

Adoption of Cloud Computing among Enterprises in Malaysia

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Abstract

The motivation to perform this study is to find out the significant variables that will impact on stage of cloud computing adoption among enterprises in Malaysia. Moreover, to investigate whether there are any significant variances among the means of independent variables and also the suggested contexts based on the stage of cloud computing adoption in enterprises. The study applies the Technology–Organization–Environment (TOE) framework to build a cloud adoption model. The framework has been verified using 41 enterprises in Malaysia. The results of data analysis show that: (1) the cloud computing adoption level is still low; (2) the 5 significant variables are security and privacy, top management support, cost saving, competitive pressure and trading partner pressure; (3) among the suggested three contexts, the most important one is organizational followed by technological and environmental context; (4) among the independent variables, the results indicate significant differences for top management support based on stage of cloud computing adoption in enterprises; (5) among contexts, the results indicate significant differences for organizational context. Since the cloud computing is a novel concept, then it is a new area for research. The findings of the current research are similar to other studies in case of significant factors for cloud adoption and also the coverage level of cloud among enterprises. The results of this study help IT decision maker to come out with novel cloud computing products to satisfy IT market. Moreover, to help Malaysia government to design a comprehensive roadmap to increase the penetration rate of cloud computing among enterprises in Malaysia.

Keywords: Cloud Computing Adoption, Cloud Computing Penetration Rate, Small and Medium Enterprises (SMEs), Technology Organization Environment (TOE) Framework

1. Introduction

The capacity of a company to maintain its competitiveness is challenged by the growing globalization and the fast technological revolution in today's business world¹. The competition is more dynamic and innovation is crucial for upcoming business growth in economic globalization². Information technology has the ability to improve operational efficiency and effectiveness, change the way

businesses contest to create strategic opportunity and rework competitive limits³. The next movement of information technology for individuals, companies and governments is cloud computing. The sufficient amount of information technology competencies of cloud computing at a low cost presents many attractive opportunities. The cloud technologies have become the base for fundamental business innovation and new business models along with decreasing functioning costs⁴. NIST⁵ (National of Standards and Technology)

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defines cloud computing as a model for enabling global, suitable, on-demand network access to a shared configurable computing resources such as software, services and servers. These computing resources can be rapidly supplied and released with minimal service provider communication or management effort.

In almost all countries, SMEs are the most dynamic economic growing force. As a result, SMEs are performing an important role in economic growth and considered as a backbone of industrial development⁶⁻⁸. Therefore, the government of Malaysia established some rules and policies to satisfy SMEs to adopt IT products as a novel, more effective way of acting a profession. One of the most important strategic technology preferences is cloud computing⁹.

An online-based survey was conducted by VMware Cloud Index between 799 senior IT specialists across the Asia Pacific (including Japan) in September 2012. The Malaysia-specific survey results showed that 36% of surveyed companies are “at this time planning” to use cloud in the next year and 40% are “at this time using” cloud computing¹⁰. This mentioned study shows that the coverage level of adoption of cloud computing among SMEs in Malaysia is still low. Defining the variables that affect the adoption of cloud computing among SMEs and large enterprises is an essential issue. To this point, this issue has not been studied enough by researchers in this research field. Therefore, in the following section, a research framework to construct a cloud adoption model is proposed.

2. Research Framework and Hypotheses Formulation

The research model in Figure 1 is proposed by using TOE framework proposed by DePietro et al^{11,12}. TOE framework has a strong theoretical foundation, reliable experimental support to study IS/IT innovation adoption¹³⁻¹⁵. This framework assumes that adoption of IT technology by firms and organizations is affected by technological, organizational and environmental context^{11,12}. In the following subsections, the definition of each context is stated. Moreover, the variables have been offered in each context are specified.

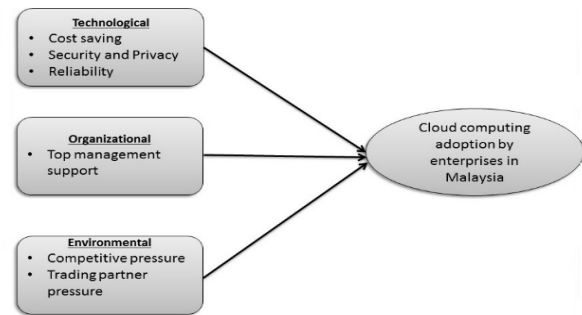


Figure 1. The proposed research model for cloud computing adoption among enterprises in Malaysia.

