

**FACTORS AFFECTING THE ADOPTION OF CLOUD  
COMPUTING BY SMES IN SABAH**



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**UMS**  
UNIVERSITI MALAYSIA SABAH

**FACULTY OF COMPUTING AND INFORMATICS  
UNIVERSITI MALAYSIA SABAH  
2019**

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**UMS**

**THESIS SUBMITTED IN FULFILLMENT FOR THE  
DEGREE OF MASTER OF SCIENCE**

**FACULTY OF COMPUTING AND INFORMATICS  
UNIVERSITI MALAYSIA SABAH  
2019**

**UNIVERSITI MALAYSIA SABAH**

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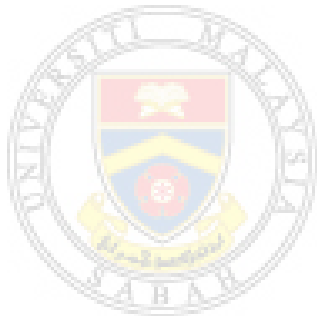
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## DECLARATION

I hereby declare that the material in this thesis is my own work except for certain quotations, equations, summaries, definitions, and references, which have been duly acknowledged.

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## CERTIFICATION

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Chin Fook Ming  
21 January 2019

## ABSTRACT

Cloud computing offers organisations many benefits such as cost saving with pay-as-you-go structure, enhanced flexibility of work practices, ubiquitous access of shared resources and applications, as well as scalability in terms of operational resources and storage needs. Despite the benefits, Small and Medium Enterprises (SMEs) are still hesitated towards the adoption of cloud computing services as compared to large organisations. Moreover, recent cloud computing studies show that the adoption rate of cloud computing is slower than anticipated. Hence, it is important to determine and understand the adoption of cloud computing services in SMEs as compared to large organisations. Nonetheless, there are only limited literature, works and research frameworks that were designed to examine the factors affecting the adoption of cloud computing by SMEs in the context of Sabah. Therefore, this study attempts to bridge the gap by studying various factors affecting the adoption of cloud computing by SMEs in Sabah. As the Technology Organisation Environment (TOE) framework is a matured framework to study IT adoption within the organisation, it is chosen as the research model to conduct this research. In this research, data were collected via survey questionnaires from 500 SMEs across all sectors within Sabah. There was a total of twelve factors have been verified in this research, and the results indicated that compatibility, cost saving, top management support, technology readiness and regulatory support were factors affecting the adoption of cloud computing by SMEs in Sabah. However, other factors, such as relative advantage, complexity, security and privacy, firm size, competitive pressure, trading partner pressure and external support have not affected the adoption. Therefore, the current research findings have provided another insight and clarity information for the SMEs' decision and policymakers in various sectors for the better understanding of the various influential factors which affect the SMEs perceptions on the importance of adopting cloud computing. Besides, in order to promote the adoption of cloud computing among SMEs in Sabah, cloud service providers have to provide reliable services and secure environments in the most cost-effective, scalable and accessible manner to the customers. For example, 24/7 technical support for cloud services can be provided to gain confidence from the customers, thus help to increase the adoption of cloud computing among SMEs in Sabah. Lastly, the government agencies may use it as a roadmap to promote the use of cloud computing among SMEs as well as to decide on appropriate policies, legislative measure and economic incentives.

