

The Determinant Factors Affecting Cloud Computing Adoption by Small and Medium Enterprises (SMEs) in Sabah, Malaysia

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Abstract—Cloud computing offers organisations many benefits such as low entry costs, enhanced flexibility, ubiquitous access, and scalability. Despite its attractiveness and benefits, Small and Medium Enterprises (SMEs) are still hesitant to adopt cloud computing services. This study used the Technology Organisation Environment (TOE) framework to identify the determinant factors affecting the adoption of cloud computing by SMEs in Sabah, Malaysia. Survey questionnaires collected data from 170 SMEs across all sectors within the region. A total of six factors were verified in this research. The results indicated that cost saving, top management support and technology readiness are the main factors affecting the adoption of cloud computing by SMEs in Sabah. However, other three factors; relative advantage, competitive pressure, and external support did not affect the adoption of cloud computing for these organisations. This finding could provide insight and clarity of information for the SMEs' decision and policymakers in various sectors. It also provides understanding on the different influencing factors that affect SMEs' perceptions of the importance of adopting cloud computing.

Index Terms—Cloud Computing Adoption; Small and Medium Enterprises (SMEs); Technology Organization Environment (TOE) Framework.

I. INTRODUCTION

Globally, Small and Medium Enterprises (SMEs) are often referred to as the backbone of the economy because SMEs provide a potential source of economic growth, job creation, innovation and social integration [1]. SMEs in Malaysia are a vital component of the country's economic development and account for 98.5% (907,065) of total business establishments [2]. These SMEs are responsible for 36.3% of the country's Gross Domestic Product (GDP), 65% of the country's employment and almost 18% of Malaysia's exports [3]. The Malaysian government aims to set 41% of the SMEs' contribution to GDP and 23% to export by 2020 [4].

With the rapid growth of SMEs, there are intense competitions and challenges among SMEs. Moreover, with the advancement of Information and Communication Technology (ICT), wider choice and flexibility of products, changing buying patterns as well as more demands of consumers have prompted many organisations to conduct their businesses in highly complex and changing environments [5]. Organizations need to explore efficient ways to reduce costs continuously.

Today, organisations need to be able to make decisions at the right time and spend efficiently and appropriately to succeed and survive. In a competitive marketplace, the competitiveness and survival of any organisation are often attributed to its ability to adopt innovative technology which gives a competitive edge and reduce the costs, improves the quality and the efficiency of its business processes [7]. Therefore, the widely recognised innovative technology which has attracted many organisations for adoption is cloud computing [8]. Apart from enhancing competitive advantage [9], it is also becoming a vital part of the organisations' business tactics. It assists the organisations with its capabilities to increase organisational agility, promptly change the ways of buying, selling and dealing with customers [10].

Many organisations may have already been using some cloud computing services in their day to day business operations without even realising it. For example, the use of Gmail, Google Docs, and Dropbox services, Facebook and so forth [11]. Organizations will enjoy the benefits of cloud computing if they start to implement strategies on how they can access the business efficiently to transform their cloud capabilities [12]. The Chief Minister of Sabah, Datuk Seri Musa Aman, has openly advised those SMEs concerned to have a different attitude when embracing ICT and the need to adopt appropriate technologies to stay competitive and achieve sustainable growth [13].

Despite cloud computing attractiveness and many perceived benefits, many organisations especially SMEs are still hesitant. They prefer to wait and see the trends. In contrast, large organisations are more open to this idea, and the number of cloud computing adoptions is growing gradually [14]. A review of cloud computing studies shows that the adoption rate of cloud computing is slower than anticipated [15]. The findings of [16] stated that 68% of Malaysia SMEs do not adopt cloud computing due to the lack of confidence in cloud services. Therefore, there is a need to identify factors that could affect the adoption of cloud computing amongst SMEs.

There are many published researches on cloud computing adoption and implementation which were conducted in the developed and industrialised countries [9, 12]. However, there is less work on identifying factors affecting the adoption of cloud computing in the context of Sabah's SMEs. Also, there no research framework designed specifically to examine

the adoption of cloud computing by SMEs in Sabah.

