DETERMINING FACTORS FOR THE ADOPTION OF CLOUD COMPUTING AMONG SMALL AND MEDIUM-SIZED ENTERPRISES DURING THE COVID-19 PANDEMIC

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DECEMBER 2021

ABSTRACT

DETERMINING FACTORS FOR THE ADOPTION OF CLOUD COMPUTING AMONG SMALL AND MEDIUM-SIZED ENTERPRISES DURING THE COVID-19 PANDEMIC

Tan Keng Yeng

Cloud computing services (CCS), the vital technologies which provide on demand usage for networking access, security permission, data storage thru cloud and application platform to run the business processing for users. Adoption of CC provide various of benefits such as flexibility, cost reduction, upgrading of software and hardware and agility. TOE framework used in the research to analyse the factors influence the adoption based on technological (T), organisational (O) and environmental (E) contexts. The objectives of this research are: i) to investigate the factors for the adoption of CC during the COVID-19 pandemic; ii) to investigate the effects of the adoption of CC on project performance during the COVID-19 pandemic. After analysing the collected data, the top five ranking factors of the cloud adoption are compatibility; perceived usefulness; relative advantage; technological capability; and perceived ease of use. It did find that there are three critical principal factors which affect the adoption of CC are: i) Environmental Conduciveness; ii) Technological Advantages; and iii) Organisational Capabilities. In conclusion, the principal components of the factor analysis will positively impact the decision of cloud adoption and the effects of using CC in project will improve the performance of project.

APPROVAL SHEET

This dissertation/thesis entitled "**DETERMINING FACTORS FOR THE ADOPTION OF CLOUD COMPUTING AMONG SMALL AND MEDIUM-SIZED ENTERPRISES DURING THE COVID-19 PANDEMIC**" was prepared by TAN KENG YENG and submitted as partial fulfilment of the requirements for the degree of Master of Project Management at Universiti Tunku Abdul Rahman.

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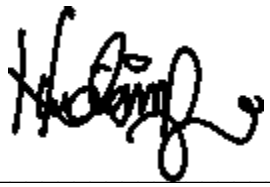

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Date: 15th December 2021

SUBMISSION OF THESIS / DISSERTATION *

It is hereby certified that TAN KENG YENG (ID No: 19UEM00677) has completed this thesis/dissertation* entitled "DETERMINING FACTORS FOR THE ADOPTION OF CLOUD COMPUTING AMONG SMALL AND MEDIUM-SIZED ENTERPRISES DURING THE COVID-19 PANDEMIC" under the supervision of Asst. Prof. Ts Dr. Toh Tien Choon from the Department of Surveying , Lee Kong Chian Faculty of Engineering and Science, and Co-Supervisor Sr Nurdiana Binti Azmi from the Department of Surveying, Lee Kong Chian Faculty of Engineering and Science.

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I, TAN KENG YENG hereby declare that the thesis/dissertation is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UTAR or other institutions.

TAN KENG YENG

Date: 15th December 2021

DETERMINING FACTORS FOR THE ADOPTION OF CLOUD COMPUTING AMONG SMALL AND MEDIUM-SIZED ENTERPRISES DURING THE COVID-19 PANDEMIC

BY

TAN KENG YENG

A research project submitted to
Lee Kong Chian Faculty of Engineering and Science,
Universiti Tunku Abdul Rahman,
in partial fulfilment of the requirement for the award of
Master of Project Management
December 2021

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LIST OF ABBREVIATIONS

CC	Cloud Computing
CCS	Cloud Computing Service
DOI	Diffusion of innovation
DOSM	Department of Statistics, Malaysia
IaaS	Infrastructure as a Service
IOT	Internet of things
KMO	Kaiser-Meyer-Olkin
MCO	Movement Control Order
MSBR	Malaysia Statistical business Register
MSIC	Malaysian Standard Industrial Classification
NIST	The National Institute of Standards and Technology
PaaS	Platform as a Service
PCA	Principal component analysis
SaaS	Software as a Service
SME	Small and Medium Sized Enterprises
SPSS	Statistical Package for Social Science
SSM	Suruhanjaya Syarikat Malaysia
TOE	Technology-organisation-environment
VRIN	Valuable, rare, inimitable and no substitutable
XML	Extensible Mark-up Language

CHAPTER 1 - INTRODUCTION

1.1 Introduction

In today's era, information technology (IT) playing a vital role in all the industry and becoming an indispensable platform for the Small and Medium-Sized Enterprises' (SME) daily routine. SMEs have been playing significant role in the Malaysian economy, but the adoption of CCS are growing slower than the larger enterprises. During the COVID-19 pandemic, Malaysia had implemented the movement control order (MCO) to restraint the public to increase outbreak of COVID-19 thus the SMEs must implement employees to work from home during this period. This makes the users difficult to access the archived data or the network systems. With the huge daily data and files generated, it carried difficulty to the SMEs for archiving.

Nowadays, cloud computing services (CCS) as the vital technologies to provide services such as networking access, security permission, data storage thru cloud and application platform to run the business processing for the users based on the demand (Katzan, Jr, 2010). With CCS application, it help to improve the competitiveness of businesses, potential to reduce the cost of internet of things (IoT), improvement of business operations, and optimize time to market (Abolfazli et al., 2015).

The organisation doesn't have to fund the upfront costs of hardware and software, networking and the infrastructural elements and provide training and maintenance staff for the network server with the CCS application. They could utilize the resources such as electricity services and pay on demand for the

cloud service used. Furthermore, CCS provided support, training, reduce the downtime and take care of the peak period of the system whereas most of the organisations would prefer not to get involved.

Main objectives of this research are to investigate the factors for the adoption of CCS among SMEs and with the understanding of the factors, it helps to improve the adoption rate of CCS and indirectly help the Malaysia's economic growth.

1.2 Research Background

As per the statistical data from MSBR, SMEs were the main key player in the Malaysia economies and contributed 97.2% of the total business in 2020. In the normal practices, the daily routine operation process of the SMEs will be conducted via computer in the physical offices. During the COVID-19 pandemic, the cloud technology was become crucial for business continuity due to the global lockdown order in Malaysia. According to Pathma (2021), there are 44% of SMEs are using cloud computing (CC) for their daily process, thus it means that there are 56% of SMEs still haven't adopt the CCS as their services process.

The main reasons that SMEs unwilling to adopt CCS are the top management of the organisation reluctant to change and they had low budget to adopt the changes. Moreover the organisation lack of knowledge and trained expertise on the new technology therefore they are worried on the loss of data and information, data stealing and security. So with this disclosures and privacy issues, SMEs unwilling to adopt the crucial innovation. Furthermore, the top management of the organisation unaware of the benefit

and important of CC such as the reliability, cost reduction and performance of the system.

Hence, we examined the main determination factors for SMEs in decision-making process for adoption of CCS in their business activity and alert the SMEs the benefit of adoption of CCS.

1.3 The Problem Statement

In this COVID-19 pandemic, it did bring big impact to the economy of Malaysia. Thus, it is important to implement a better way to help the key player of Malaysia's economy which is the SMEs organisations to maintain their daily operations process although their staff will be working from home for this pandemic.

Base on Xue and Xin (2016) research, CCS has played a vital role in helping to solve the inefficiencies problem and to increase the growth of business of the organisations. With the CCS, it brings the benefits such as flexibility, cost reduction, upgrading of the hardware and software, agility and scalability which will help the organisation to stay competitive among others.

Since the CCS as an innovative technology and bring a various benefit to the business, therefore it is important to analyse the factors that affect adoption of CCS among SMEs in Malaysia.

1.4 Research Objectives

The objectives of this research are to determine the factors of the adoption of CCS among SME during this Covid-19 pandemic. In this research, we could examine the relationship between the two majority business sectors (Services and Construction) and their consideration factors in adoption of CCS.

Upon identifying the factors, we will understand and analyze the importance of each factors and which are the most significant factors that play as the main influencers, this will help to improve the adoption rate of CCS and indirectly help the Malaysia's economy grow. Furthermore, we would analyze the impact of adoption of CCS on the project in term of time, cost and quality.

i. To investigate the factors for the adoption of CC during the COVID-19 pandemic.
ii. To investigate the effects of the adoption of CC on project performance during the COVID-19 pandemic.

1.5 Research Scope

The scope of this research will be focusing on the construction and services sector SMEs located in Klang Valley, Malaysia. The research will investigate the determination factors for the adoption of CC and investigate the effects of the adoption of CC on project performance during the COVID-19 pandemic.

1.6 Research Justifications

During COVID-19 pandemic, fully lockdown had been order by Malaysia government to all the public and majority of the businesses have to allow their worker work from home or reduce full time worker in the physical office. Thus, to ensure the business continuity, the owners or managements of the organisation have to find way to allow the workers work virtually. Therefore, this research is to investigate the factors for adoption of CC which can allow the workers work virtually.

CHAPTER 2 - LITERATURE REVIEW

2.1 Small and Medium Enterprises (SMEs) definition

According to SME Corporation Malaysia, SMEs had defined as Small and Medium Enterprises (SMEs) which must be entities registered with Suruhanjaya Syarikat Malaysia (SSM) and it covers all the business sectors such as services, manufacturing, agriculture, construction and mining & quarrying.

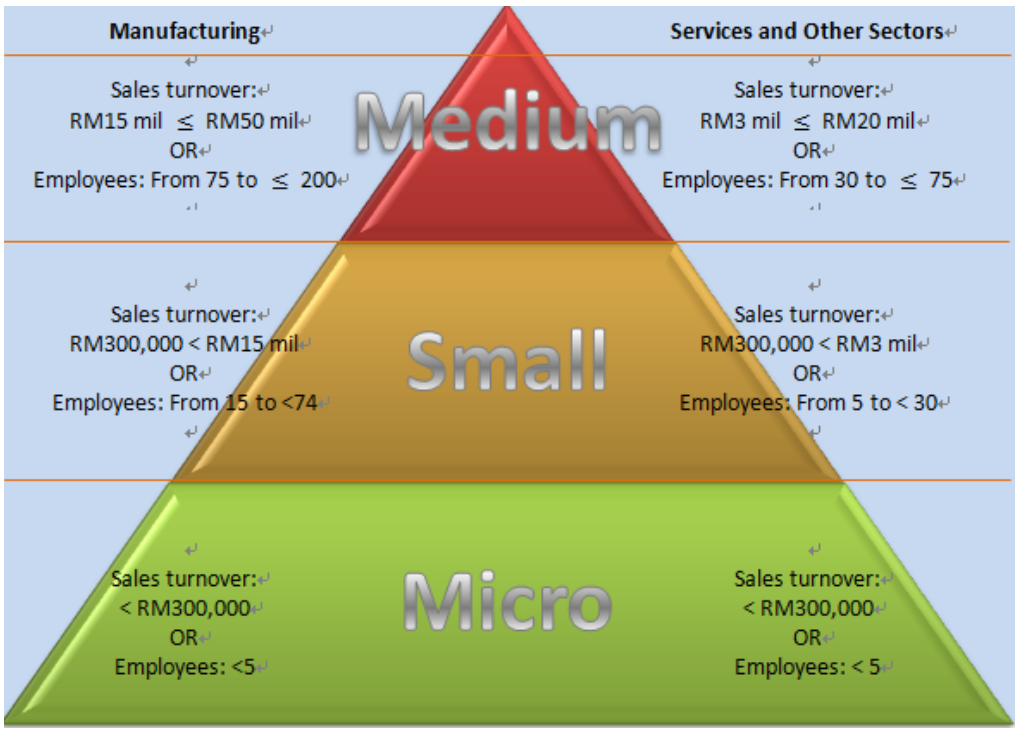

Figure 2.1: Definition of SMEs

Note: Adapted from *SME Definitions*, by SME Corporation Malaysia,2013 (https://www.smecorp.gov.my/index.php/en/policies/2020-02-11-08-01-24/sme-definition). In this public domain.