2.1 Technological Context

The technological context (Tech) defines the attributes of the technologies that will affect decisions about IT adoption, such as perceived benefits, and worries about the technology¹⁶. Based on the literature review, three variables have been proposed in the technological context which are cost saving, security and privacy and reliability. In following, these three variables are described in detail:

2.1.1 Cost Saving (CS)

A study directed by Easynet Connect between UK SMEs has declared that of those companies which indicate their readiness to adopt cloud computing, 35% of them mentioned CS as an important factor to adopt cloud¹⁷. Small and medium-sized businesses (SMBs) can save their budget due to the time saving on IT administrative by adopting cloud computing. They can apply this budget for growing their core business¹⁸. Moreover, there is a massive cost savings for small businesses due to the subscription-based pricing model¹⁹. However, there are hidden costs for companies when they want to adopt cloud computing. These costs are the cost of upgrading a company's infrastructure, the cost of learning and the cost of time. Moreover, there are future costs for companies moving to the cloud due to the difficulty of the system or the lack of ability of IT employees to handle the relations among the in-house applications and cloud computing services²⁰. However, these costs can be easily prevented with a slight insight and preparation for cloud computing adoption by businesses²¹.

2.1.2 Security and Privacy (SP)

The World Economic Forum report on year 2009 states that approximately 60% and 75% of respondents from

Asia-Pacific organizations mentioned that SP are very serious barriers for adoption of cloud computing²². Moreover, a study conducted by IDC in the year 2008 among 244 IT executives and chief information officers (CIOs) and their colleagues about their companies' use of, and views about IT cloud services states that most of them mentioned security issues to be the most critical obstacle for cloud adoption. Companies have stated doubt in the cloud and are careful of applying it to store their important data²³. Furthermore, a study conducted by Symantec Corporation between SMEs in 29 countries in the year 2013 shows that 40 percent of SMEs faced the disclosure of confidential information. Moreover, more than 25 percent encountered account takeover issues, destruction of Web properties, or robbed goods or services²¹. These mentioned studies show that the provided SP by cloud computing service providers is still weak.

2.1.3 Reliability (Rel)

In the perspective of past studies, it is necessary to improve Rel of cloud technology. A same study conducted by Symantec Corporation states that more than 37 percent of SMBs have lost their information in the cloud and have had to restore their information from backups. Moreover, most of those SMBs have experienced failure in recovery operations. Furthermore, recovering information from the cloud is slow. Sometimes recovering needs three days or longer²¹. Another study conducted by Prashant Gupta et al. in year 2012 among 211 staff working in SMEs/SMBs in developed countries as well as Asia Pacific region states that SMEs perception about cloud reliability is still low²³. These mentioned studies show that the reliability of cloud service provider is not trustworthy. However, regardless of lacking reliability in the cloud, SMEs are still interested to adopt cloud computing due to cost saving in their budget. SMEs concentrate more on price and they are less anxious about the performance of the service²⁴.

2.2 Organizational Context (Org)

The internal factors for an organization which are influencing an innovation adoption and implementation are studied in the organizational context²⁶. Size, quality of human resources, and difficulty of the firm's managerial structure are the characteristics for organizational context^{27,28}. Based on the literature review, one variable has been proposed in the organizational context which is top management support. In following, this variable is described in detail:

2.2.1 Top management Support (TMS)

It is crucial to have TMS for building a positive organizational climate to provide sufficient resources of the organization to adopt new technologies^{29,30}. SMEs are less expected to adopt new technologies without TMS³¹⁻³³. Top management can deliver a vision and obligation to create a positive environment for innovation when the complexity and sophistication of technologies increase^{34,35}. A qualitative study was conducted by Alshamaila et al. In year 2012 among 15 different SMEs and service providers in the north east of England. The result of these semi-structured interviews show that in many cases service providers mentioned TMS as a main factor to adopt cloud computing. However, adopters and prospectors of cloud computing mentioned IT staff's suggestion as a key factor to adopt cloud computing. This result may show that the nature of the sectors determines which factors are important³⁶.