Therefore, the primary aim of this research is to examine various factors which affect the cloud computing adoption specifically in the context of Sabah's SMEs. In this paper, Technological, Organisational and Environmental (TOE) framework developed by [17] was chosen as the proposed research framework to examine what factors affect the adoption of cloud computing by SMEs in Sabah. The proposed TOE framework will assist in the understanding of various factors that can affect the perceptions of cloud computing adoption across various sectors of SMEs in Sabah. This study may subsequently lead to well-managed SMEs, which in turn will stimulate or attract more entries and participation into this segment of the economy. The findings of this study will also be used for further empirical research in this field.

II. THEORETICAL BACKGROUND

Many theoretical models have been used to study the adoption of technological innovations among SMEs such as Technology Acceptance Model (TAM), Diffusion of Innovation (DOI) Theory, Theory of Planned Behavior (TPB) and the TOE Framework [18]. However, as noted by [19], many of the previous researches on IT/IS innovations' adoption/diffusion focused on evaluating the aspect of technologies, organisation and environment factors that facilitate or inhibit adoption or diffusion of innovation technology.

Since this research study is conducted to identify the determinant factors affecting the cloud computing adoption by SMEs in Sabah, the TOE framework was used to analyse the organisational-level adoption of technologies [20]. The TOE framework was selected as not only it provides the technological perspective solely, it also investigates other importance of influences of organisational characteristics and environmental factors [21]. Similarly, [22] has pointed out that the decision to adopt IT/IS and inter-organisational systems should not be based solely on the characteristics of the technology itself. It is necessary to consider other related factors such as the internal characteristics of the organisation and the external environment. Thus, the TOE framework is seen ideally more strategic than others.

III. RESEARCH MODEL AND HYPOTHESES

The proposed research model of this study using the TOE framework as shown in Figure 1. The TOE framework was developed by [17] to analyse the adoption of technologies at organisational-level by using three types of contexts namely technological, organisational and environmental. The TOE framework as suggested by [17] is the process in which organisation implementation or adopting technological innovations are affected due to various factors from the inter-related contexts of technologies, organisational and environmental. As such, TOE framework is chosen as the research model in this study because it considers three aspects of contexture: the characteristics of cloud computing (technological context), the SMEs' organisational capabilities (organisational context) and the external environment (environmental context) in which SMEs run its business [23].

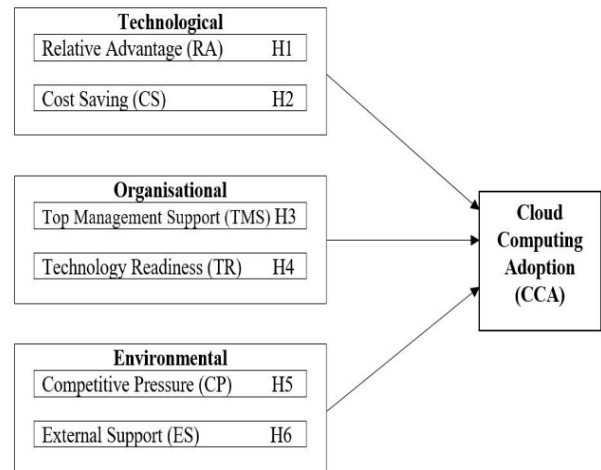


Figure 1: Research model

A. Technological Context

Technological context refers to the internal and external technologies that are relevant to the organisation [17]. Many authors have frequently cited relative advantages or perceived benefits. Both could be one of the leading attractions for the organisations in the adoption of cloud computing [21, 24, 25, 41]. The anticipated relative advantages include flexibility, scalability, reduced costs, creating the competitive advantage and enabling easy and faster access to information [26, 42]. It has been shown that when the organisations perceive the relative advantage of the technology, the likelihood of the adoption will increase [25]. Therefore, the following hypothesis was proposed:

H1: Relative advantage will affect the adoption of cloud computing by SMEs in Sabah.