## **ABSTRAK**

### **FAKTOR-FAKTOR MEMPENGARUHI PENGAMALAN PENGKOMPUTERAN AWAN BAGI PERUSAHAAN KECIL SEDERHANA DI SABAH**

*Pengkomputeran awan menawarkan banyak manfaat seperti penjimatan kos dengan struktur pay-as-you-go, fleksibiliti kelebihan amalan kerja, pengaksesan sumber dan aplikasi di mana-mana yang dikongsi bersama, dan juga skalabiliti dari segi kapasiti storan dan keperluan operasi. Walaubagaimanapun, Perusahaan Kecil dan Sederhana (PKS) masih teragak-agak untuk menggunakan perkhidmatan pengkomputeran awan berbanding dengan organisasi besar. Selain itu, kajian pengkomputeran awan baru-baru ini menunjukkan bahawa kadar pengambilan awan lebih lambat daripada jangkaan. Oleh itu, adalah penting untuk menentukan dan memahami penggunaan perkhidmatan pengkomputeran awan dalam PKS berbanding dengan organisasi besar. Walau bagaimanapun, hanya terdapat kerangka kerja sastera, kerja dan penyelidikan terhad yang direka untuk mengkaji faktor-faktor yang mempengaruhi penerimaan pengkomputeran awan oleh PKS dalam konteks Sabah. Oleh itu, kajian ini cuba merapatkan jurang dengan mengkaji pelbagai faktor yang mempengaruhi pengambilan pengkomputeran awan oleh PKS di Sabah. Oleh kerana rangka kerja Organisasi Teknologi Alam Sekitar (TOE) adalah rangka kerja yang matang untuk mengkaji penggunaan IT dalam organisasi, ia dipilih sebagai model penyelidikan untuk menjalankan penyelidikan ini. Dalam kajian ini, data dikumpulkan melalui soal selidik tinjauan daripada 500 PKS di semua sektor di Sabah. Terdapat sejumlah dua belas faktor yang telah disahkan dalam kajian ini, dan hasilnya menunjukkan bahawa keserasian, penjimatan kos, sokongan pengurusan atas, kesediaan teknologi dan sokongan kawal selia adalah faktor yang mempengaruhi pengambilan pengkomputeran awan oleh PKS di Sabah. Walau bagaimanapun, faktor lain, seperti kelebihan relatif, kerumitan, keselamatan dan privasi, saiz firma, tekanan persaingan, tekanan rakan perdagangan dan sokongan luaran tidak menjejaskan penggunaan. Oleh itu, penemuan penyelidikan semasa telah memberikan satu lagi maklumat wawasan dan kejelasan untuk keputusan dan pembuat dasar PKS di pelbagai sektor untuk pemahaman yang lebih baik mengenai pelbagai faktor berpengaruh yang mempengaruhi persepsi PKS mengenai kepentingan penggunaan pengkomputeran awan. Di samping itu, untuk menggalakkan penggunaan pengkomputeran awan di kalangan PKS di Sabah, penyedia perkhidmatan awan perlu menyediakan perkhidmatan yang boleh dipercayai dan persekitaran yang selamat dengan cara yang paling kos efektif, berskala, dan boleh diakses kepada pelanggan. Sebagai contoh, 24/7 sokongan teknikal untuk perkhidmatan awan boleh disediakan untuk mendapatkan keyakinan daripada para pelanggan, oleh itu membantu meningkatkan penerimaan pengkomputeran awan antara PKS di Sabah. Akhir sekali, agensi-agensi kerajaan boleh menggunakannya sebagai pelan tindakan untuk mempromosikan penggunaan pengkomputeran awan di kalangan PKS serta membuat keputusan mengenai dasar, langkah perundangan dan insentif ekonomi yang sesuai.*

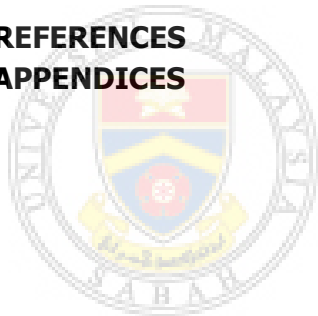


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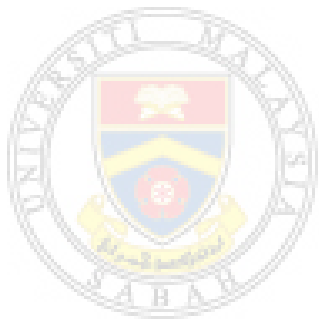
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## LIST OF ABBREVIATIONS