2.3 Environmental Context (Env)

In this study, two variables have been proposed in the environmental context. These variables are described in detail following:

2.3.1 Competitive Pressure (CP)

Accepting a novel technology by firms is frequently considered as an essential strategy to contest in the marketplace. As a consequence, the firms can profit from higher functioning proficiency, better market view and more precise access to real-time data³⁷. Moreover, SME and large companies can contest significantly with its competitors in the market place by adopting novel technology. Low et al. stated that CP can obligate firms to adopt cloud computing ($\beta=0.842, p<0.05$)³⁸. This study was conducted among 111 firms under the category of high-tech industry in Taiwan. However, a study conducted by Tiago Oliveira et al. from mid-2012 to early 2013 among 369 directors, and senior IS managers in the manufacturing and services sectors in Portugal. It was found that CP is not significant among these firms to adopt cloud computing³⁹. Despite the effect of CP on cloud computing, the enterprises still prefer to adopt this technology due to some issues such as cost saving⁴⁰.

2.3.2 Trading Partner Pressure (TPP)

An enterprise is encouraged to apply cloud computing by noticing that business partner receives benefit from

adopting this technology^{38,41}. Moreover, a business partner can force an enterprise to adopt cloud computing if it wants to stay in connection with it⁴². A same study conducted by Low et al.³⁸ stated that TPP has a significant outcome on the adoption of cloud computing ($\beta=1.834c$, $p < 0.01$). However, Pei-Fang et al. stated that external pressures from business partner is not a significant forecaster for cloud adoption ($P > 0.1$)¹⁶.

3. Research Methodology

An online survey was conducted among enterprises in Malaysia. Since cloud computing is a new concept among enterprises, definitions for the service and deployment models of the cloud are stated in the glossary of the questionnaire. The questionnaire includes seven major variables with a total of 25 items. In the first two parts of this questionnaire, we ask about the company characteristics and general information of the respondents. In the last part of the survey, the level of cloud computing adoption among enterprises is measured. The businesses chosen for the survey were distributed over two sectors: manufacturing and services. The gathered sample size was 41 enterprises during the second half of 2015. The One-way analysis of variance (ANOVA) is used to examine whether there are any significant variances among the means of independent variables based on stage of cloud computing adoption in enterprises.

4. Data Analysis and Result

4.1 Demographic Statistic

In the perspective of the enterprises' characteristics participated in the survey, the majority are from service sector (73 percent). Therefore, based on the number of full time employees and their annual sales turnover, it can find out that the majority of enterprises participated in this survey are SMEs.

In the perspective of level of cloud computing adoption, 34 percent of enterprises have already adopted services, infrastructure or platforms of cloud computing. Meanwhile, the rest of enterprises have not yet adopted this technology. This result shows that the level of cloud computing adoption is still low. Those enterprises that have evaluated and plan to adopt cloud have planned to adopt this technology in not more than 5 years.

Regarding the possibility of changing the enterprises' current Information System into cloud, 45 percent of them have already migrated the email system into the cloud. As a result, the email system is the most accepted information system in the cloud. However, 29 percent of enterprises are not willing to migrate human resource system into the cloud. Therefore, the human resource system is the least likely to be migrated to the cloud.

Regarding the level of Software as a service (SAAS), platform as a service (PAAS) and infrastructure as a service (IAAS) adoption, the highest accepted service model is SAAS. Thirty-two percent of the enterprises have already adopted this model. However, the lowest acceptance level for a service model belongs to PAAS. Twenty-seven percent of the enterprises have already adopted this model. Among SAAS, PAAS and IAAS, the highest rejection level belongs to PAAS which accounted for 78 percent. This result shows that the level of the cloud service models adoption is still low. In perspective of using cloud models by enterprises, the highest acceptance level belongs to private cloud (39 percent). Meanwhile, the lowest acceptance level is for community cloud (12 percent). The acceptance level of public and hybrid cloud model is 24 and 32 percent respectively.

4.2 Reliability Statistic

The measure of reliability shows that the questions asked in the study demonstrate an inconstant consistently. In order to conclude the reliability based on internal consistency, Cronbach's alpha is applied⁴¹. The minimum standard of 0.7 is set by Nunnally to pass this test⁴³. The Cronbach's alpha for CP and TPP is 0.64 and 0.67 respectively and very close to 0.7. Moreover, the Cronbach's alpha for TMS, CS, SP and Rel is 0.90, 0.84, 0.91 and 0.88 respectively and higher than 0.7. Consequently, the internal consistency of the measurement of all variables exists. These results show that these variables can be used for this study.