Another significant benefit of cloud computing for SMEs is cost saving as it notably lowers the startup cost or entry cost. The convenience of almost instantly accessing many on-demand software and hardware resources which are accessible via the Internet with a minimum upfront of capital investment [27]. From the organisation's point of views, they would like to see the advantages of any new adoption of technology to commensurate with the costs related to the adoption of the innovation [28]. [35] did a similar survey on Malaysian SMEs and confirmed that cost saving is one of the crucial factors in the adoption of cloud computing for SMEs. However, [29] found cost saving has a direct and indirect effect on the relative advantage of cloud computing adoption. Therefore, the following hypothesis is proposed:

H2: Cost Saving will affect the adoption of cloud computing by SMEs in Sabah.

B. Organisational Context

The organisational context describes how various factors of an organisation such as technology readiness, the level of top management support, communication processes and the availability of internal slack resources will affect the intention to adopt an innovation [17, 29]. [30] stated that the organisational factors among SMEs play a major role in the adoption decision as it looks at the structure and process of an organisation whether to constrain or facilitate the adoption and implementation of innovations [31].

The top management support is considered a vital organisational factor when considering the adoption of cloud computing [32, 43]. It has been recognised that top management (the decision-makers for the organisation) who understand the potential advantages of cloud services will likely allocate the required resources for the adoption or to expand its use and will support its employees to implement and manage the organisational change [20, 29]. On the other hand, top management that does not understand the advantages of cloud computing for the business will choose against the implementation [29]. Therefore, it is hypothesised as follows:

H3: Top management support will affect the adoption of cloud computing by SMEs in Sabah.

The technology readiness refers to the degree to which technological infrastructure and human resources affect the adoption of new technology [24, 29]. The technological infrastructure, for example, consists of installed hardware, software, network technologies and resources which are required to provide a platform for the operation, management of cloud computing services within an organisation. On the other hand, the human resources refer to the availability of IT/IS knowledge and skills of people in the organisation to implement, operate and manage cloud computing related services [33]. As a result, organisations that have a higher degree of technological infrastructure and relevant personnel resources may be readier for the adoption of cloud computing. Therefore, the following hypothesis is proposed:

H4: Technology readiness may affect the adoption of cloud computing by SMEs in Sabah.

C. Environmental Context

The environmental context concerns the external factors that affect where the organisation conducts its business and is influenced by its surroundings such as industry, competitors, external supports from suppliers/sellers and the presence of technologies service providers [17, 23, 29]. The competitive pressure relates to those levels of pressure encountered by the organisation from their competitors in similar businesses [29]. It has long been recognised as an important determinant of innovation adoption among SMEs [28]. During business operations, due to intense competitions from the same industry and the rapid changes in technologies, organisations frequently face various pressures and will search for new alternatives or attempt to follow their competitors to adopt the new technologies such as cloud-based services to maintain their competitiveness in a dynamic environment [24]. Therefore, this study adopts competitive pressure as an external factor affecting the adoption of cloud computing. Thus, the following hypothesis is formed:

H5: Competitive pressure will affect the adoption of cloud computing by SMEs in Sabah.

External support refers to the availability of external support from IS/IT vendors, consultants or cloud service providers that organisations obtain for implementing and using IT/IS systems [27, 28]. According to [34], the external supports includes pre and post customer service, training and technical assistance offered by cloud service providers which influence the decision of SMEs to adopt cloud technology.

Organisations will be more willing to take risks in trying new IT/IS technologies if they feel that there is sufficient vendor or third-party support [28]. The higher levels of external support provided by the IT/IS vendors or cloud service providers, increases the chance of cloud adoption by SMEs. Hence, in the environmental context, this paper predicts that:

H6: External support will affect the adoption of cloud computing by SMEs in Sabah.

IV. RESEARCH METHODOLOGY

The main purpose of this study is to find out what are the determinant factors and how these factors affect the adoption of cloud computing among Sabah's SMEs. This study uses a quantitative research method based on a survey questionnaire. The questionnaire was adapted from previous relevant literature [20, 27, 29, 32, 35, 36]. It consists of two sections, Section A: general information and usage, where demographic profile items are included, and Section B comprises the main interest of this study where six adoption factors are included. The constructs used in the study were to measure by 5 points Likert-type scales which is from 1 "Strongly Disagree" to 5 "Strongly Agree".