2.1.1 Classification of Sectors

According to the SME Corporation Malaysia, business sectors was

classified into two main sectors and three key economic activities for other sectors based on the Malaysian Standard Industrial Classification (MSIC) 2008 codes as per Annex 1.The following was the define of the classification: -

i. Manufacturing:- This sector is to transform the materials or components into new physical or chemical products.
ii. Services:- This sector is the services that distribute trade; hotels and restaurants; business including professional and information technology; private education and health; entertainment; financial intermediation and related services for manufacturing such as research and development (R&D), logistics, warehouse and engineering.
iii. Agriculture: - This sector is included perennial crops such as rubber, oil palm, cocoa and pepper; cash crops such as vegetables, fruits and etc; livestock; forestry & logging; marine fishing and aquaculture.
iv. Construction:- This sector is included the infrastructure construction activities; residential & non-residential construction activities and special trade construction activities.
v. Mining & quarrying:- This sector is included the extraction of natural minerals such as in solid form (coal & ores); liquids (petroleum) and gases (natural gas).

2.1.2 SMEs' Profile in 2020

Based on the SME Corporation Malaysia, the latest statistics data from Malaysia Statistical business Register (MSBR) reported by Department of

Statistics, Malaysia (DOSM) shown that SMEs was become the key player in Malaysia economies and contributed 97.2% of the total business in 2020 and it did achieved growth of 4.9% every year since 2015. According to the analysis on each of the sector, Services sector did contribute 85.5% of the total business during year 2020 and follow by the Construction sector which did contributed 7.4% during year 2020. And the other sectors did contribute 5.1% (Manufacturing), 1.7% (Agriculture) and 0.3% (Mining & Quarrying).

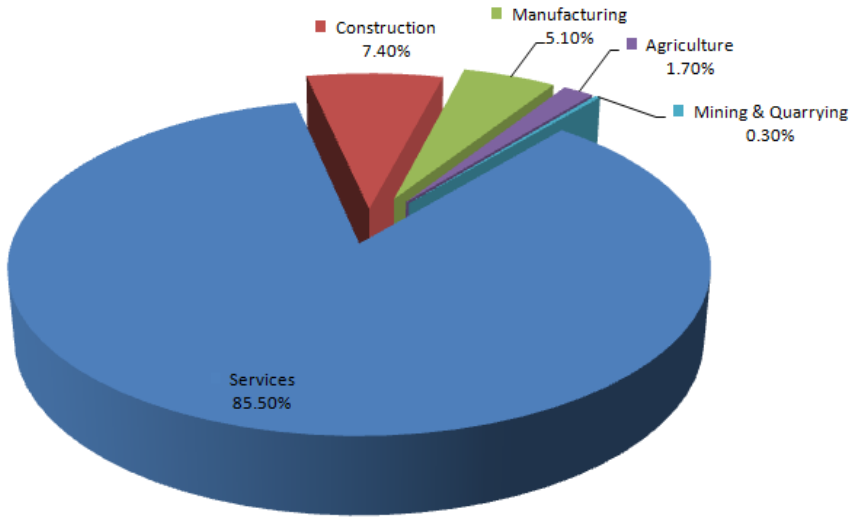

Figure 2.2: Profile of SMEs in 2020

Note: Adapted from *Profile of SMEs in Malaysia*, by SME Corporation Malaysia, 2020 (https://www.smecorp.gov.my/index.php/en/policies/2020-02-11-08-01-24/profile-and-importance-to-the-economy). In this public domain.

2.2 Cloud computing definition & concept

Based on Osorio, DelReal, Valdez, Miranda, and Garay (2006), The National Institute of Standards and Technology (NIST) had defined CC is a cloud model that enabled on-demand network access of a shared pool of the

configurable computing resources which can be access ubiquitous and convenient. It helps the management or service provider to manage the model with minimal effort and interaction. There are five essential characteristics, three service models and four deployment models of the cloud model.

- **Essential Characteristics**:
  - *On-demand self-service*. Consumer can provision their computing capabilities without interacting with the service provider for the servicing time or network storage as their needed directly through the model.
  - *Broad network access*. The service is available over the network and accessible via standard mechanisms such as mobile phones, tablets, laptops, personal computer and workstations which were networked.
  - *Resource pooling*. A multi-tenant resources models will be pooled by the service provider and it will serve multiple consumers with different dynamically assigned physical and virtual resources. Therefore, the consumer might not need to control and manage the high level of abstraction by the knowledgeable technical staff. These resources are including the storage, processing, memory and network bandwidth.
  - *Rapid elasticity*. Consumer can adjust the capabilities of the service rapidly with the outward and inward of the demand commensurate. Therefore, the capabilities availability to become unlimited and can reassign at any time.
  - *Measured service*. A capability measuring metering used to

control and optimize resources use to measure on storage, processing, bandwidth, and active user accounts. This measured usage provide transparency and used as the monitoring, controlling and reporting for both provider and consumer.

- **Service Models:**

  CCS models can be referred as Software as a Service (SaaS), Platform as a Service (PaaS) or Infrastructure as a Service (IaaS) (Nosratabadi, Atobishi, & Motaghi, 2018).

  - *Software as a Service (SaaS).* This service model allowed consumer to access to the application on a cloud infrastructure. It can be accessible via web browser interface or the application interface that are networked. All the managerial and control underlying cloud infrastructure issues will be done by the service provider throughout the cloud application configuration settings including the network, servers, operating systems or storage.
  - *Platform as a Service (PaaS)*. This service model allowed consumer to deploy the consumer-created or acquired application onto the cloud infrastructure with the programming languages, libraries, services and tools that are provided by the service provider. All the managerial and control underlying cloud infrastructure issues will be done by the service provider throughout the cloud application configuration settings including the network, servers, operating systems or storage.
  - *Infrastructure as a Service (IaaS).* This service model allowed consumer to deploy and run the software on the service provider

platform. The infrastructure can be including the processing, storage, networks, operating systems and applications. Managerial and control underlying cloud infrastructure does not require consumer to manage but consumer can control the operating systems, storage and deployed applications and had a limited control on the host firewalls and other networking components.

- **Deployment Models:**
  - *Private cloud.* This infrastructure is to use by a single organisation which is involved multiple consumers such as business units or departments. The infrastructure may be owned, managed and operated by the organisation or a third party. And it may be existing on or off premises of the organisation.
  - *Community cloud*. This infrastructure is to use by a specific community of consumers from the organisations. Most of the community had the shared concerns such as mission, security requirements, policy and compliance considerations. The infrastructure may be owned, managed and operated by several organisations of the community or a third party. And it may be existing on or off premises of the community.
  - *Public cloud*. This infrastructure use by the general public. The infrastructure may be owned, managed and operated by a business, academic or government organisation. Majority of it may exists on the premises of the cloud provider.
  - *Hybrid cloud*. This infrastructure is composition of two or more

cloud infrastructures. It remains unique entities but bound together with a standardized or proprietary technology that can be cloud bursting on the load balancing between the cloud infrastructure.

Majority of the server of the CCS will be based at the data centre and it bring more benefits than having own server in the normal office. The benefits of the data centre such as: -

- Protecting power - Minimize of the impact of power failure.
- Secure data storage - Clustering multiple servers to ensure no data loss.
- High Availability - Load balancing clustering in multiple servers to ensure minimum downtime.
- Performance - Increase concurrent user capacity by load balancing clustering node to have better performance.
- Instant Scalability - Adding a new node to the data centre cluster without any downtime to improve the performance when larger load needed.

2.3 Benefits of Cloud Computing in SMEs

In today's era, CC as an innovative technology helps SMEs to improve their performance and stay competitive among their industry. There were various of benefits that showed CC provide improved new capabilities than traditional technology model provided. According to Xue and Xin (2016), the following benefits showed CC Model help on SMEs especially on the covid-19 pandemic.

- *Flexibility*. Adopt to the CC model, it increased the flexibility on their business. There is flexibility for the employee to work in or out of their workplace as they will able to access the workstation or repository data from anywhere ensure they have the broadband connection. Thus, in the pandemic period, "work from home" is the order from the Malaysia's government. Therefore, with the adoption of CCS, work from home will not be a dream that cannot be reachable. CC allowed the employees/users to share and upload their documents or files over the broad on the real time, thus the updated version of the documents or files can be viewable and retrieve by the others.
- *Cost Reduction*. Based on Alkhalil (2013) research, one of the main factor that SMEs will adopt CC for their business is to help in the cost reduction. The service providers provide the service to the SMEs' consumer to pay whatever they willing to use thru the cloud services.

