work:

- How perceived costs would influences the user acceptance towards SaaS ERP?
- How would perceived risks influence the user acceptance towards SaaS ERP?
- How would perceived system performance influences the user acceptance towards SaaS ERP?

4.0 Research Objectives

This research work is intended to investigate the issues related to cloud solution currently faced by the users in this construction tools provider company. Issues related to the system in this company will be analyzed for further actions required. In addition, this research is to investigate plausible factors that are able to predict the acceptance of cloud solution in the company. This study will be able to predict the acceptance of cloud solution among the users in the company by examining and investigating on those unique factors. This will improve the acceptance rate of this cloud solution among the users in the company and reduce failure risk of implementation of this cloud solution in the company. In a summary, these are main objectives that are going to be explored throughout this research:

- To investigate the issues related to cloud solution currently faced by the users.
- To investigate factors that predict the acceptance of cloud solution.

5.0 Proposed Research Model

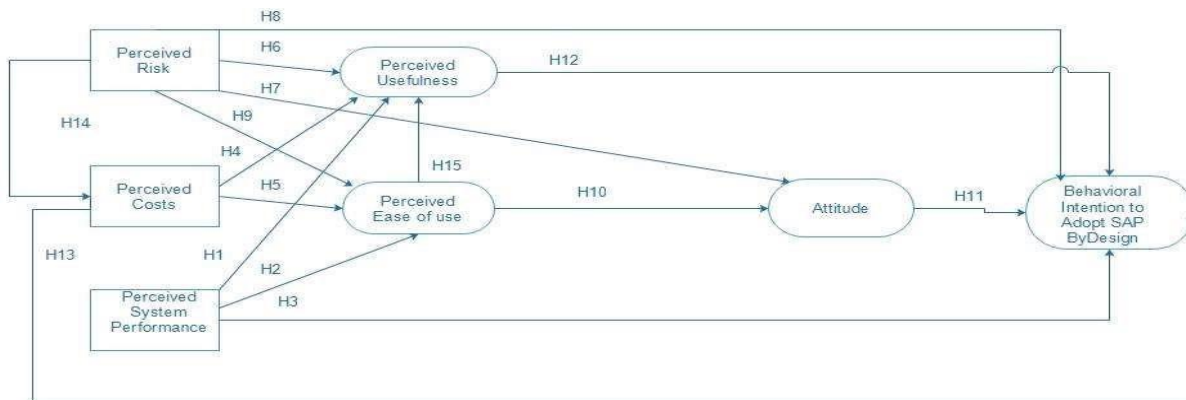


Figure 2: Proposed Research Model

There are many research hypothesis in this research concerning the variables (perceived risks, perceived system performance, perceived costs) that are going to be examined through this research when related to this proposed research model. The research hypothesis are shown as below:

Hypothesis 1. Perceived system performance has a positive influence on the perceived usefulness of a system.

Hypothesis 2. Perceived system performance has a positive influence on the perceived ease of use of a system.

Hypothesis 3. Perceived system performance has a direct positive impact on the user's behavioural intention to adopt a system.

Hypothesis 4. Perceived costs will have a negative effect on perceived usefulness of the system.

Hypothesis 5. Perceived costs will have a negative effect on perceived ease of use of a system.

Hypothesis 6. Perceived risk has a negative influence on perceived usefulness.

Hypothesis 7. Perceived risk has a negative influence on the attitude for acceptance intentions of SaaS ERP solution.

Hypothesis 8. Perceived risk has a negative influence on the acceptance intention to accept the SaaS ERP solution.

Hypothesis 9. Perceived risk has a negative influence on the perceived ease of use.

Hypothesis 10: Perceived ease of use has a positive influence on the attitude of the users towards accepting the system.

Hypothesis 11: Attitude has a positive influence on the behavioral intention to accept by the users. Hypothesis 12:

Perceived usefulness has a positive influence on the attitude towards the intention to accept by the users.

Hypothesis 13. Perceived cost have a positive influence on behavioral intention to adopt SAP ByDesign system.

Hypothesis 14: Perceived risk has a negative effect on the perceived cost of the system.

Hypothesis 15: Perceived ease of use has a positive influence on the perceived usefulness of the system.

6.0 Justification of Research

This research can contribute in terms of reducing the risk of failure during the implementation phase of the cloud solution's roll-outs to the company's subsidiaries. Consequently, sunk costs can then be prevented. Nevertheless, the factors that predict the user acceptance on the cloud solution in the company will be tested and analyzed. Based on the findings, the company could focus on the factors that could essentially contribute to the user acceptance of SAP ByDesign in their companies.