Before collecting any data, survey questionnaire was sent to the academic researcher with IT/IS background for review and subsequently sent for pilot testing by two SMEs business advisors, and eight SMEs Managers who are also familiar with IT/IS to assess or validate the questionnaire's contents, appropriate wording, length of the questionnaire and question format. However, these SMEs' organisations were not involved in the current survey. The feedback obtained from this process gave evidence that the questionnaire was understandable, and the scales used were reliable.

The study population comprises of SMEs' owners, managers of both IT and Non-IT, administrative staff and others. The owners and managers are considered important respondents in this study as they hold key positions in the organisation who are familiar with their own organisation's requirements, available IT resources and technological environment. In the absence of owners and managers, those respondents such as administrative staff who are aware of their organisation's IT operations and overall business activities were asked to participate in this survey.

A total of 300 survey questionnaires were distributed to various SMEs in various locations in Sabah. All the respondents were informed about the purpose of the study. Their participation was entirely voluntary, and all the information provided by them are strictly confidential and will be used solely for this study. Out of the 300 questionnaires, only 180 were returned. After the data filtering was done, only 170 valid responses fulfilled the research focus; ten responses were excluded due to excessive missing values. Therefore, the final analysis of this study involved 170 responses which are equivalent to a usable response rate of 57%.

According to [37], the sample size that is larger than 30 and below 500 is appropriate for most of the researches, so the sample size of 170 is acceptable for this study. From the responses received, 78.23% and 16.47% are from services and other sectors and the remaining 5.3% are from manufacturing sectors. Majority of the SMEs being surveyed have less than 30 full-time employees (52.35%) which falls into the micro or small size category. 47.06% are SMEs'

owners, 20% and 20.59% are Managers of IT and Non-IT and 12.35% others have responded in this study. In addition, 85.29% of the SMEs have indicated that they were already using cloud computing.

V. SURVEY INSTRUMENT AND ANALYSIS

The use of Constructs and Indicators have been obtained from past verified sources and reliability have been demonstrated. Also, where appropriate some modifications have been done to suit the purpose of this research: Relative Advantage [29], Cost Saving [27, 29, 35]. Top Management Support [29], Technology Readiness [29], Competitive Pressure [29] and External Support [20, 36]. The statistical methodology used to measure this research model is the Partial Least Squares-Structure Equation Modeling (PLS-SEM) or PLS path analysis using SmartPLS version 3.2.7 software [38]. The PLS-SEM is a popular statistical technique used to conduct data analysis with a graphical user interface which simultaneously examines and estimates the causal relationships between various independent variables and dependent variables. Therefore, the two stages of analysis were conducted. The first step is to assess the quality and reliability of the measures in this research study by using the measurement model (also known as an outer model). In the second step, the hypotheses were tested using the structural model (also known as an inner model) [39, 48].

VI. FINDING AND DISCUSSION

A. The Measurement Model (Outer Model)

The outer model measures the various inter-relationships of constructs and related measures. The testing of the outer model involves factor loadings, discriminant validity as well as convergent validity. Based on the results shown in Table 1, factor loadings for all items are above the recommended value of 0.7 as suggested by [39]. Also, the composite reliability (CR) values that describe the internal consistency of the items are ranged from 0.861 to 0.915, which exceeded the recommended value of 0.7 or above as recommended by [39]. Moreover, the average variance extracted (AVE) which is a method used to estimate the convergent validity as shown in Table 1 ranged from 0.566 to 0.787 exceeded the recommended value of 0.5 as recommended by [39]. Thus, this suggests that all measures in this model can be considered reliable and sufficiently meet the validity.

B. Discriminant Validity

After the convergent validity is calculated, the discriminant validity was investigated to ensure the constructs are distinct by examining the square root of AVEs of all constructs that are larger than the off-diagonal elements in the corresponding rows and columns, thereby suggesting that the required discriminant validity has been achieved [40]. As shown in Table 2, the square root of AVEs is larger than the off-diagonal elements in the corresponding rows and columns. Thus, the required discriminant validity in [40] has been achieved. In total, the measurement model demonstrated the adequate convergent validity and discriminant validity.