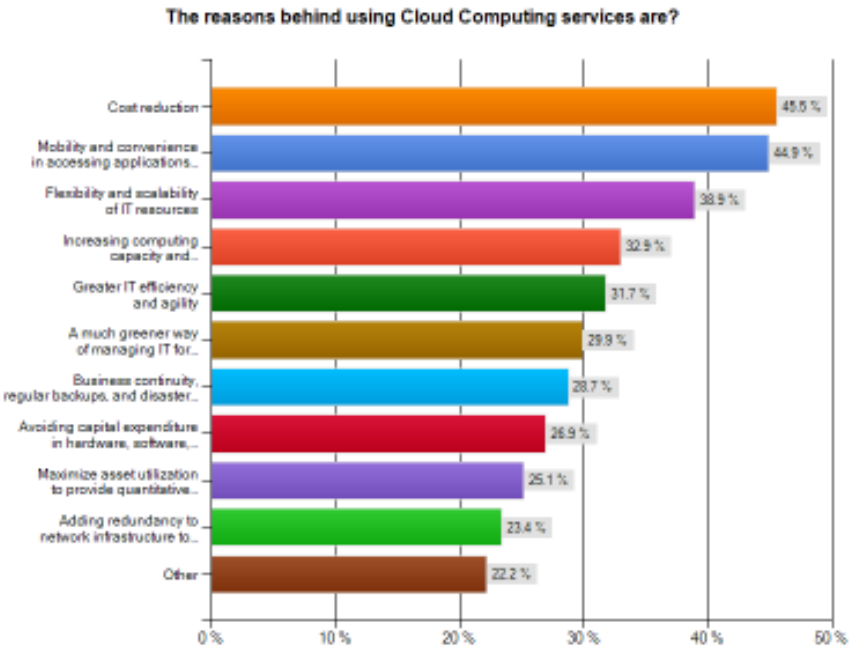

Figure 2.3: Factors for Adopting Cloud Computing (Alkhalil, 2013).

From the Figure 2.3, showed that one of the main reason which can

impact the organisation for adoption of the CC model is the cost reduction. A business organisation usually concerned on how much they can save or gain from adopting a new technology. With the CC model, the organisation can save the staff training cost and manpower salary to maintain the IT hardware and software since all the technical support will be done by the service provider.

- *Upgrading of software and hardware*. To implement a technology innovation, the upgrading of the software and hardware always an issue for the organisation to achieve the best performance. The expenses of changing or upgrading the hardware and software of the technology were high. Thus, with the adoption of CC model, the expenses that budgeted for this upgrading can be reduce and providing the organisation for other investment which help to increase industrious competitive. CC model provide on-demand subscription fee on what the organisation used and willing to use and all the software will be maintain by the service provider. Therefore, the organisation only must maintain the requirement specification of the IT devices and doesn't need to maintain the server to run the application and data storage.
- *Agility*. According to Pazowski and Pastuszak (2013), business agility should be one of the main reason for the organisation to adopt the CC model. In today's business, agility is one of the main abilities for a business to grow and efficiency response on the change of the business environment. An agility organisation will implement the business operation with flexibility, balance, adaptability and

coordination. Instead of only focus on the cost reduction, the ability to help to grow and improve the business opportunities and competitive is more important. This will help to increase the gain and income for the organisation. Thus, with enabling the CC, it incessantly helps to reduce the cost of technology operational costs also help to improve the performance and increase industrious competitive.

2.4 Risks of adoption Cloud Computing in SMEs

CC brings benefits to SMEs, but a SME start with the innovation technology, it may bring some risks that may impact their performance on the business and cause inconvenient for them. Therefore, it will be some considerations for the decision makers to consider before it takes the innovation technology into their business. Based on the research of Xue and Xin (2016), they found that there are several risks such as data stealing, malware injection, wrapping and authentication attack.

- *Data Stealing*. Data is significant to each of the organisation, when the data of the organisation had been stolen by the internet hackers then the strategy and all the important information will be dispute to others.
- *Malware Injection, Wrapping & Authentication Attack.* CCS is the application that will work in broad. When the application was bringing to broad, there will have internet hackers who will try to damage it or find vulnerabilities of it to get the valuable information from it. Malware injection attack such as "Trojan" usually will be use

by the hackers to inject into the cloud services for the data theft or eavesdrop. Beside of malware, XML (Extensible Mark-up Language) wrapping attack will be used to translate the message transport of the user and cloud service thru the Simple Object Access Protocol (SOAP). With the wrapping attack information, the hacker will get the user account login details and use for the authentication to access the cloud server. Finally, the SMEs' confidential and sensitive data will be accessible by the hackers and being stolen by the hackers for illegitimate actions.

Risks might not only impact the organisation confidential data; it might bring inconvenient to the organisational. According to Khajeh-Hosseini, Greenwood, and Sommerville (2010), the researchers had summarized few organisational risk that will bring by the adoption of CC.

- *Deterioration quality of customer service*. Organisation might not have control over the quality of the customer service of the cloud service provider. The supporting works will be maintaining by the third-party service provider and it required additional resources to deal with the service provider on the application issues. It required more time for the staff to perform the same tasks since they must learn on how-to perform the tasks in the new environment. It will take longer time to resolve the issues since it required to cooperate with external party.
- *Departmental downsizing*. Due to the responsible of maintenance work will be fall to the third-party service provider, therefore the IT department of the organisation may take the risk of downsizing. The

support and IT department may lose their position in the organisation as this department might be unnecessary after adoption of CCS.

- *Uncertainty with new technology*. There are risks may present to the finance/business department as the CCS may occur several costs for the implementation or data transfer transactions. All these costs may be long-term as the cloud service will be on-demand purchasing instead of internal server hosting is one-off costing. In future, for the new business proposal it might lock-in a support fee as the support maintenance will be responsible by the external service provider. Therefore, it will be causing reducing of in-house expertise and might be causing insufficient in-house support on the IT issues.

2.5 Challenges of adoption of Cloud Computing Service by SMEs

Although CCS bring benefits to the SMEs, but there are some imperfection need to be consider by the decision makers (Khajeh-Hosseini et al., 2010). Where the network traffic can be harmful to the performance of CC. On the other hand, in Llorente (2013)'s research (as cited in (H. A. S.Ahmed, Ali, Kadhum, BinZolkipli, & Alsariera, 2017)), the weak supporting of compliance management in CC may cause the serious issue in the data security and privacy on the CCS. Data security and privacy always the critical concern of the new innovation, but there is no clearly stated by the service providers how the security and responsibility of the CC going to achieve (Zhang et al., 2014). Interoperability of CC may be one of the main challenges for some sectors. There have different system or software use for daily operation, but not all the system or software can be interacting with the CC.

However, based on Prasad, Naik, and Bapuji (2013), there are number of issues, challenges and implications which are addressed by the researchers, academicians and business intelligence practitioners.

- *Security*. The main challenge for the CC is still concerned about the security of CC. Consumers worried about their important data and information resources will be stolen and hacked by the industrious hackers. Moreover, all the repository of data will be stored virtually in the cloud server and it is beyond on their control.
- *Reliability*. Most of the CC offer round the clock and no outages service reliability. Although there were still cases that the CCS were suffered few hours' outages, but it might be more stable than the personal servers that the cloud service providers have a better team of the expertise that can resolve the critical issues immediately.
- *Privacy*. CC model utilizes virtual computing technology which is different from the traditional computing model. The data will be stored in the virtual data centre and the privacy protection may be weak and it may leak hidden information when accessing the services. Moreover, the industrious hackers can analyse the critical task depending on the task by the consumer.
- *Performance*. One of the most critical issue of the CCS is the performance of the model. The CC may be lack on performance for the user of long distance or weak bandwidth, they may experience high latency and delay. And the network bandwidth speed will be important for the organisation to have better performance.

- *Bandwidth Cost*. CC help consumer to save costs on the hardware and software but it incurs higher network bandwidth which can be costly. A better network bandwidth may be significant to achieve better performance for the system and this may incur higher cost for the organisation.
- *Long-term feasibility*. Consumer may be worried that the repository data and information stored in the CC might be lost and unable to retrieve once the service provider were closed or engulf by a larger organisation.
- *Legal Issues*. Different country will have different jurisdictions legal system, the CC servers might be hosting in the different country than the consumer's origin. This may raise up a vexing legal issue when the CC arising the data export and migration. Different legal jurisdictions may cause loss of the ownership of data and liability or the consumer might suffer on the vexing legal issues.

2.6 TOE Framework

Different factors can influence the new technologies adopt by SMEs such as the (T)echnological, (O)rganisational and (E)nvironmental contexts (TOE). This TOE framework was developed by the work of Tornatzky and Fleischer (1990) and based on Iacovou, Benbasat, and Dexter (1995) model, the researcher analysed that the factors influence the organisations to adopt IT innovations based on TOE framework are Perceived benefits of the (T), Organisational readiness such as top management support and IT resources of the (O) and External pressure of (E).

Based on the Rogers (1995), the researcher pointed that there are three major group of adoption predictors that are depending on the individual innovativeness, organisational factors such as business size, resources availability and procedures. Rogers (1995) showed that the technological characteristics did impact the decision makers minds instead of just concentrating on the objective aspects of technology. Oliveira and Martins (2010) conducted the research based on the new technology adoption at the organisational level with the TOE and DOI framework and concluded that TOE is one of the enhanced frameworks that to illustrate intra-firm innovation adoption by its environmental contexts. With Oliveira and Martins (2010)'s approach, this research will explore influences of the decision consideration factors of TOE context-specific.

2.6.1 Technological Factors

According to Abolfazli et al. (2015), researcher indicated that IT user friendly will impact on and would be main factors of the CC adoption. CC had different features than traditional computing model such as high availability, lower complexity, cost reduction, lesser capital investment and flexible scalability. Researcher Avram (2014) summarized that security and privacy will be significant to the adoption decision and highlighted that CC as a new innovation whether the CC ensures the data secure or its privacy is good enough. Other than this, Avram (2014) also concern about the reliability or connectivity of the CC that is critical for the decision maker. This is critical because the information of the application will be important to the organisation and it should be accessible round the clock without outages

service. Therefore, implementation of emergency and disaster planning must be focus and minimization of the failure and outages.

Alshamaila's research [as cited in (Skafi, Yunis, & Zekri, 2020)] pointed out that the main factor in adoption of CC by the SMEs will be relative advantage, uncertainty, compatibility and trialability. Advantages and benefit to the organisation in adopting an innovation technology need to be focus and have clear vision to the decision maker when decide to adopt CC model. User friendly and compatibility of the system will be highly important to the organisation because it will affect the daily workflow process of the organisation.

2.6.2 Organisational Factors

From the research of Zainol (2013), the researcher stated that the organisational factors of the TOE framework also play significant role for the decision maker. The research pointed out size of the organisation will be important factor for the adoption, researcher believe that the smaller size of the organisation will be easier to change their vision and mission and able to adopt innovation technology. In addition, the top management of a smaller size organisation may be more tended to adopt CC since this innovation technology may help them to reduce the expenses of the IT department on the upgrading the hardware and software. With the support of the top management, IT department will positively on the adoption of CC.

2.6.3 Environmental Factors

On the previous research paper Mohammadi, Saeedikondori, and Ali

(2017), the researcher had further analysed environmental factors of the TOE framework which will enforce the adoption of an innovation. The only factor that they covered in their research is the external pressure.

