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**ACCEPTANCE MODEL OF SAAS CLOUD COMPUTING AT  
NORTHERN MALAYSIAN MAIN CAMPUS PUBLIC  
UNIVERSITIES**



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**DOCTOR OF PHILOSOPHY  
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2018**



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## Abstrak

Kemajuan teknologi mempunyai kesan sampingan, walaupun ia bergerak pantas bagi memudahkan kehidupan dan meningkatkan pendapatan perniagaan. Untuk mengatasi aspek negatif sambil mendapatkan teknologi berkonsep mesra, Pengkomputeran Awan sebagai Suatu Servis Perisian (SaaS) telah muncul bagi tujuan mengekalkan sumber semula jadi, menggunakan pengkomputeran dan kuasa secara efektif disamping mencapai prestasi, mengurangkan kos dan meningkatkan pendapatan. Walau bagaimanapun, terdapat kekurangan dalam kajian empirikal yang menyiasat faktor penting yang mempengaruhi penggunaan, penerimaan, atau pengaplikasian perkhidmatan SaaS dari perspektif individu khususnya dalam sektor pendidikan tinggi. Matlamat utama kajian ini adalah untuk menyiasat faktor penting dengan menggunakan model bersesuaian yang merangkumi ciri teknikal, sosial dan kawalan individu, serta kecenderungan keselamatan pengguna. Selain itu, tahap pendidikan juga telah terbukti berpengaruh dalam pengaplikasian inovasi. Oleh itu, satu lagi objektif kajian ini adalah untuk menyiasat peranan tahap pendidikan tersebut. Objektif yang terakhir adalah untuk menyiasat perbezaan di antara kumpulan pelajar dan pensyarah dalam hubungan yang dikemukakan dalam model yang digunakan. Kajian yang menggunakan soal selidik telah dilaksanakan ke atas pelajar dan pensyarah di empat universiti awam di utara Malaysia. Skop penerimaan ialah untuk menyiasat penggunaan perkhidmatan SaaS pada peringkat peribadi. Teori Menguraikan Perilaku yang Dirancang (DTPB) dan Teori Penyebaran Inovasi (DOI) telah digunakan. Keputusan menunjukkan kesesuaian model walaupun peranan Triabiliti dan Norma Subjektif didapati tidak signifikan. Penemuan ini menyumbang kepada bidang pengetahuan dan literatur dalam menonjolkan peranan faktor yang mana penyedia SaaS boleh memanfaatkan dalam perancangan perkhidmatan baru dan untuk mempromosikan penggunaan SaaS kepada universiti.

**Kata kunci:** Decomposed Theory of Planned Behavior (DTPB), Pengkomputeran Awan SaaS, Persepsi keselamatan, Penerimaan teknologi.

## Abstract

Technology advancement has side effects, although it has moved in a fast pace that facilitated life and increased business revenue. To cope with negative aspects while looking for friendly technology, Software as a Service (SaaS) Cloud Computing emerged to preserve natural resources, effectively utilize computing and power consumption, while achieving performance, decreasing cost, and increasing revenue. Yet, there are paucity in empirical studies investigating salient factors affecting the usage, acceptance, or adoption of SaaS services from the individual perspectives specifically in higher education sector. The main objective of this study is to investigate the salient factors with proper model that includes technical, social and control characteristics, as well as user security predisposition. Besides, educational level has also proven to be influential in adopting innovations. Hence, probing its role is another objective. The last objective is to investigate differences between student and lecturer groups in the relationships postulated in the model. A survey with questionnaires was conducted on students and lecturers in four public universities in Northern Malaysia. The scope of the acceptance is to investigate the personal-level use of SaaS services. Decomposed Theory of Planned Behaviour (DTPB) and Diffusion of Innovation Theory (DOI) were applied. Results revealed appropriateness of the model although the role of Trialability and Subjective Norms were not significance. The findings contribute to the body of knowledge and literature in highlighting the role of these factors that SaaS providers could benefit in planning for new services and in promoting SaaS usage to universities.