Table 1
Result of the Measurement Model

Constructs	Indicators	Loadings	CR	AVE
Relative Advantage (RA)	RA4	0.908	0.881	0.787
	RA5	0.866		
	CS1	0.712		
	CS2	0.729		
Cost Saving (CS)	CS4	0.787	0.867	0.566
	CS5	0.779		
	CS6	0.752		
	TMS1	0.900		
Top Management Support (TMS)	TMS2	0.884	0.915	0.782
	TMS3	0.868		
	TR1	0.873		
Technology Readiness (TR)	TR2	0.858	0.878	0.706
	TR3	0.786		
	CP1	0.838		
Competitive Pressure (CP)	CP2	0.888	0.866	0.683
	CP3	0.748		
	ES1	0.935		
External Support (ES)	ES2	0.800	0.861	0.758

Table 2
Discriminant Validity

		1	2	3	4	5	6
1	CP	0.827					
2	CS	0.412	0.752				
3	ES	0.386	0.249	0.87			
4	RA	0.29	0.336	0.275	0.887		
5	TR	0.334	0.574	0.168	0.312	0.84	
6	TMS	0.528	0.295	0.3	0.176	0.291	0.884

C. The Structural Model (Inner Model)

The inner model provides the relationship of various constructs. The inner model involves testing of hypotheses and path coefficients (β). After that, the bootstrapping procedure with resamples of 500 was examined for the path coefficients (β) and hypotheses testing [39].

Table 3
Hypotheses Testing

Hypothesis	Relationship	β	SE	t-value	p-value	Result
H1	RA \rightarrow CCA	0.006	0.075	0.083	0.934	NS
H2	CS \rightarrow CCA	0.244	0.094	2.594	0.01	S
H3	TMS \rightarrow CCA	(0.231)	0.112	2.068	0.039	S
H4	TR \rightarrow CCA	0.176	0.119	1.471	0.142	S
H5	CP \rightarrow CCA	0.012	0.107	0.109	0.913	NS
H6	ES \rightarrow CCA	(0.001)	0.092	0.012	0.99	NS

Note: S = Supported, NS= Not Supported

The structural model results are summarised in Table 3. From the six hypotheses, three are supported: H2: Cost Saving, H3: Top Management Support and H4: Technology Readiness. On the other hand, H1: Relative Advantage, H5: Competitive Pressure and, H6: External Support is not supported.

The study provides empirical evidence that cost-saving has significantly affect cloud computing adoption among SMEs ($\beta = 0.244$, $p = 0.01$). Thus H2 is supported. This shows that the sampled SMEs are aware that cloud computing offers recognisable benefits such as reduced operating cost, energy costs, environmental costs as well as lower maintenance costs. This finding is consistent with prior studies (see, for example, [35, 44]).

Also, the study provides another empirical evidence that support from top management significantly affects the cloud computing adoption among Sabah's SMEs ($\beta = -0.231$, $p = 0.039$). Thus, H3 is supported. The current results indicate that in organisations such as SMEs, the top management

usually is the owners or managers and if they are not convinced or understand the cloud technology it is unlikely that they will adopt it. On the other hand, if the top management understands the potential advantages of cloud computing, they will likely allocate the required financial and organisational resources for the adoption or to expand its use and will support their employees to implement and manage the organisational change. The finding is consistent with results from earlier studies, such as [28, 29]. Lately, there are studies which indicated that top management support is no longer a driving factor in the adoption of cloud computing because of the agility of IT/IS resources, cheap and affordable. Thus, many of the SMEs have started to adopt cloud services by using public storage such as Dropbox services, Google Drive, Gmail and others [26, 41].