External Pressure referred to the pressure that will be faced by the organisations from their industrious competitors and this pressure will be an enforcement for the organisation to adopt an innovation technology. For example, the competitors that adopted the CCS which will improve their business performance, efficiency and agility that emphasized the organisation take in consideration on the decision.

Besides of the mentioned factors, government regulatory support plays significant factors for the CC adoption for the SMEs. The researcher Pathan et al. (2017) mentioned that the regulatory support from government will enforce SMEs consider to adopt CCS and with the elastic policies and regulations offer by the government, it should be motivation for SMEs to decide adoption.

Table 2.1 TOE-Based Studies and factors

Authors	IS Innovation	Technological Context	Organisational Context	Environmental Context
Ramdani, Chevers, and Williams (2013)	Enterprise Systems	◆ **Relative Advantage** ◆ **Compatibility** ◆ **Trialability** ◆ **Observability**	◆ **Organisational Readiness** ◆ **Top Management Support**	◆ **Market Demand** ◆ **Competitive Pressure** ◆ External Pressure
Amin, Rezaei, and Abolghasemi (2014)	Mobile Websites	◆ **Perceived usefulness** ◆ **Perceived ease of use** ◆ Trust		
Dhingra and Mudgal (2020)	Information Technology	◆ **Perceived usefulness** ◆ **Perceived ease of use**		
Pathan et al. (2017)	Cloud Computing	◆ **Relative Advantage** **Compatibility** ◆ Complexity	◆ **Managerial Support** ◆ **Firm Size**	◆ **Regulatory Support** ◆ **Competitive Pressures**
Chandra, Jain, and Chandra (2021)	Block chain	◆ **Relative Advantage** ◆ Uncertainty	◆ **Top Management Support** ◆ **Organisational readiness**	◆ Industry ◆ Regulatory Environment ◆ **Competitive Pressure**
Oliveira and Martins (2010)	e-Business	◆ **Perceived Benefits** ◆ **Technology readiness** ◆ Technology Integration	◆ **Firm Size** ◆ **Organisational readiness**	◆ **Competitive Pressure** ◆ **Trading Partner Collaboration**
Ahuja, Sawhney, Jain, Arif and Rakshit (2020)	BIM	◆ Complexity ◆ **Compatibility** ◆ **Trialability**	◆ **Top Management Support** ◆ Perceived Cost ◆ **IT Expertise**	◆ **Client Requirement** ◆ **Trader Partner Readiness** ◆ **Regulatory Support**
Ahuja, Jain, Sawhney, and Arif (2016)	BIM	◆ Complexity ◆ **Compatibility** ◆ **Trialability**	◆ **Top Management Support** ◆ Perceived Cost ◆ **Expertise**	◆ **Client Requirements** ◆ **Trading Partner Readiness**
Correia Simões, Lucas Soares, and Barros (2020)	Robots (Cobots)	◆ **Relative Advantage** ◆ **Compatibility** ◆ Complexity ◆ **Trialability** ◆ **Observability** ◆ Portability of Knowledge ◆ Support / Augmentation	◆ Structural Determinants ◆ Receptiveness ◆ Readiness	◆ **Competitive Pressure** ◆ **Business Partners** ◆ **Government/Political Directives** ◆ **Regulatory Environment** ◆ Technology Infrastructure

Namisiko, Munialo, and Nyongesa (2014)	e-Learning	◆ Cost of ICT Infrastructure ◆ e-Learning Curriculum ◆ **Perceived Usefulness** ◆ **Perceived Ease of Usefulness**	◆ Teachers' competences ◆ Performance Expectancy	◆ **Government Policy**
Abed (2020)	Social Commerce	◆ **Perceived Usefulness** ◆ Security Concern	◆ **Top Management Support** ◆ **Organisational Readiness**	◆ **Consumer Pressure** ◆ **Trading Partner Pressure**
Cruz-Jesus, Pinheiro, and Oliveira (2019)	CRM	◆ Technology Competence ◆ Data quality and Integration	◆ **Top Management Support**	◆ **Competitive Pressure**
Gui et al. (2020)	Cloud Computing	◆ **Relative Advantage** ◆ Complexity ◆ **Compatibility** ◆ Privacy Concern ◆ Vendor Lock-in	◆ **Top Management Support** ◆ **Organisational Readiness**	◆ **Competitive Pressure** ◆ **Government Support** ◆ **Business Partner Pressure** ◆ Regulatory Policies
Borgman, Bahli, Heier, and Schewski (2013)	Cloud Computing	◆ **Relative Advantage** ◆ Technology Complexity ◆ **Technology Compatibility**	◆ **Firm Size** ◆ **Top Management Support** ◆ **IT expertise of business users**	◆ Competition intensity ◆ Regulatory environment
I.Ahmed (2020)	Cloud Computing	◆ Related Improvement ◆ **Compatibility**	◆ **Top Management Support** ◆ **Organisational Readiness**	◆ **Competitive Pressure** ◆ Administration Regulation ◆ Technology Support Infrastructure
Picoto, Crespo, and Carvalho (2021)	Cloud Computing	◆ Lack of Interoperability ◆ Convenience ◆ **Compatibility**	◆ Organisational Confidence ◆ IT Know-how	◆ Trust in Supplier ◆ **Competitive Pressure**
Ali, Shrestha, Osmanaj, and Muhammed (2021)	Cloud Computing	◆ Cost ◆ Security Concern	◆ **Top Manage Support** ◆ **Organisation Size** ◆ Employees' Knowledge	◆ Government Regulation ◆ Information Intensity

Note: Factors that emerged from the encoding process have been highlighted

CHAPTER 3 - RESEARCH METHODOLOGY

3.1 Research Method & Framework

A research framework was developed as the Figure 3.1. From Figure 3.1, a quantitative research method will be adapted in this research to generate and evaluate the findings. This method being selected due to during this COVID-19 pandemic, it will be more convenience for collecting the large sample of research data and reduce the face to face meet up while collecting the data. A pre-test run has been carried out by distributed to six (6) respondents and collect the comments on the questionnaire. It is not feasible to cover all the SME owners in Klang Valley, Malaysia. According to Stevens(1996) & Tabachnick and Fidell (2007), the smaller sample size requirements for the researchers to conduct factor analysis should with the minimum of 150 sample size. Thus, for the purpose of this research, there will be randomly selected 230 of SME owners for the survey through a group of business network which consists of business entrepreneurs and also disseminated to friends who are SME entrepreneurs. All the primary data collected from the survey questionnaire will be analyse with the SPSS software. Lastly, the results and findings obtained will be discuss and conclude with the hypothesis and recommendations will be addressed on the identified issues for the future research purposes.

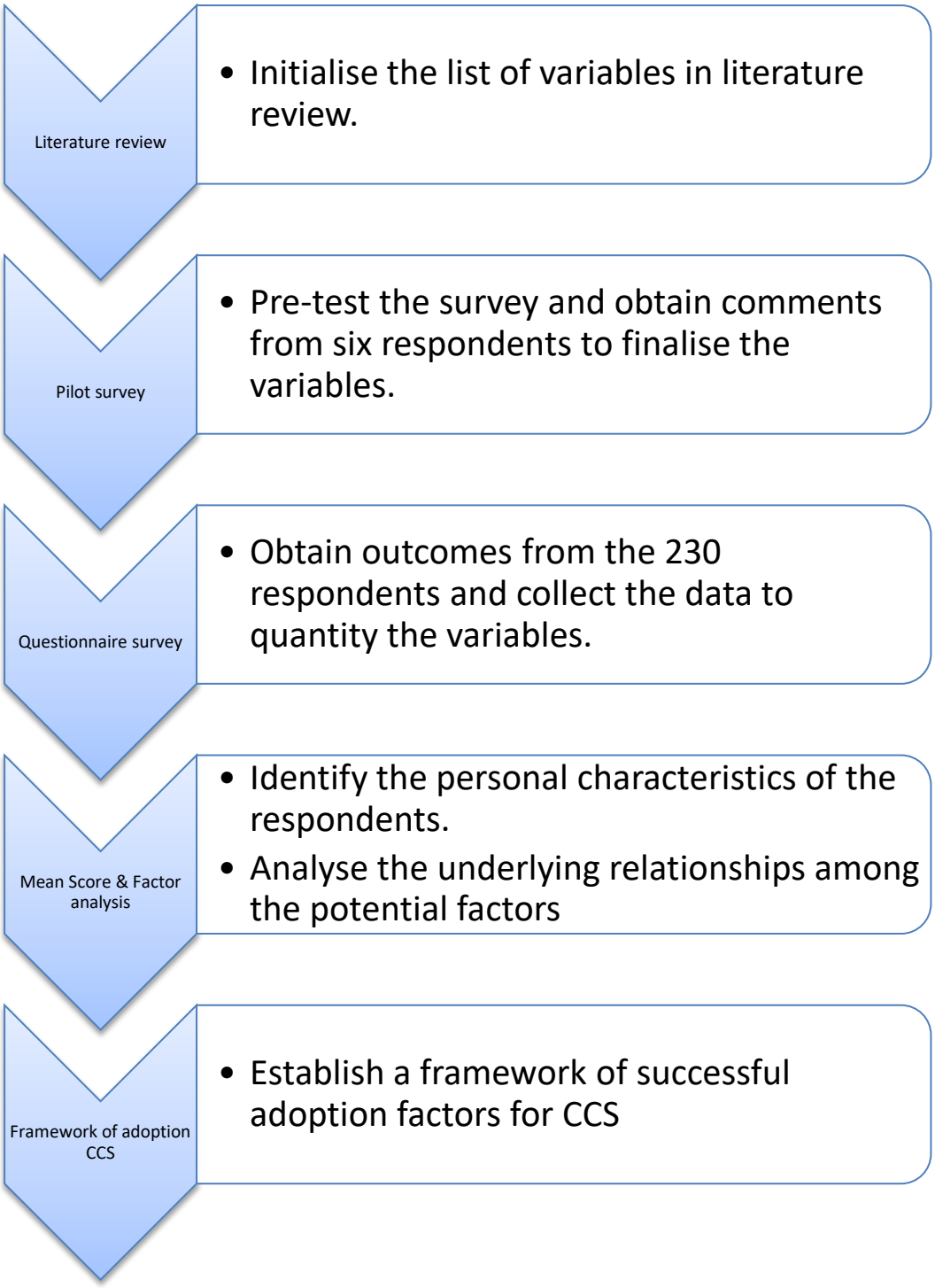

Figure 3.1: Research Framework

3.2 Hypothesis Development

3.2.1 Technological Context

Perceived usefulness

Perceived usefulness refers to the perceptions of the organisation that the innovation could change their business operating procedure and improve their business performance (Wilson, Keni, & Tan, 2021). Davis and Doll's studies [as cited in (Wilson et al., 2021)] defined that perceived usefulness as the user's perception of the innovation improve on the business efficiency and effectively and the task performance. Perceived usefulness should play vital role in improving business performance and help the organisation develop towards success(Amin et al., 2014). Therefore, perceived usefulness could add some values toward the adoption rate of CCS.