7.0 Research Methodology

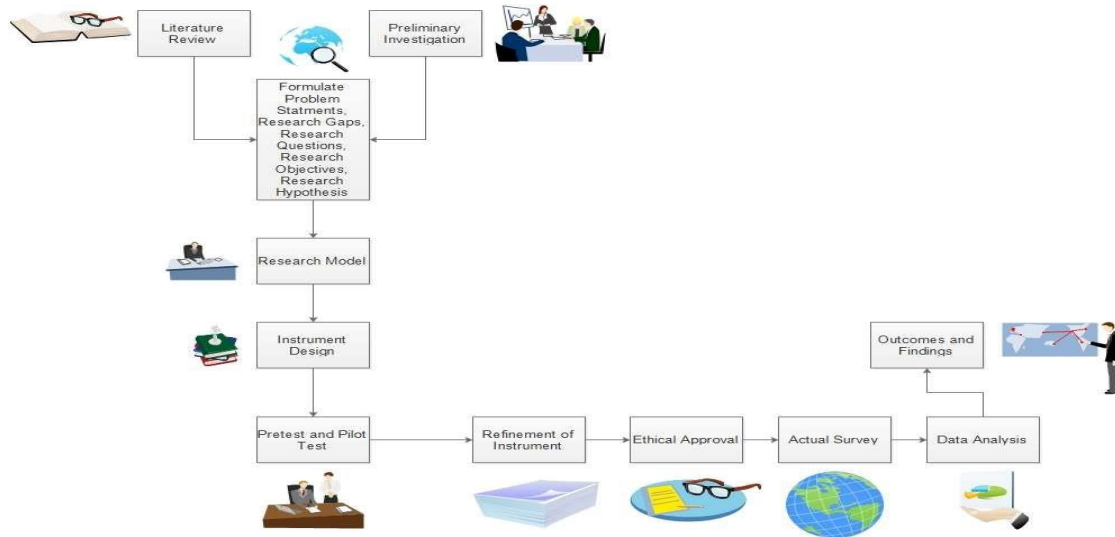


Figure 3: Research Methodology

The figure above shows the research methodology that is going to be conducted throughout this research.

8.0 Conclusion

The proposed research model will collect data from the samples to test the proposed model and analyze the findings from analysis generated in the research activities. Based on the findings from the analysis, it could benefits the company by understanding the issue related to the cloud solution and predicting the user acceptance of SAP ByDesign among the users. The other factors that discovered during this research will not be ignored but instead it will consider for future research work.

References

1. Bailey, J.E. and Pearson, S.W. (1983). "Development of a Tool for Measuring and Analyzing Computer User Satisfaction," *Management Science*, Vol.29, pp. 530-545.
2. Boillat T, Legner C (2014). Why do companies migrate towards cloud enterprise systems? A post implementation perspective.
3. BUYYA, R., YEO, C. S., et al. (2008) Market-oriented Cloud Computing: Vision, Hype, and Reality for Delivering IT Services as Computing Utilities. 10th IEEE Conference on High Performance Computing and Communications. IEEE
4. Chen, Hsin-Yi (2003). The usage intention on personalized services provided by online bookstores, National Sun Yat-sen University Press.
5. Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3), 319-340. doi:10.2307/249008
6. Davis, Fred D., Richard P. Bagozzi, and Paul R. Warshaw (1998), "User acceptance of computer technology: A comparison of two theoretical models," *Management Science*, 35 (8), 982-1003.
7. Elragal, A. and El Kommos, M. (2013). In-House versus In-Cloud ERP Systems: A Comparative Study. *Journal of Enterprise Resource Planning Studies*, pp.1-13.
8. EN, W, LU, M, WANG, W, & CHANG, Y 2013, 'Effects of Perceived Benefits and Perceived Costs on Passenger's Intention to Use Self-ticketing Kiosk of Taiwan High Speed Rail Corporation', *Journal Of The Eastern Asia Society For Transportation Studies*, 10, 0, pp. 215-230, J-STAGE, EBSCOhost, viewed 21 July 2015.
9. Featherman, M., and M. Fuller (2003) "Applying TAM to E-services Adoption: the Moderating Role of Perceived Risk" *Proceedings of the 36th Hawaii International Conference on System Sciences*.
10. Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior: An introduction to theory and research*. Reading, MA: Addison-Wesley.
11. Igarria, M., (1993) "User Acceptance of Microcomputer Technology: An Empirical Test" *Omega*, 21(1). 73-91
12. Liu, L. and Ma, Q. (2006). Perceived system performance. *ACM SIGMIS Database*, 37(2-3), p.51. 13. LUIS, M. V., LUIS, R.-M., et al. (2008) A breaks in the clouds: towards a cloud definition. *SIGCOMM Comput. Commun. Rev.*, 39, 50-55
14. Martins, L. L., & Kellermanns, F. W. (2004). A model of business school students' acceptance of a web-based course management system. *Academy of Management Learning and Education*, 3(1), 7-26. doi:dx.doi.org/10.5465/AMLE.2004.12436815
15. Moore, G. C., Benbasat, Izak (1991). "Development of an Instrument to Measure the Perceptions of Adopting an Information Technology Innovation." *Information Systems Research* 2(3): 192-222.
16. Parasuraman, A. (2000), "Technology readiness index (TRI): a multiple item scale to measure readiness to embrace new technologies," *Journal of Service Research*, 2(4), 307-320.
17. Park, S. Y. (2009). An analysis of the technology acceptance model in understanding university students' behavioral intention to use e-learning. *Educational Technology & Society*, 12(3), 150-162. Retrieved from http://www.ifets.info/journals/12_3/14.pdf
18. Roselius, T. (1971). "Consumer Rankings of Risk Reduction Methods." *Journal of Marketing* 35(January): 56-61
19. Saini, S. L., Saini, D. K., Yousif, J. H. & Khandage, S. V. (2011). Cloud Computing and Enterprise Resource Planning Systems. In: *Proceedings of the World Congress on Engineering*. London, UK.
20. Shimba, F. (2010): *Cloud Computing: Strategies for Cloud Computing Adoption*. Masters Dissertation. Dublin, Dublin Institute of Technology
21. Sun, Q., Cao, H. and You, J. (2010). Factors influencing the adoption of mobile service in China: An integration of TAM. *JCP*, 5(5).
22. Tsai, I.-C., Tung, I.-P., & Laffey, J. (2013). Exploring the impact of students' motivation and selfregulation on the social nature of online learning experiences. *International Journal of Learning Technology*, 8(1), 86-108. doi:10.1504/IJLT.2013.052833