**Keywords:** Decomposed Theory of Planned Behavior (DTPB), SaaS Cloud Computing services, Security perception, Technology acceptance.

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## List of Abbreviations

AB	Actual Behavior
ADP	Technology Adopting or Acceptance
ATT	Attitude
AUSaaS	Usage, Acceptance, or Adoption of SaaS Cloud Computing
AVE	Average Variance Extracted
BI	Behavior Intention
COM	Compatibility
CR	Composite Reliability
CRD	Credibility (Security and Privacy)
CRI	Cloud Readiness Index
DOI	Diffusion of Innovation Theory
DTPB	Decomposed Theory of Planned Behavior
DV	Dependent Variable
ED	Educational Level
$f^2$	Effect size for $R^2$
FC	Facilitating Conditions
FIMIX-PLS	Finite Mixture Partial Least Squares
HE	Higher Education
IaaS	Infrastructure as a Service
IPMA	Importance Performance Map Analysis
IT	Information Technology
MGA	Multigroup Analysis
MICOM	Measurement Invariance Composite
PaaS	Platform as a Service
PBC	Perceived Behavior Control
PBCFC	Facilitating Conditions Technology and Resources
PBCSE	Self-Efficacy
PEU	Perceived Ease of Use
PLS-SEM	Partial Least Squares- Structural Equation Modeling
PU	Perceived Usefulness
$Q^2$	Predictive relevance
$q^2$	Effect size for $Q^2$
$R^2$	Coefficient of determination
SaaS	Software as a Service
SN	Subjective Norms
SNPI	Peer Influence
SNSI	Superior Influence
TPB	Theory of Planned Behavior
TRI	Trialability
TRT	Trust
TRA	Theory of Reasoned Action
USecP	User Security Predisposition

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background of Study

Since the beginning of the 21<sup>st</sup> century, the development of technology increased and the need for a more powerful hardware is becoming a must to cope with the fast pace of software development, database designs, and operating systems. In essence, the higher the demand for such high-tech hardware, the higher the cost of owning and maintaining. Moreover, the increasing demand for technology, communication, networking, led to a growing number of datacenters with huge sizes, an increasing of electricity consumption, higher demand for processing power, extremely high necessity for storage, and so on. As a result, a high cost of energy, cooling, maintenance, and increasing demand for skilled manpower have embarked. In principle, there are everyday new innovations that changed the course of our life. On the other hand, the technology has negative aspects that veil in silence (Ahmad, Bello, & Nordin, 2013).

Besides, the issues of global warming, CO<sub>2</sub> emission, floods and droughts, pollution, toxic materials, E-waste, and energy crisis are some negative outcomes of technology advancement and production (Ahmad et al., 2013). These emerging issues are increasing to a warning level and, consequently, act as a catalyst for the interest and awareness among ecologists, green groups, practitioners, and academia to look for solutions to cope with the increasing demand for high performance, reliable, and cost effective technology (Ahmad et al., 2013; Bose & Luo, 2011) that are less harm to environment and achieve these demands for the providers of the IT services and the

consumers. Hence, the cloud computing emerged as solution for these issues with its different service and deployment models.

## **1.2 Cloud Computing as a Solution**

Cloud computing with its virtualized technology that better utilizes IT resources and brings efficiency to IT equipment (Bose & Luo, 2011; Durkee, 2010; Vouk, 2008), is one of the emerging technologies that appeared to overcome the negative aspects of technology, increase efficiency of hardware equipment, and reduce IT expenditure. It is noteworthy that ICT is responsible for almost 2% (i.e., 0.86 metric Gigatons) of the global carbon emission (Ahmad et al., 2013; Bose & Luo, 2011; Sultan, 2010). Therefore, the research on solving these issues (i.e., the expenditure, the efficiency, and energy and environmental side effects) gained greater demand among technical and researches on different related fields (Bose & Luo, 2011). Also, cloud computing is an emerging innovative technology that did not reach the maturity level and still at the infancy that needs further exploration of different aspects (Marston, Li, Bandyopadhyay, Zhang, & Ghalsasi, 2011; Saedi & Iahad, 2013a; Saya, Pee, & Kankanhalli, 2010; Senyo, Addae, & Boateng, 2018; W. Y. C. Wang, Rashid, & Chuang, 2011; W.-W. Wu, Lan, & Lee, 2011).