- H1: Perceived usefulness is positively affect the adoption of CCS

Perceived ease of use

Perceived ease of use defined by Amin et al. (2014) as the users' perceptions of how convenience on using the innovation, how feasible to learn the innovation and how flexible will be while using the innovation. According to Dhingra and Mudgal (2020), perceived ease of use is how easy is the implement and use of the innovation. The users will be expected that the use of the innovation is effortless. The research of Wilson et al. (2021) stated that the organisation opined that the innovation is difficult to learn and will spend long time to implement for the users to pick up, they will not adopt the innovation and will look for better solution which is suitable for them.

Therefore, the hypothesis for this research stated that perceived ease of use will be positively affect adoption of CCS.

- H2: Perceived ease of use is positively affect the adoption of CCS

Technology optimism

Technology optimism refers to the technology will provide organisation on more convenience and control over their daily operating process (Parasuraman, 2000). Parasuraman (2000)'s research also stated that the users will prefer to use the advanced technology and trust that the technology will provide them convenience and freedom of mobility to perform the same daily operating process. The researcher Blut and Wang (2020) believe that optimism is one of the vital attributes on the technology readiness and it did provide a positive view of technology and a belief that will help the organisation increase on control, flexibility and efficiency over their daily works. Therefore, we believe that technology optimism will positively affect adoption of CCS for this research.

- H3: Technology optimism is positively affect the adoption of CCS

Technological capability

Technological capability defined as one of the vital resources for organisation establish innovation and it is the form of tacit knowledge with VRIN characteristics (valuable, rare, inimitable and no substitutable) (Liu, Wu, & Wang, 2020). Liu et al. (2020) also stated that technological capability is important to the organisation and it bring them to a differentiation with the industrious competitors because their competitors will unable to perform the

task without the similar technological capability. Therefore, this ability brings advantages and help the organisation to be competitive in their business sector. Salisu and Abu Bakar (2019) concluded that technical capability not only the technical mastery capability, it should deploy and expand the organisation core capabilities and it will effectively integrate all the existing technologies and mobilize resources. Thus, this research hypothesizes that: -

- H4: Technological capability is positively affect the adoption of CCS

Compatibility

According to Rogers (2003), compatibility refer to the level of consistency and adaptability of innovation to their existing operating systems including the operating procedures, needs, beliefs and values. Based on the Azhar, Khalfan, and Maqsood (2012), they claimed that the compatibility and interoperability of the new innovation to other systems is the major barrier of new innovation adoption. Haddud, DeSouza, Khare, and Lee (2017) also showed that compatibility among the systems from different vendors, the compatibility will be important to the adoption. Thus, from all the reviews from different research, compatibility will be positively affecting the adoption of CCS.

- H5: Compatibility is positively affect the adoption of CCS

Relative advantage

Relative advantage refer to the perceived advantage of adoption of CCS compared to the existing network system (Savoury, 2019). There are several attributes that should be taken in place such as prestige, efficiency,

convenience and economic advantage that the innovative can help the organisation. The researcher concluded that relative advantage is one of the significant factors that will help the adoption rate of an innovation.

- H6: Relative advantage is positively affect the adoption of CCS

Trialability

Trialability refers to the availability of experimentation with new innovation (Kumar & Swaminathan, 2003). Trialability allowed the user to have a trial on the innovation and try an error on the system. Therefore, the greater availability of the trialability improved the adoption rate of the CCS.

- H7: Trialability is positively affect the adoption of CCS

Observability

Rogers' research [as cited in (Ramdani et al., 2013)] defined observability of the innovation are the visible of the innovation to the others. Therefore, for the better observability of the CCS then positively impact the adoption rate of the CCS.

- H8: Observability is positively affect the adoption of CCS

3.2.2 Organisational Context

Organisational scale

Organisational scale or size will be affected the innovation adoption due to the larger organisation will have a greater need, resources, skills and experience and ability to solve the failures than smaller scale of organisation

(Ramdani et al., 2013). Oliveira and Martins (2010) stated that organisational scale will bring negatively impact to the adoption due to larger the organisational scale tends to be less agile and flexible than the smaller organisational scale. In other words, larger of organisational scale will slow down the innovation adoption. Pathan et al. (2017) stated that the larger organisational scale has an advantage compared to the smaller scale because they will have more resources and expertise to tolerate the risks. With the above explanations, in this research we hypothesize that: -

- H9: Organisational scale is positively affect the adoption of CCS

Organisational readiness

Iacovou's research [as cited in (Ramdani et al., 2013)] had stated organisational readiness as "*the availability of the needed organisational resources for adoption*". They also showed that economic costs and technical knowledge of the organisational will be significant factors for the growth of Information Technology in the SMEs. Chandra et al. (2021) stated that organisational readiness also refers to the technology readiness of the organisation's infrastructure as well as the manpower are well preparing for the innovation adoption. In summaries, we hypothesize in this research that: -

- H10: Organisational readiness is positively affect the adoption of CCS

Absorptive capacity

Absorptive capacity of the organisational defined as the routines and processes that use by the organisation to analyse, interpret, learn and understand information for the innovation (Xie, Wang, & García, 2021). They

also noted that this attribute is the ability of the organisation to acquire, absorb and rationally use of innovation to improve their business performance. Rossetto et al. (2021) defined that absorptive capacity as the soft skill of organisation to recognize the new value of innovation, transform them and apply them commercially. Nazeer, Rasiah, and Furuoka (2021) declared that the level of absorptive capability will indirectly improve the organisation success in commercial and quality, it did allow them efficiently to acquire and re-use the knowledge and enhance their innovation capabilities. From all the above reviews, we hypothesize that: -

- H11: Absorptive capacity is positively affect the adoption of CCS

Top management support

Top management support stated as one of the vital predictors of organisational adoption of innovation Ramdani et al. (2013), top management might reinforce the change through better vision for the organisation and most of the decision maker in the SMEs were likely to be in the top management team, therefore top management support will be vital for the adoption. Chandra et al. (2021) stated that top management of an organisation will directly control the overcoming barriers and change of the resistance, thus top management will be one of the most influential factor in adoption of innovation. Mohammadi et al. (2017) showed that support from top management will be one of the main factors in innovation adoption due to the financial investment, human resources and technological competencies will be approved by the top management of the organisation. The most significant factor for innovation adoption is to be support received from the top

management in SMEs (Ahuja et al., 2016). With the top management support, SMEs can ensure the innovation shall be successfully implementation and adoption. With all the above reviews, we hypothesize that: -

- H12: Top management support is positively affect the adoption of CCS

Human resources

Human resources refer to the employees or IT expertise of the organisation that believed will improve the innovation adoption. Human resources of the organisation with skilled and technological expert will enforce the adoption rate of CCS (Ahuja et al., 2016). Namisiko et al. (2014) stated that the significant factors for the organisational context are human resources, financial resources, competitiveness and innovativeness of the organisation and all these factors should be the prime influential to the innovation adoption. According to the Skafi et al. (2020), top management of the organisation usually will encourage the IT staff to investigate the innovation adoption, therefore human resources will play a vital role in the adoption of CCS. With the existing reviews, we hypothesize that: -

- H13: Human resources is positively affect the adoption of CCS

Managerial support

Managerial support refers to support from the managerial level of the organisation. These support play a vital role in influencing the innovation adoption when the top management fail to recognize the advantages from the adoption (Pathan et al., 2017). Based on Correia Simões et al. (2020) research, managerial support tends to be one of the important characteristics and

influence to the adoption rate. In this research, we hypothesize that: -

- H14: Managerial support is positively affect the adoption of CCS

3.2.3 Environmental Context

Market demand

Market demand refers to the industries' requirement which is significant for the organisation to adopt the CCS. Chandra et al. (2021) due to the new technology features should only benefit the adopted organisation. Ahuja et al. (2016) stated that this refer to the requirement from the client that drive the organisation to follow on for the project and this should recognised as an important momentum for innovation adoption. Ramdani et al. (2013) stated that market demand become one of the most influencing factor for the innovation adoption and when the organisation want to expand their market area, it should introduces a high level of complexity in dealing with legal and cultural issues such as global or international supply chains. From the existing reviews, we hypothesize that: -

- H15: Market demand is positively affect the adoption of CCS

Competitive pressure

Competitive pressure refers to the pressures faced by organisation from their industrious competitors and the research also stated that the force from the industrious competitors consider as an important determinant for innovation adoption (Mohammadi et al., 2017). According to Oliveira and Martins (2010), competitive pressure as the degree of pressure from their industrious competitors. In their research, they also stated that "With new

innovation, organisation able to alter the rules of competition, impact the industry pattern and strengthen a new way to compete competitors". Chandra et al. (2021) on their research did mentioned that competitive pressure is main influential for the organisation heightened the adoption rate. Ramdani et al. (2013) was concluded that competitive pressure can become an essential tactics on innovation adoption to compete in the industry. Thus, in this research we hypothesize that: -

- H16: Competitive pressure is positively affect the adoption of CCS

Government support

Government support refers to the support from government with provide tax advantages by introducing regulation or pass constraining regulation (Borgman et al., 2013). Gui et al. (2020) stated that support from government consider as incentive and motivate to enhance the adoption. And they suggested that government can provide the profitable organisation special tax regulation or funding that help on CC adoption. Ali et al. (2021) stated that regulations imposed by the government will one main influential for the innovation adoption and they found that in the previous studies government support as an investigate factor that positively impact the innovation adoption. From the previous studies, we hypothesize that: -

- H17: Government support is positively affect the adoption of CCS

Trading partner readiness

Oliveira and Martins (2010) defined that trading partner readiness would be an important factor for the organisation decide to adopt innovation. When

the trading partner had adopted the new platform, in order to be compatible with their new platform, the organisation have to decide to adopt the innovation. Abed (2020) stated that to enhance technologies implementation successfully, business partner and supplier readiness was the main factors because there are critical determinants of inter-organisational system adoption. Gui et al. (2020) defined that organisation decided to adopt innovation must be comparable and compliant with their trading partner in order to share and exchange the data among them. From the above research findings, the following hypothesis is developed in this research: -