4.2.1 Descriptive Analysis

Among those variables which positively impact on cloud adoption, TMS has the highest average score. Then, it can be concluded that top managements are very interested about adoption of cloud computing in their enterprises. However, TPP acquired the lowest average score. The enterprises are under less pressure from partners in comparison to pressure from competitors. Among those

variables which have a negative impact on cloud adoption, SP has the highest mean. Therefore, in respondents' point of view, the main issue to adopt cloud is security and privacy issues rather than reliability of cloud computing. Among technological, organizational and environmental contexts, organizational context has the highest mean (3.79 of 5). Therefore, the respondents believe that organization structure is the most important context. The average mean for the technological and environmental contexts is 3.65 and 3.35 of 5. Therefore, the technological context of a technology is more important than the environmental context of an enterprise for cloud organizational. Table 1 shows the descriptive analysis.

Table 1. Descriptive analysis

Context (Mean/ Std. Deviation / Rank)	Variables	Rank	Std. Deviation	Mean
<i>Technological</i> (3.65/0.54/2)	Cost saving	2	0.79	3.65
	* Security and privacy	1	0.78	4.00
	*Reliability	2	0.85	3.29
<i>Organizational</i> (3.79/0.83/1)	Top management support	1	0.81	3.79
<i>Environmental</i> (3.35/0.65/3)	Competitive pressure	3	0.66	3.34
	Trading partner pressure	4	0.85	3.32

*These variables have a negative impact on cloud adoption

4.2.2 ANOVA Analysis

The one-way analysis of variance (ANOVA) is applied to investigate whether there are any significant variances among the means of independent variables based on the stage of cloud computing adoption in enterprises. These results indicate significant differences for TMS. For this variable, the major differences are among those enterprises that currently evaluating cloud computing (mean=4.05) and those enterprises that are not considering to adopt cloud computing (mean=2.91). As a result, top managements in the enterprises that currently evaluating cloud computing are more interested to adopt cloud compare to top managements in the enterprises that are not considering to adopt the cloud. The mean differences

are significant at the 0.05 level. Moreover, there are major differences among those enterprises that have already adopted services, infrastructure or platforms of cloud computing (mean=4.38), those enterprises that are not considering to adopt cloud computing (mean=2.91), those enterprises that have evaluated cloud computing, but do not plan to adopt this technology (mean=3.35), and those enterprises that have evaluated cloud computing and plan to adopt this technology (mean=3.47). The mean differences are significant at the 0.05 level. Consequently, top managements in the enterprises that have already adopted services, infrastructure or platforms of cloud computing are much more interested to adopt cloud compare to other top managements except those top managements in enterprises which are currently evaluating cloud.

ANOVA is also applied to the technological, organizational and environmental contexts to find out whether there are any significant variances among the means of contexts based on stage of cloud computing adoption in enterprises. These results indicate significant differences in organizational context. For this context, the major differences are among those enterprises that currently evaluating cloud computing (mean=4.05) and those enterprises that are not considering to adopt cloud computing (mean=2.91). The mean differences are significant at the 0.05 level. Moreover, there are major differences among those enterprises that have already adopted services, infrastructure or platforms of cloud computing (mean=4.38), those enterprises that are not considering to adopt cloud computing (mean=2.91), those enterprises that have evaluated cloud computing, but do not plan to adopt this technology (mean=3.35), and those enterprises that have evaluated cloud computing and plan to adopt this technology (mean=3.47). The mean differences are significant at the 0.05 level. As a result, an enterprise's organizational context is significant on stage of cloud computing adoption inside the enterprise.

5. Conclusion

The level of cloud computing adoption among enterprises is low. As a consequence, the enterprises cannot take advantage of a variety of benefits provided by the cloud such as cost saving, improve flexibility and etc. The findings of this study help IT decision makers and the Malaysian government to find out how to raise the

adoption rate of cloud computing among enterprises in Malaysia. This study adopts the TOE framework to build a cloud adoption model. The outcomes of this study show that enterprises are worried regarding the security and privacy and reliability of the cloud. In order to improve the cloud in perspective of mentioned variables, the Malaysia government and cloud service providers need to collaborate in increasing the quality of services provided by the cloud over the Internet. Another result of current study shows that top management support is a significant variable for adoption of the cloud. Therefore, the Malaysia government needs to establish motivational rules and policies to satisfy top management to support the adoption of the cloud. The major limitation of this study is the sample size of respondents. In order to generalize the findings, we need a much bigger sample size to acquire significant results. Therefore, future studies are needed.

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