It is noteworthy to know that cloud computing has brought various benefits to different sectors in business, industry, education sectors as well as individual satisfaction. In the educational sector, M. S. Ibrahim, Salleh, and Misra (2015) contended that student and teachers have benefited from cloud services in their daily use inside or outside the campus in terms of immense resource exchange, collaboration, customized learning environments and virtual communities where the educational process is growing and benefiting from cloud computing emerging technology.



In higher education (HE) specifically the universities are challenged to have better technology standards to help students in the learning process with latest teaching methods, and to provide an appropriate technical environment to help researchers and academics. Additionally, higher education institutes have to have good reputation to gain good image and be one of the pioneers that have the latest technologies not only for research purposes, but also to attract more students from the globe. Hence, universities by adopting cloud computing can overcome financial issues (Massadeh & Mesleh, 2013) and, therefore, can facilitate the adoption of innovative technologies (Okai, Uddin, Arshad, Alsaqour, & Shah, 2014) that can help universities to achieve their academic objectives, reduce cost, better utilize IT resources, while achieving good reputation among other institutes to attract students from over the world.

In addition, SaaS Cloud Computing, which can be defined as using the applications on the cloud infrastructure of the service provider by the consumer (Mell & Grance, 2011), is a service model of cloud computing that is an important topic that needs further investigation in developing countries, and Malaysia in specific. Therefore, cloud computing (such as SaaS) becomes an important tool to overcome the hurdle of HE financial issues and to comply with the resolve of environmental issues to lower side-effects of technology while meeting the demands of the consumer on the organizational and the individual levels. The following subsection will shed the light on different issues and gaps under problem statement of this current study.

### **1.3 Problem Background on Cloud Computing Usage, Acceptance, or Adoption**

Development of technology is a fast-growing sector that infiltrate our life in all aspects. Information technology has run into different stages, namely: stage of general purpose mainframes and minicomputers, Personal Computers (PC), Client-Server, Enterprise computing, and recently the cloud computing with its mobility era (Bayramusta & Nasir, 2016). Additionally, the growing demand for a more powerful hardware in terms of storage, scalability, reliability, high performance, and cost-effectiveness is becoming a must to cope with the fast pace of software development and database architecture designs.

In the awake of these events and immense need for high technology to achieve business and consumer satisfaction, cloud computing surfaced with its virtualized technology to better utilize IT resources and bring efficiency to IT equipment (Bose & Luo, 2011; Durkee, 2010; Vouk, 2008) in addition to overcome the negative aspects of technology. More importantly, the future trend of the expenses on IT resources in the coming years until 2020 will be on cloud computing systems and services based on Gartner (Gartner, 2016) and this lead to a fierce competition among the giant providers of cloud computing services, including SaaS services, to share in this projected revenue of \$1 Trillion (Senyo et al., 2018). This issue triggers more focus on the usage, acceptance, and adoption of SaaS Cloud Computing services, among other Cloud service and deployment models, in the academia.

#### **1.3.1 Cloud Computing in Malaysian Context**

The cloud computing adoption programs were initiated in Malaysia in 2014 by the government to create an ecosystem and encourage the migration to a new innovative

and global market trend (S. K. Chan & Miyazaki, 2015). However, cloud computing has been investigated in Malaysian contexts in previous works with focus on the organizational level. For example, Mokhtar, Ali, Al-Sharafi, and Aborujilah (2013) conducted a study on the adoption in the organizational level and proposed transition strategies for the academic institutes. However, the focus was on the organization (i.e., mezzo-level) and not the individual (i.e., micro-level). Likewise, a study conducted by Gupta, Seetharaman, and Raj (2013) focused on the inclination of small and medium business firms in Singapore, India, and Malaysia to adopt cloud computing. Their investigation aimed to unveil the factors influencing the adoption. However, their studies lack the investigation of the user-level factors and focused on the business side and the views of the organizational level.