<b>AWS</b>	-	Amazon Web Services
<b>COMP</b>	-	Compatibility
<b>CP</b>	-	Competitive Pressure
<b>CPLX</b>	-	Complexity
<b>CRM</b>	-	Customer Relationship Management
<b>CS</b>	-	Cost Saving
<b>DOI</b>	-	Diffusion of Innovation
<b>EDI</b>	-	Electronic Data Interchange
<b>EPF</b>	-	Employees Provident Fund
<b>ERP</b>	-	Enterprise Resource Planning
<b>ES</b>	-	External Support
<b>FS</b>	-	Firm Size
<b>GDP</b>	-	Gross Domestic Product
<b>GST</b>	-	Goods and Services Tax
<b>IaaS</b>	-	Infrastructure as a Service
<b>ICT</b>	-	Information and Communication Technology
<b>ICT</b>	-	Information and Communication Technology
<b>IDE</b>	-	Integrated Development Environment
<b>IEBT</b>	-	Internet/E-Business Technology
<b>IoT</b>	-	Internet of Things
<b>IS</b>	-	Information Systems
<b>IT</b>	-	Information Technology
<b>MDEC</b>	-	Malaysia Digital Economy Corporation
<b>MDeC</b>	-	Multimedia Development Corporation
<b>MSC</b>	-	Multimedia Super Corridor
<b>NIST</b>	-	National Institute of Standards and Technology

<b>NITA</b>	-	National IT Agenda
<b>PaaS</b>	-	Platform as a Service
<b>PLS-SEM</b>	-	Partial Least Square – Structural Equation Modelling
<b>RA</b>	-	Relative Advantage
<b>RS</b>	-	Regulatory Support
<b>SaaS</b>	-	Software as a Service
<b>SAP</b>	-	Security and Privacy
<b>SLA</b>	-	Service Level Agreement
<b>SME Corp</b>	-	SME Corporation Malaysia
<b>SMEs</b>	-	Small and Medium Enterprises
<b>SMIDEC</b>	-	Small and Medium Industries Development Corporation
<b>SST</b>	-	Sales and Service Tax
<b>TAM</b>	-	Technology Acceptance Model
<b>TMS</b>	-	Top Management Support
<b>TOE</b>	-	Technology Organisation Environment
<b>TPP</b>	-	Trading Partner Pressure
<b>TR</b>	-	Technology Readiness
<b>UKM</b>	-	Universiti Kebangsaan Malaysia
<b>UMS</b>	-	Universiti Malaysia Sabah



## LIST OF SYMBOLS

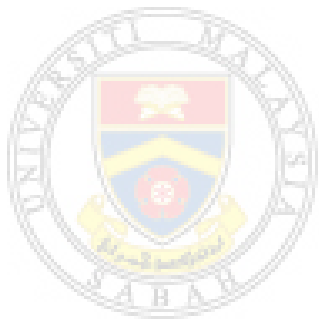
$\beta$	-	The probability of Type II error in any hypothesis test.
$\alpha$	-	The probability of Type I error in any hypothesis test.
$f^2$	-	Effect size.
$P$	-	P-value, the probability of getting a result equal to or more extreme than actually observed, when the null hypothesis is true.
$SE$	-	Standard error.



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# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction

The emergence of cloud computing has assisted the living of modern society due to its ubiquitous property. For examples, students may use Google Docs to do group assignments, outstation workers may access the web services hosted by the company, and the industrial sectors such as Small and Medium Enterprises (SMEs) may use cloud storage to backup company data. As for SMEs, cloud computing is crucial because the cost of using cloud computing services is way lower than hosting a server (Zhang, Cheng, & Boutaba, 2010). SMEs can save cost with the pay-as-you-go structure by using cloud computing (Zhang et al. 2010). SMEs can benefit from cloud computing with the enhanced flexibility of work practices as well, especially when the workers are outstation (Zhang et al. 2010). Moreover, the scalability of cloud computing in term of operational resources and storage needs is vital for SMEs as SMEs may scale up in the future which ends up require more resources and storage (Zhang et al. 2010). Without cloud computing, the cost of upscaling SMEs will be very expensive as SMEs may need to reconstruct the operational structure of the company in term of resources and storage, where SMEs may need to spend more on purchasing new servers, additional IT staffs, and increased cost for server's maintenance. Instead, by adopting cloud computing, SMEs can save money for other capital investments (Alkhater, Walters, & Wills, 2014; Gide & Sandu, 2015). Hence, cloud computing is an important element to support the operation and growth of an SME.