The technology readiness in this study is a significant driver for cloud computing adoption by SMEs in Sabah ($\beta = 0.176$, $p = 0.142$), and thus H4 is supported. This finding indicates that SMEs with ready or established IT/IS infrastructure and staff force with the necessary skills, and technical competence is more likely to adopt the cloud technology. The finding is consistent with prior studies [29, 35, 41]. However, some studies on technology readiness were found to not necessarily influencing cloud computing adoption. For example, [24] had found out that the technology readiness did not apply to those organisations in the technological sector.

However, the relative advantage was not significant in the adoption of cloud computing for SMEs in Sabah ($\beta = 0.006$, $p = 0.934$). Thus, H1 is not supported. This result is not consistent with a few past studies, for example [21, 29] which identified that relative advantage has a positive influence on cloud computing adoption. Even though there are many advantages of cloud computing, the cloud technology may not have been considered if the SMEs do not see there is any need or any advantage of the cloud technology [28]. Some SMEs in Sabah who took part in this survey were aware of the technology but did not find any need for these technologies in their businesses. Nevertheless, this study's finding is consistent with [26, 41].

Competitive pressure has not affected the adoption of cloud computing ($\beta = 0.012$, $p = 0.913$). Thus, H5 is not supported. This result may suggest that competitive pressure from competitors, trading partners and suppliers will not necessarily lead to the greater intention of SMEs to adopt cloud computing. This may imply that SMEs are aware of the advantages of cloud computing but do not perceive that cloud computing would provide any competitive advantage for them. However, the finding is consistent with previous cloud computing research done in this area [29, 45, 46].

Although prior studies on external or vendor support have affected the cloud computing adoption for small businesses [34, 36], the current study's finding did not provide support for the claim ($\beta = -0.001$, $p = 0.99$). Thus, H6 is not supported. It may be that the sampled SMEs felt that the local external IS/IT support vendors are not able to meet the specific needs or provide the desired services of SMEs. As noted by [47], a good working relationship between external IS/IT vendors and SMEs is the key to advancing the booming of e-economy in the country. Therefore, the finding of this study may suggest that the levels of available local external IS/IT support vendors in Sabah's SMEs may not be sufficient to affect the adoption of cloud computing. Despite this, the study is consistent with other studies from [28, 46].

VII. CONCLUSION, CONTRIBUTION, LIMITATIONS AND FURTHER RESEARCH

The popularity of cloud computing has prompted many organisations such as SMEs to adopt cloud computing to keep themselves in a competitive advantage. It is undeniable that SMEs will gain many advantages if they adopt cloud technology into their business. Thus, what are the significant factors influencing the adoption of new technology or service solutions, especially in cloud computing adoption? It is always an endless debatable hot topic among academic, companies and organisations. Hence, this study builds upon prior research studies but is different in importance in a way that it analyses factors that may affect the adoption of cloud computing in the context of SMEs in Sabah.

The current research findings are expected to provide insight and clarity of information for the SMEs decision and policymakers in various sectors to understand the different influential factors which affect the SMEs perceptions on the importance of adopting cloud computing. The findings of this study can be used as a reference for government agencies, for example, SME Corporation Malaysia, National IT Agenda (NITA) and Malaysia Digital Economy Corporation in encouraging the more usage of cloud computing services within SMEs as well as to decide on appropriate policies, legislative measures and economic incentives. Furthermore, it may be used by academia as a model/framework to undertake further research for the adoption of cloud technology in Sabah's. Also, the software developers and vendors may use it as a guideline to improve their products and services for the adoption of cloud computing.

Nonetheless, the study is not without limitations. As this study focuses on the adoption of cloud computing by SMEs in Sabah, which implies that the study reflects only the situation in the context of Sabah and not the whole of Malaysia. Hence, it is difficult to generalise the results for other regions in Malaysia. For a comparative perspective, it would be more practical and helpful to look at the issues across the whole of Malaysia. On the other hand, as a future direction, this research can be extended to include other regions of Malaysia with more influential factors.

This study uses a quantitative research method; in the future, the qualitative method can be considered such as conducting interviews to receive detailed information and precise explanations from SMEs on the factors affecting the adoption of cloud computing. As cloud computing becomes mature, other factors such as compatibility, complexity, firm size and regulatory support may need to be investigated in the near future.

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