- H18: Trading partner readiness is positively affect the adoption of CCS

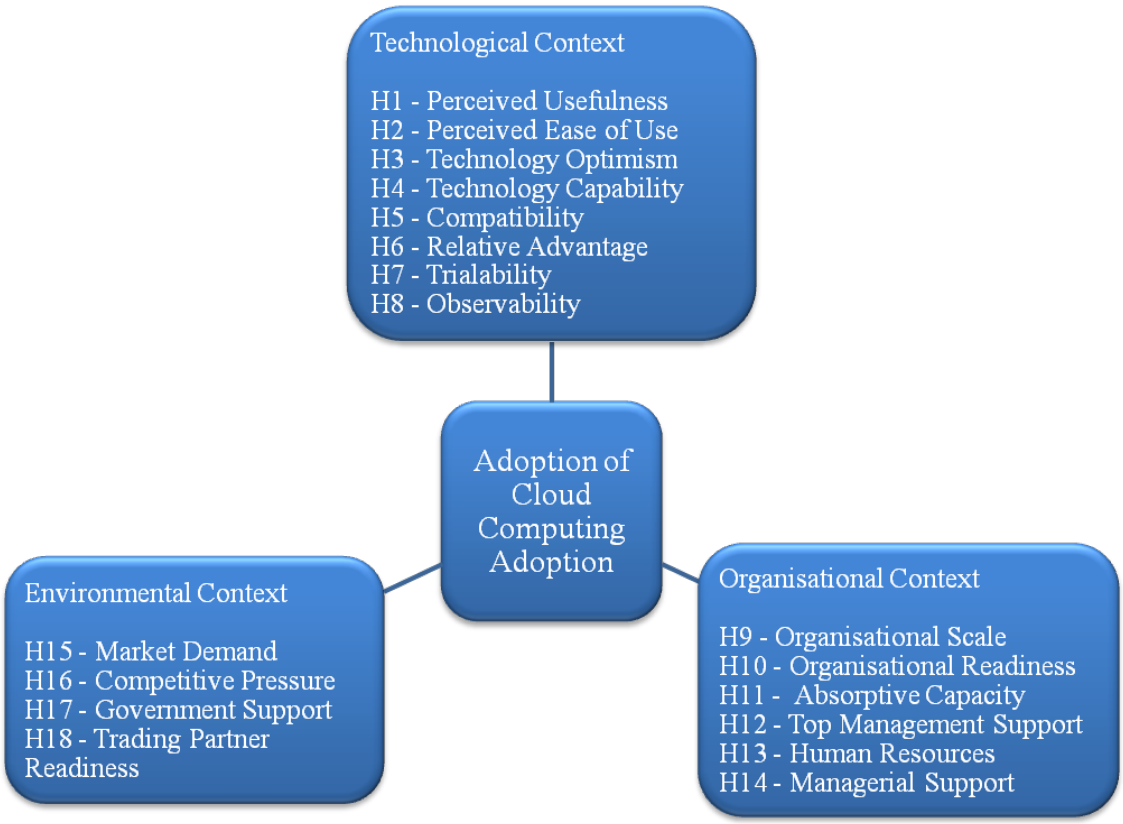

Figure 3.2: TOE Framework & Hypothesis

3.3 Survey Questionnaire

Questionnaire survey choose to be the primary techniques of data collection. It consists of a standardized question and answer categories to be coded to all the respondents and it only take about 5-10 minutes to complete the survey. Respondents asked to rate the factors listed in the questionnaire on a Likert scale of 1 to 5 (1 being disagree, 5 strongly agree) in terms of their importance level. The targeted respondents of this survey are the managerial levels and IT professionals of the SMEs in Klang Valley, Malaysia.

3.4 Analysis of Data

Statistical Package for Social Science (SPSS) software will be used for the data analysis and hypothesis testing. The data to be collected from the survey will be expected to show that the factors of the TOE framework have a significant impact to the adoption of CCS. To analyse the importance of each of the factors and their importance level, further analysis tests such as Factor analysis and Descriptive analysis will be carried out to analyse the data collected.

3.4.1 Descriptive Analysis

Descriptive analysis depicts the characteristics of the respondents and shown the general reactions which gave by the respondents. It is a method used in order to summarise data collected from the survey. There are several questions structured in this survey including demographic profile of the respondents. Ranking of the factors will be summarised in this analysis to get the mean score and standard deviation of the collected data.

3.4.2 Factor Analysis

Factor analysis will be tested to analyse whether the independent variables conducted from the survey did provide same patterns of the responses to create a construct because there are interrelationships among the variables. The dependent variables of the determination factors which identified on the literature reviews will be analyse and conclude that whether they are impacting the adoption of CCS. Principal components analysis will be conducted in factor analysis to get a set of principal components that grouped all the variables which can represent the total variances.

CHAPTER 4 - ANALYSIS AND DISCUSSION

4.1 Descriptive analysis on respondents' demographic profile

The Table 4.1 presents the demographic information of respondents on their firm size, business sector, position in the firm and working experience. From the table, it showed that there are 53.5% of small sized enterprises and 46.5% of medium sized enterprises of the respondents. Regarding to the business sector, Table 4.1 showed that out of the 230 respondents there are 111 from the construction sector and 119 from the services sector.

Regarding to the position in the firm, it showed that there are 40.4% of the population are upper management of the firm, 35.2% of them are middle management and 24.3% are the lower management of the firm. From the Table 4.1, the majority of the respondents are experienced, whereas there are 66.5% of the population were with 5 years and above working experience and the remaining 33.5% are less than 5 years working experience.

`Table 4.1 Personal characteristics of the respondents

Personal Characteristics	Frequency	Percent
Firm Size		
Small (5 to 29 full-time employees)	123	53.5
Medium (30 to 75 full-time employees)	107	46.5
Total	*230*	*100.0*
Business sector		
Construction	111	48.3
Services	119	51.7
Total	*230*	*100.0*
Position		
Upper management	93	40.4
Middle management	81	35.2
Lower management	56	24.3
Total	*230*	*100.0*
Working experience		
Less than 5 years	77	33.5
5 years and above	153	66.5
Total	*230*	*100.0*

To determine the awareness of CCS on the SMEs organisation and usage of CCS on their project were asked with a Likert scale question. Where the scale was broken down into 5 segments from 1 denoting extremely low to 5 represented extremely high. According to Field (2005), the mean score value less than 3.0 as an insignificant to the research since in the 5 level Likert scale, 3.0 was catered as neutral. Therefore, descriptive analysis results displayed on the Table 4.2 and showed that the organisation used CC on their project with a mean score of 3.7870 that regarded as significant and also showed that the SMEs considered highly using CCS on their projects.

Table 4.2 Cloud computing usage on projects

	Mean	Std. Deviation
Level of usage	3.7870	1.00774

4.2 Rank analysis on factors

In order to have a better understand on the prioritises of the adoption factors of CCS, the questionnaire were deemed to evaluate the importance of each of the factors and the collected data were analysed with the Descriptive statistical in SPSS to rank the adoption factors of CCS. Based on the publisher of Field (2005) as defined on the above, the mean score that more than 3.0 will be deemed as significant factors for the research and the standard deviation values less than 1.0 indicate consistency among the respondents. Therefore, if the multiple factors which have the same mean score and the lower standard deviation factor will be rank as higher importance.

The rank analysis from the SPSS's descriptive statistical analysis outcome was displayed on the Table 4.3. The top five critical factors from the result are: Compatibility; Perceived usefulness; Relative advantage; Technological capability; and Perceived ease of use. This top five factors' mean score values were higher than 4.0 which is deemed as agree in the Likert scale of 5 level. Even more, the lowest factor mean score value is 3.5652 which is much higher than the threshold of 3.0 as per Field (2005) deemed as the significant factors. Therefore, based on the mean score of Table 4.3, the results show that all the factors are significant to the research and it will positively affected the adoption of CCS for the SMEs during the pandemic.

The highest-ranked factor that affected the adoption decision is Compatibility and it has mean score higher than 3.0 therefore the hypothesis

(H5) was accepted which means it has positive relationship with adoption of CCS. Perceived usefulness ranked as second and has the mean score 4.1348 therefore the hypothesis (H1) was supported and it has positive relationship with adoption of CCS. Relative advantage ranked as third and has the mean score 4.1043 therefore the hypothesis (H6) was accepted and it shows that it will positively affect the adoption of CCS. Technological capability ranked as forth with mean score 4.0913 therefore the hypothesis (H4) was accepted and has positive relationship with adoption of CCS. Perceived ease of use ranked as fifth and has mean score 4.0087 therefore the hypothesis (H2) was supported and it positively affect the adoption of CCS.

The sixth ranked factor is top management support with mean score of 3.9696, thus it shows that the hypothesis (H12) has positive relationship with adoption of CCS and accepted. The seventh ranked factor is Technology optimism with mean score of 3.9348, therefore it shows that the hypothesis (H3) was accepted and has positive relationship with adoption of CCS. The eighth factor is organisational scale and has mean score of 3,9261 which is higher than 3.0 therefore hypothesis (H9) was supported and it will positively affect adoption of CCS. Organisational readiness was ranked on ninth place with mean score 3.8783, thus hypothesis (H10) was accepted and positively affect adoption of CCS. The tenth factor is market demand with mean score of 3.8739, therefore hypothesis (H15) was supported and positively affect adoption of CCS.

The eleventh factor is competitive pressure with mean score of 3.8000 therefore hypothesis (H16) was accepted and it has positive relationship with adoption of CCS. Absorptive capacity ranked as twelfth and it has mean score

3.7261 therefore hypothesis (H11) was accepted and will positively affect adoption of CCS. Managerial support was ranked as thirteenth with mean score of 3.7130, thus hypothesis (H14) will positively affect the adoption of CCS and supported. The fourteenth factor is human resources with mean score 3.7043, therefore hypothesis (H13) was accepted and has positive relationship with adoption decision.

Trading partner readiness was ranked as fifteenth factor and has mean score of 3.6739, therefore hypothesis (H18) was accepted and positively affected the adoption of CCS. The sixteenth factor trialability with mean score 3.6304, therefore hypothesis (H7) was accepted and has positive relationship with adoption of CCS. The seventeenth factor is government support with mean score 3.6130, therefore hypothesis (H17) was accepted and it will positively affect adoption of CCS. The last ranked factor is observability with mean score of 3.5652, although it ranked last but the mean score is higher than 3.0 therefore hypothesis (H8) was supported and it will positively affect adoption of CCS. From the result of Table 4.3 showed that all the mean score of the analysis were higher than 3.0 thus it prove that all the hypothesis will be accepted and will positively affect the adoption decision of CCS.