Globally, SMEs are often being referred to as the backbone of the economy because the SMEs are providing a potential source of economic growth, job creation, innovation and social integration (Airaksinen, Luomaranta, Roodhuijzen, & Alajääskö,

2016). In fact, the SMEs in Malaysia plays a vital role in the country's economic development and account for 98.5% of total business establishments, or 907,065 are SMEs (Economic Census, 2016). These SMEs are responsible for 37.1% of the country's Gross Domestic Product (GDP), remarkable 66% of the country's employment and almost 18% of Malaysia's exports (Economic Census, 2016; The World Bank, 2016). The Malaysian government aims to set 41% for the SMEs contribution to GDP and exports from SMEs to 23% by 2020 (The Star, 2015).

On the other hand, the advancement of Information and Communication Technology (ICT) has widened the choice and flexibility of products and changed the buying patterns (Habjan & Popovic, 2007). As the demands of consumers nowadays are higher and variable, organisations faced challenges by having to conduct the businesses in highly complex and changing environments (Habjan & Popovic, 2007). Hence, organisations need to explore continuously for ways to reduce costs and operate more efficiently. The need to make decisions in a timely, efficiently and appropriate manner is considered today as essential not only to succeed but even to survive (Lönngqvist & Pirttimäki, 2006) in this competitive marketplace. The competitiveness and survival of organisation are often attributed to its ability to adopt innovative technology which will give a competitive edge and reduce the costs, quality improvement and improve the efficiency of its business processes (Trigueros-Preciado, Pérez-González, & Solana-González, 2013). Therefore, the widely recognised innovative technology which has attracted many organisations for adoption is cloud computing (O. Ali, Soar, Yong, & McClymont, 2017; Behrend, T. S., Wiebe, E. N., London, J. E., & Johnson, 2010) as it is not only enhancing competitive advantage (Nie, 2007; Truong, 2010) but it is also becoming a more vital part of organisations' business tactics because it assists the organisations with the capability to increase organisational agility, promptly change the approaches that organisations are buying, selling and dealing with customers (Pyke, 2009). In fact, many organisations probably already using some cloud computing services in their day to day business operations but without even realising it. For example, the use of Gmail, Google Docs, Dropbox services, Facebook, and so forth (Nair, 2012). Organisations will enjoy the benefits of cloud computing if they start to implement strategies on

how they can access the business and technical factors to transform their cloud capabilities (Mahmood, 2014). Frankly, by adopting cloud computing, organisations will benefit from competitive advantages, clearer market visibility, improved operational efficiency, etc. (Low, Chen, & Wu, 2011; Misra & Mondal, 2011; Oliveira, Thomas, & Espadanal, 2014).

Sabah, the second largest state in Malaysia, based on the Economic Census, 2016, there were around 55702 business establishments in various sectors are SMEs. Since then till today 2018, as the number of SMEs keep increasing, there will be increased business competitions and challenges of fulfilling the variable demands of consumers. Thus, the former Chief Minister of Sabah, Datuk Seri Musa Aman, has openly called upon those SMEs in Sabah it is time to adopt appropriate technologies and to have a different mindsets to embrace the ICT to improve competitiveness and prosper for their businesses as many of today's customers preferred to buy online instead of the traditional buying and selling (The Sunday Daily, 2017).

One typical example was a conventional seaweed farmer: Kabilah Hassan in Kunak, Sabah, although had been in the business for generations, however, she could only sell her seaweed through word-of-mouth, earning a merely RM450 or less per month. With limited market exposure and unstable income hence, putting food on the table was a constant worry for Kabilah (Digital News Asia, 2013). By making a change not only transformed the small, struggling seaweed business into a dynamic e-commerce enterprise but also improve her life as a whole, as her monthly income has been tremendously increased from RM450 to as much as RM20,000 after going online (Bernama, 2013; Nusuara, 2012).

The Employees Provident Fund (EPF), a retirement savings fund organisation has mandatory required all Malaysian employers regardless of their business sizes from 1 January 2017 must use the EPF's e-Caruman facility when remitting their monthly EPF contributions and its current Form A manual system method of payment

will be scrapped (Bahari, 2016). Consequently, the SMEs will need to use the cloud-based online payment system for EPF contributions, if not, be prepared to pay the massive fine to EPF or imprisonment term or to cease their businesses since they are not able to comply with the rules and regulations as required by the government.