Further, in a recent study on the adoption of cloud computing in Malaysia, Hassan, Nasir, Herry, Khairudin, and Adon (2017) conducted a research on Malaysian Small and Medium business Enterprises. They emphasized on the lack of empirical investigation in Malaysian contexts to investigate the salient factors influencing it. Besides, the authors assert the growing demand on the cloud end-user services such as office applications and e-mail on daily business activities that created challenges and opportunities. However, their study focused mainly on the Organizational level.

In the same token, a study conducted by Tarmidi, Rasid, Alrazi, and Roni (2014) emphasized on the scarcity of studies on the area of cloud computing in general and in Malaysian context in specific. Similarly, Saedi and Iahad (2013b) developed an instrument and framework to study cloud computing adoption in Malaysian Small and Medium Enterprises (SME) on the organizational level. However, their studies merely focused on SME. Another study investigated the influence rate of cloud computing

services and applications in Malaysian (Moghaddam, Karimi, & Hajivali, 2013). Their study, also, took into consideration the organizational business level and overlooked the user-level. Besides, the results revealed a recommendation to raise the awareness and interest of the business companies of this technology by the service providers and IT organizations in Malaysia. Hence, this is another indication of the immense need to further probe the cloud computing in Malaysia.

Hence, this review of previous works gives an indication of the paucity of research on the Malaysian context and justifies the investigation on cloud computing on different levels, not only the organizational level, but also the user level. Besides, the researcher addresses this gap in the current study.

### **1.3.2 SaaS Cloud Computing**

Software-as-a-Service provides tangible benefits and opportunities to individual in their daily errands and academic tasks. Besides, W.-W. Wu (2011) opined that SaaS is the most tempting solutions among other cloud services; however, it is not adopted eagerly as expected. Furthermore, it is found in literature that SaaS cloud computing services are most commonly used at universities and users are more interested in using them compared with other models, such as PaaS (i.e., Software as a Service) and IaaS (i.e., Infrastructure as a Service) (Akande & Van Belle, 2014; Vaquero, 2011). The reason behind that could be to the user-friendly and easiness nature of SaaS applications and services that meets the needs of the individual in his/her daily errands (e.g., communication, and entertainment, collaboration, and storage) compared with other services such as PaaS and IaaS, where high technical skills are required, coding, and are difficult to extrapolate to other subjects that are non-technical (Vaquero, 2011).

On the other hand, Martins, Oliveira, Thomas (2016) stated that SaaS has an important role in the software delivery market but less attention on its adoption has been paid in the previous works. Besides, the authors addressed the importance of studying SaaS Cloud Computing as it is challenging and evolving technology; however, they addressed that it is still a nascent concept that gained the popularity only in recent years.

Furthermore, Gashami, Chang, Rho, and Park (2016) indicated that previous works on SaaS Cloud Computing focused their lenses on small and medium enterprises (SME) in both public and private sectors. The author contended the scarcity of SaaS adoption studies on the user-level that probe their perceptions in the decision-making phase of SaaS usage. Also, the authors noted the lack of empirical research and verification on SaaS and cloud computing, which most of the studies are descriptive in nature. This gap is addressed in this research to be filled by the current research.

On the other hand, existing literature focuses on the organizational level of the potential of SaaS Cloud Computing and overlooked the individual's perceptions and understanding of SaaS acceptance or adoption, although of its potential market share (Gashami et al., 2016; W.-W. Wu et al., 2011). This study addresses this issue in studying SaaS Cloud Computing on the personal level use and aims at closing the gaps in scarcity of empirical studies on SaaS and on the user-level. Indeed, narrowing the scope to study the personal use of SaaS services extrapolates the future development from the current trends of the respondents that revealed from this study.