Table 4.3 Ranks of adoption factors of cloud computing

No	Factors	Mean score	SD	Mean Ranking
1.	Compatibility	4.1565	0.85234	1
2.	Perceived usefulness	4.1348	0.87374	2
3.	Relative advantage	4.1043	0.82403	3
4.	Technological capability	4.0913	0.85418	4
5.	Perceived ease of use	4.0087	0.85136	5
6.	Top management support	3.9696	0.76720	6
7.	Technology optimism	3.9348	0.85146	7
8.	Organisational scale	3.9261	0.87104	8
9.	Organisational readiness	3.8783	0.80552	9
10.	Market demand	3.8739	0.83938	10
11.	Competitive pressure	3.8000	0.82748	11
12.	Absorptive capacity	3.7261	0.76991	12
13.	Managerial support	3.7130	0.80137	13
14.	Human resources	3.7043	0.84081	14
15.	Trading partner readiness	3.6739	0.87803	15
16.	Trialability	3.6304	0.90024	16
17.	Government support	3.6130	0.86807	17
18.	Observability	3.5652	0.83201	18

Apart from the adoption factors, in the questionnaire survey we did joined additional question for the project performance (work productivity, cost and work quality) once adopted CCS in the organisation. The collected data were analysed with descriptive statistical analysis in SPSS and the outcome was displayed on the Table 4.4. The results showed that after adoption of CCS in the organisation, project performance will be improved in work productivity, cost and work quality. As stated in Field (2005), the mean score of these three performances are much higher than the threshold of 3.0.

Table 4.4 Ranks of project performance with adoption of CC

No	Project Performance	Mean Score	SD	Mean Ranking
1.	Work productivity	4.2130	0.78901	1
2.	Cost	4.0304	0.79515	2
3.	Work quality	3.9870	0.87906	3

4.3 Factor analysis

Factor analysis was conducted for the collected data and there are two statistical measures also generated by the SPSS with the factor analysis that help to assess the data factorability which are Kaiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity to measure of sampling adequacy. From the results of Table 4.5, KMO value obtained 0.878 which is higher than the minimum value (0.6) for a good factor analysis as suggested by Julie (2011). And the Bartlett's test of sphericity (χ^2= 1522.753, df = 153, significant level = 0.000) where the significant (p<0.05). According to Julie (2011), this prove that the data considered appropriate for factor analysis.

Table 4.5 Kaiser-Meyer-Olkin and Bartlett's test of sphericity of adoption factors

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0.878
Bartlett's Test of Sphericity:	
Approx. Chi-Square	1522.753
df	153
Sig.	0.000

Factor analysis was conducted for the project performance with adoption of CCS and the results of Table 4.6 showed that the obtained KMO value is 0.653, Bartlett's test of sphericity (χ^2= 145.173, df = 3, significant level = 0.000). Thus, the results prove that the data are appropriate for conducting the factor analysis.

Table 4.6 Kaiser-Meyer-Olkin and Bartlett's test of sphericity of project performance

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0.653
Bartlett's Test of Sphericity:	
Approx. Chi-Square	145.173
df	3
Sig.	0.000

The factor analysis was further conducted with the principal component analysis (PCA) with varimax rotation. This varimax rotation represent the correlation between the variables and how the variables weighted. The analysis used to determine the principal component by examines the eigenvalues of the components which are above 1.0 will be selected as the principal components as showed in the Table 4.7.

Table 4.7 Eigen values of the components for adoption factors

Component	Eigen values	% of Variance	Cumulative % of variance
1	6.353	35.292	35.292
2	1.926	10.698	45.990
3	1.059	5.881	51.871

The Table 4.7 showed that there are three principal components were selected and where the first component with the eigenvalue of 6.353, follow by the second component with eigenvalue of 1.926 and the last component with eigenvalue of 1.059. The second column of the table was presenting the percentage of the variance of each of the component and the last column was presenting the cumulative percentage of variance. From the results, it showed that this three components were represented 51.871% of the variance which is fulfilled the minimum criterion of 50% of the variation based on Stern's research [as cited in (Aghimien, Aghimien, Fadiyimu, & Adegbembo, 2018)].

Table 4.8 Eigen values of the components for project performance

Component	Eigen values	% of Variance	Cumulative % of variance
1	1.929	64.310	64.310
2	0.650	21.651	85.961
3	0.421	14.039	100.00

The results of Table 4.8 showed that only one principal component will be selected and the eigenvalue is 1.929 and it did represented 64.310% of the total variance. Based on the results, it proven that this factor analysis fulfilled the minimum criteria of the variation.

From the consequence in the Table 4.9, there are three component which the eigenvalues were greater than 1.0 on the principal component analysis. Based on the factor inherent relationships among the variables of each of the components, the component was named as: -

- Component 1: Environmental Conduciveness
- Component 2: Technological Advantages
- Component 3: Organisational Capabilities

The result of factor analysis slightly different with the pre-determined variables of the TOE framework but the main/highest values of the factors for each component were still belonging to the TOE framework context. For the first component, the top few factors were belonging to the environmental context factors therefore the fight component were named as Environmental Conduciveness. For the second component, all the adoption factors were belong to the technological context factors, therefore it named as Technological Advantages. For the third component, the top five adoption factors were from the organisational context factors. Thus, the third component will be named as Organisational Capabilities.

Table 4.9 Rotated components matrix for adoption factors

Adoption Factors	Component		
	1	2	3
Managerial support (F14)	0.749		
Trading partner readiness (F18)	0.689		0.383
Competitive pressure (F16)	0.632		
Observability (F08)	0.594		
Organisational readiness (F10)	0.559		0.313
Trialability (F07)	0.559		
Top management support (F12)	0.531		
Perceived usefulness (F01)		0.779	0.324
Compatibility (F05)		0.745	
Technological capability (F04)		0.697	
Relative advantage (F06)		0.689	
Perceived ease of use (F02)		0.675	
Technology optimism (F03)	0.376	0.552	
Organisational scale (F09)			0.718
Absorptive capacity (F11)			0.656
Human resources (F13)	0.341		0.656
Market demand (F15)			0.627
Government support (F17)	0.304		0.550

Table 4.10 Components matrix for project performance

Project performance term	Component
	1
Work productivity	0.844
Cost	0.828
Work quality	0.728

From the result of Table 4.10, it showed that there is one principal component will be formed and it do represent more than 64.310% of the total variance of the project performance. Since there is only one principal component will be selected, therefore there will not conduct rotated component matrix for project performance. With the related term of the variables, this component will be named as "Project performance with the cloud adoption".

4.3.1 Environmental Conduciveness

The first component "Environmental Conduciveness" consists of seven critical variables: Managerial support; Trading partner readiness; Competitive pressure; Observability; Organisational readiness; Trialability; and Top management support. These critical variables under this component focus on the environmental conduciveness when adoption of CCS. The component were represent 35.292% of total variance of all the critical variables as displayed on Table 4.7.

Skafi et al. (2020) stated that environmental conduciveness such as managerial and professionals are significant, and the competitive pressure will have significant relationship with the adoption of CCS. Based on Vidhyalakshmi and Kumar (2016)'s research, the researcher stated that the trust of the cloud supplier and competitive pressure will have strong relationship to the decision of adoption and did proven that these factors positively influenced the cloud adoption. The researcher Borgman et al. (2013) stated that environmental context such as government support or external competitive intensity could be important to the adoption but it could also block the adoption decision in unregulated legal environments. Al-Mascati and Al-Badi (2016) concluded that trusted and reliable service provider and inadequate telecom services may be the essential factors which play an important role in the cloud adoption since they will provide sustainable availability and accessibility to the provided services.

Ali, Soar, and Shrestha (2018) concluded that trusted service provider dependability is a requirement for the consideration factors in adoption of CC. The degree of user confidence of the system will be measured on the principal

features in term of availability, reliability, safety and security.

4.3.2 Technological Advantages

There are six variables consisted in this "Technological Advantages" component such as (Perceived usefulness; Compatibility; Technological capability; Relative advantage; Perceived ease of use; and Technology optimism). These critical variables focus on the technological advantages that will gain from the adoption of CCS. From the Table 4.7, it did represent 10.698% of the total variance of the critical variables.

Based on Ali et al. (2021)'s research, the researcher stated that technological advantages such as compatibility and complexity as the significant factor for the new technology adoption and the technological perceived benefits of the innovation will positively impact the cloud adoption. Cost reduction of cloud technology from the capital expenditures on IT devices, reducing maintenance and energy costs will be one of the critical roles for the cloud adoption.

Picoto et al. (2021) stated that technological advantages like convenience of the technology will be a strong determinant of cloud adoption and the organisation emphasize the need for compatibility of CCS with the existing information systems. Based on Borgman et al. (2013)'s research, the researcher did conceptualized the link of TOE framework and adoption decision and they found that technological perceived related advantages positively influence the adoption decision. Al-Mascati and Al-Badi (2016) stated that cost benefits that will help the organisation to reduce the expenditures on IT devices and trialability of the system that provide trial

periods to examine the solution will positively influence the decision of cloud adoption.

Ali et al. (2018) had summarised transportability of the CC such as capability and flexibility of the systems and equipment will permits the organisation towards the adoption of CCS. They also highlighted anticipated benefits from the CC will impact the cloud adoption such as provision of better services, cost reduction, reduction of IT infrastructure; time efficiencies and risk minimisation.

4.3.3 Organisational Capabilities

For the "Organisational Capabilities" component, it contains of five critical variables: Organisational scale; Absorptive capability; Human resources; Market demand; and Government support. This cluster is responsible for 5.881% of the total variance explained among all the critical variable (Table 4.7).

According to Mkhabela and Lavhengwa (2021), the decision maker for the adoption of CCS will concern on the human components which will help on the decision maker to strategically utilise CC and gather the information, identify and solve the problems during the adoption. Based on Skafi et al. (2020), organisational capabilities such as top management support and skilful of resources give highly support and provide greater information on the innovation and the larger the firm size will positively influencing the adoption process, therefore organisational capabilities will play significant role in the cloud adoption.

The researcher stated that the organisation scale play a vital role for the organisational context and it demonstrate significant influence to the adoption of CCS (Ali et al., 2021).According to Picoto et al. (2021), the researcher stated that the need of IT skills in organisational resources will enhance the confidence to engage in the cloud adoption. Other than this, the scale of the IT experts, familiarity on technology and the organisation budget may result positively to the cloud adoption.

The researcher Vidhyalakshmi and Kumar (2016) analysed that employees' know how and their information skills, managerial capacity and expertise interpret the total variance in the analysis and these factors play an important role in the cloud adoption. Borgman et al. (2013) showed the top management supporting could be positively linked to the cloud adoption decision. Ali et al. (2018) summarised on the organisational context for the CC such as top management support, organisation scale and employees' knowledge were importantly supported, and it is a critical element for the cloud adoption.