## **1.2 Research Problem**

Despite cloud computing attractiveness and many perceived benefits, many organisations, in particular, the SMEs are still hesitated or wait and see attitude regarding the adoption of cloud computing services as compared to large organisations which are glowing gradually (Hashizume, Rosado, Fernández-Medina, & Fernandez, 2013; Kwang, 2011). A review of cloud computing studies shows that the adoption rate of cloud computing is slower than anticipated (Raza, Adenola, Nafarieh, & Robertson, 2015). The findings of Asohan (2012) stated that 68% of Malaysian SMEs that do not adopt cloud computing are due to lack of confidence in cloud services. According to Galligan & Mansor (2011), the SMEs have not been given much attention to investing in the IT infrastructure and caused lack of confidence and shortage of internal specialised computer expertise in understanding the cloud computing, and hence they are not willing to embrace a new system (Kwang, 2011). Also, there is insufficient information or knowledge for understanding, predicting and explaining the organisational behaviours of SMEs in cloud computing adoption (Colt Technology, 2009; Zhu, Dong, Xu, & Kraemer, 2006). Hence, there is a need to identify factors that could affect the adoption of cloud computing amongst SMEs.

There are lots of literature about cloud computing adoption and implementation in the developed and industrialised countries. To name a few examples, research done by Alshamaila et al. (2013) has indicated relative advantage, innovativeness and external computing support were the factors affecting the SMEs in North East of England to adopt cloud computing. Al-Isma'ili et al. (2016) revealed that technological factors (compatibility and cost savings), organisational factors (top management support and firm size) and environmental factors (market scope and

external computing support) were found to be determinant factors influencing the cloud computing adoption by SMEs in Australia. Also, Gutierrez et al. (2015) conducted the cloud services research in the UK by using the TOE framework; the results showed that factors such as complexity, technology readiness, competitive pressure and trading partner pressure have a significant influence on the managers' decision to adopt cloud services. However, there are only limited works and literature that focus on the factors affecting the adoption of cloud computing in the context of Sabah's SMEs.

Besides, the research framework specifically designed to examine the adoption of cloud computing by SMEs in Sabah is very limited. For the effective, smooth and successful adoption or migration, a lot more facts need to be established, including scientific evidence on cloud computing issues related to the Sabah's SMEs environment. Therefore, this study attempts to bridge the gap by studying various factors affecting the adoption of cloud computing by SMEs in Sabah.

### **1.3 Research Questions**

In this study, the Sabah's SMEs have been selected to examine what are the factors affecting the cloud computing adoption by SMEs in Sabah and the major questions to be addressed are:

1. What are the factors that influence the adoption of cloud computing by SMEs in Sabah?
2. How to increase the adoption of cloud computing among SMEs in Sabah?

## **1.4 Research Objectives**

1. To identify, analyse and determine the factors that influence the adoption of cloud computing for SMEs in Sabah.
2. To propose the model of cloud computing adoption for SMEs in Sabah.

## **1.5 Research Motivations and Contributions**

This study aims to contribute to a growing body of research on cloud computing by studying various factors which affect the adoption of cloud computing by SMEs in Sabah, in particular, to have an in-depth understanding and broaden the knowledge for both the SMEs practitioners and academic researchers in the following areas:

1. As there are not many publications with empirical evidence that have been published on the factors affecting the adoption of cloud computing especially in the context of Sabah's SMEs though there are lots of publications about cloud computing adoption and implementation in the developed and industrialised countries. Therefore, this study hopes to add to existing knowledge by examining or identifying the factors affecting cloud computing adoption by SMEs in Sabah. It is hoped to contribute to have a better understanding of the factors that affect the perceptions, decisions as well as the right selections on the adoption of cloud computing among SMEs in Sabah, and may be of use not solely in the context of Sabah. But, also add to the knowledge base for further applications in other neighbouring countries.
2. There is limited research framework which is based on Technology-Organisation-Environment (TOE) framework to study the cloud computing adoption by SMEs in Sabah. Hence, this study will use the TOE framework as a research model to study what are the factors affecting the adoption of cloud computing in the context of Sabah's SMEs. As the TOE not only provides the technological perspective