4.3.4 Project performance with cloud adoption

The factor component concluded from the factor analysis for the project performance was named as "Project performance with cloud adoption". This component did represent 64.31% of the total variance which are the project measurements in productivity, cost and quality. According to Odusanya, Ochoa, Chileshe, and Ahn (2021) research, the researchers described that how the factors impact the IT project performance on the traditional measurement in time, cost and specification. Khayer, Talukder, Bao, and Hossain (2020)

concluded that their research confirms the adoption of CC will positively impact the organisations' project performance thus the organisation should consider on the cloud adoption to improve their performance and reduce the operational cost.

Lal and Bharadwaj (2016) found that adoption of cloud based services will impacts the organisational flexibility such as organisational performance, economic, process and market. Attaran and Woods (2019) stated that adoption of CC will provide a significant savings for the organisation, improve on their productivity and allow the organisation to save time and focus more on new opportunities. Based on Gangwar (2017) findings, the researcher found that there are significantly moderated between CC usage and project performance by the organisation scale. Therefore, with all the previous studies we can concluded that adoption of CC can significantly and positively impact the project performance.

CHAPTER 5 - CONCLUSIONS AND RECOMMEDATIONS

5.1 Conclusions

In conclusion, CCS will pilot great advantages to the organisations such as reduce the operational costs and increase their project performance. Our quantitative data of this research was presented by management level of SME in Klang Valley, Malaysia. In summarized, the main respondents were from services and construction business sector and majority of the respondents did use CC in their projects.

In this research, we have conducted factor analysis with SPSS software for the adoption factors with the TOE framework and determined three principal components for the adoption of CCS among SME during the covid-19 pandemic. The three components are conceptualized and named as Environmental Conduciveness; Technological Advantages; and Organisational Capabilities and all the components identified in the research appear to be significant to determine the adoption decision of CC.

In results, we concluded that the principal components of the factor analysis will positively impact the decision of cloud adoption. Moreover, we summarised from the quantitative data that the project with CC will positively increase the project performance in term of work productivity, cost and quality.

5.2 Study Limitation

The limitation of the research is the survey questionnaire only cater the construction and services sector that located in Klang Valley, Malaysia. And all the respondents were from the public sector not included the government sector.

5.3 Recommendation for Future Research

Recommendation for future work for this research title should develop a research that involves more business sector, other district and induct larger scale of organisation to assess the decision-making factors to determine decision of adoption of CC in Malaysia. Further research should involve government sector instead of only public sector to have a comprehensive respondents data.

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APPENDIX A - SURVEY QUESTIONNAIRES

Cloud Computing Adoption among Small and Medium-Sized Enterprises Questionnaire

tohtc@utar.edu.my (not shared) Switch account

* Required

Section A: Demographic Information

Please select only one answer for each item.

DI01) Firm size: *

- ◯ 1) Small (5 to 29 full-time employees)
- ◯ 2) Medium (30 to 75 full-time employees)

DI02) Business sector of the firm: *

- ◯ 1) Agriculture
- ◯ 2) Construction
- ◯ 3) Manufacturing
- ◯ 4) Mining and quarrying
- ◯ 5) Services

DI03) Level of cloud computing usage on projects: *

	1	2	3	4	5	
Extremely low	○	○	○	○	○	Extremely high

DI04) Position in the firm: *

- ○ 1) Upper management
- ○ 2) Middle management
- ○ 3) Lower management

DI05) Years of working experience: *

- ○ 1) Less than 5 years
- ○ 2) 5 years and above

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Cloud Computing Adoption among Small and Medium-Sized Enterprises Questionnaire

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* Required

Section B: Technological Dimension

To what extent do you agree or disagree that the following technological dimension factors are important for the adoption of cloud computing in your organisation during the COVID-19 pandemic?

F01) Perceived usefulness *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

F02) Perceived ease of use *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

F03) Technology optimism *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

F04) Technological capability *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

F05) Compatibility *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

F06) Relative advantage *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

F07) Trialability *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

F08) Observability *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

Back Next Clear form

Cloud Computing Adoption among Small and Medium-Sized Enterprises Questionnaire

tohtc@utar.edu.my (not shared) Switch account

* Required

Section C: Organisational Dimension

To what extent do you agree or disagree that the following organisational dimension factors are important for the adoption of cloud computing in your organisation during the COVID-19 pandemic?

F09) Organisational scale *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

F10) Organisational readiness *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

F11) Absorptive capacity *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

F12) Top management support *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

F13) Human resources *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

F14) Managerial support *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

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Cloud Computing Adoption among Small and Medium-Sized Enterprises Questionnaire

tohtc@utar.edu.my (not shared) Switch account

* Required

Section D: Environmental Dimension

To what extent do you agree or disagree that the following environmental dimension factors are important for the adoption of cloud computing in your organisation during the COVID-19 pandemic?

F15) Market demand *

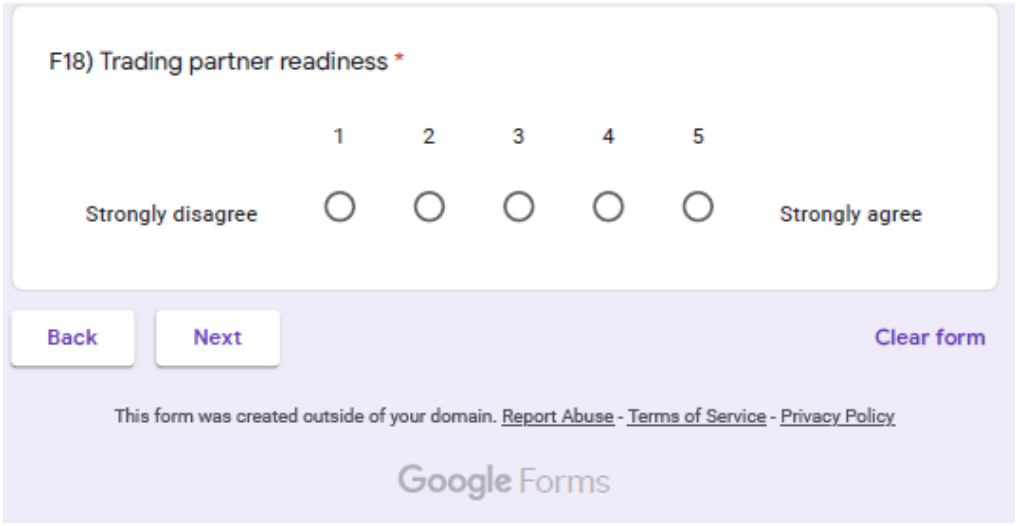
	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

F16) Competitive pressure *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

F17) Government support *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree


F18) Trading partner readiness *
1
2
3
4
5
Strongly disagree
Strongly agree
Back
Next
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* Required

Section E: Project Performance

To what extent do you agree or disagree with the following statements?

PP01) Adoption of cloud computing increases work productivity. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

PP02) Adoption of cloud computing improves cost effectiveness and efficiency. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

PP03) Adoption of cloud computing improves work quality. *

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

APPENDIX B - SPSS RESULTS

Frequency Table

DI01

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1) Small (5 to 29 full-time employees)	123	53.5	53.5	53.5
	2) Medium (30 to 75 full-time employees)	107	46.5	46.5	100.0
	Total	230	100.0	100.0	

DI02

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	2) Construction	111	48.3	48.3	48.3
	5) Services	119	51.7	51.7	100.0
	Total	230	100.0	100.0	

DI04

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1) Upper management	93	40.4	40.4	40.4
	2) Middle management	81	35.2	35.2	75.7
	3) Lower management	56	24.3	24.3	100.0
	Total	230	100.0	100.0	

DI05

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1) Less than 5 years	77	33.5	33.5	33.5
	2) 5 years and above	153	66.5	66.5	100.0
	Total	230	100.0	100.0	

Descriptive Statistics

	N	Mean	Std. Deviation
DI03	230	3.7870	1.00774
Valid N (listwise)	230		

Descriptive Statistics

	N	Mean	Std. Deviation
F05	230	4.1565	.85234
F01	230	4.1348	.87374
F06	230	4.1043	.82403
F04	230	4.0913	.85418
F02	230	4.0087	.85136
F12	230	3.9696	.76720
F03	230	3.9348	.85146
F09	230	3.9261	.87104
F10	230	3.8783	.80552
F15	230	3.8739	.83938
F16	230	3.8000	.82748
F11	230	3.7261	.76991
F14	230	3.7130	.80137
F13	230	3.7043	.84081
F18	230	3.6739	.87803
F07	230	3.6304	.90024
F17	230	3.6130	.86807
F08	230	3.5652	.83201
Valid N (listwise)	230		

Descriptive Statistics

	N	Mean	Std. Deviation
PP01	230	4.2130	.78901
PP02	230	4.0304	.79515
PP03	230	3.9870	.87906
Valid N (listwise)	230		

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.878
Bartlett's Test of Sphericity	Approx. Chi-Square	1522.753
	df	153
	Sig.	.000

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.353	35.292	35.292	6.353	35.292	35.292	3.317	18.430	18.430
2	1.926	10.698	45.990	1.926	10.698	45.990	3.299	18.328	36.759
3	1.059	5.881	51.871	1.059	5.881	51.871	2.720	15.112	51.871
4	.981	5.448	57.319						
5	.880	4.887	62.206						
6	.847	4.705	66.911						
7	.757	4.207	71.118						
8	.727	4.037	75.155						
9	.692	3.845	79.000						
10	.578	3.213	82.213						
11	.560	3.114	85.327						
12	.520	2.891	88.218						
13	.476	2.646	90.865						
14	.399	2.216	93.081						
15	.374	2.079	95.159						
16	.307	1.708	96.867						
17	.290	1.611	98.478						
18	.274	1.522	100.000						

Extraction Method: Principal Component Analysis.

Rotated Component Matrix[a]

	Component		
	1	2	3
F14	.749		
F18	.689		.383
F16	.632		
F08	.594		
F10	.559		.313
F07	.559		
F12	.531		
F01		.779	.324
F05		.745	
F04		.697	
F06		.689	
F02		.675	
F03	.376	.552	
F09			.718
F11			.656
F13	.341		.656
F15			.627
F17	.304		.550

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.653
Bartlett's Test of Sphericity	Approx. Chi-Square	145.173
	df	3
	Sig.	.000

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	1.929	64.310	64.310	1.929	64.310	64.310
2	.650	21.651	85.961			
3	.421	14.039	100.000			

Extraction Method: Principal Component Analysis.

Component Matrix[a]

	Component
	1
PP01	.844
PP03	.828
PP02	.728

Extraction Method: Principal Component Analysis.

a. 1 components extracted.