### 1.3.3 Cloud Computing in Higher Education

The higher education institutes have also their issues and gaps relevant to cloud computing usage, acceptance, or adoption. For instance, Mokhtar, Al-Sharafi, Ali, and Al-Othmani (2016) emphasized on the crucial role of cloud computing technology at higher education institutes, yet many of them did not fully benefitted from it adequately. In the same sequence, Mokhtar et al. (2013) asserted that adoption of cloud computing at higher educational institutes is low that warrants the investigation of the influencing factors in this sector. These findings, consequently, triggers an alarming situation that further justifies studying higher educational sectors empirically in more studies giving more focus on the usage, acceptance, or adoption process of cloud computing.

Mokhtar et al. (2016) investigated the adoption of cloud computing from an organizational point of view using TOE framework (i.e., technology, organization, environment) and identified the adoption factors at higher educational institutes with the inclusion of adoption plan. However, individuals' opinion and their point of view of the usage, acceptance, or adoption of cloud computing is overlooked. As it known, the main adopter of the technology is the end-user and his/her opinion is crucial to continue the usage, improvement, or adoption of innovative technologies.

Additionally, M. S. Ibrahim et al. (2015) in their explicated systematic literature review on empirical investigation of cloud computing studies at higher education institutes stressed on the paucity of extensive empirical studies on this sector and the literature merely concentrates on the frameworks and implementation. Moreover, they noted that the top users of cloud computing came from the industrial service sector (12%), business (10%), manufacturing services sector (10%), whereas the educational

sector occupies only (4%). Based on these figures, it is clear that the educational sector needs more investigation to probe this low rate of usage from different aspects and raises an issue to solve this phenomenon. Hence, this addresses a gap to be filled in the higher education sector in terms of an empirical investigation of the acceptance.

More importantly, the most recent literature review on cloud computing adoption based on remarks of Senyo et al. (2018) asserted and highlighted the limited knowledge on the theories, frameworks, and models underpinning the understanding of cloud computing in its research. The authors highly recommend the research on this area as it still lacks the comprehension and holistic understanding. They additionally recommended to explore these related issues as to provide a springboard for future studies, deep understanding of Cloud issues, and this consequently would lead to enhance the contribution to the practical implementation of cloud computing in all its different categories; deployment and service models (such as SaaS Cloud Computing).

Furthermore, Ewuzie and Usoro (2012) in their study tried to shed the light on the importance of e-learning evolution at higher education institutes with the assistance of cloud computing adoption to keep pace in the continual improvement of learning/teaching process at higher education institutes. The authors articulate the need to adopt cloud computing as a vehicle towards the development of e-learning as it has variety of applications supported regardless of the hardware used, flexibility, cost-effectiveness, QoS guaranteed, and rapid resolution for emergencies with its capability to recover and automate resource management. Besides, the authors addressed the adaptive capabilities of cloud computing in meeting the dynamic and concurrent requests of storage demand by the learners (i.e., students and other researchers) in which this technology provides. Although their conclusion advocates the research on

the adoption of cloud computing, no empirical evidence was supported to investigate the adoption process or usage of this technology in their work.

In the same sequence, Masud and Huang (2012) proposed a roadmap for higher education institutes to adopt cloud computing. However, their framework did not include any empirical investigation of the salient factors that influence the adoption process.

Besides, in an early work of Razak (2009) exploring the benefits, offerings, and challenges of cloud computing at higher education institutes in Malaysia, the researchers did not employ any empirical investigation of the adoption process at Malaysian higher education context, although emphasized on the crucial role of cloud computing in the teaching-learning process over the traditional methods. This study was based on only viewpoints of the Malaysian higher education and the focus was on the mezzo level (i.e. organizational level) and overlooked the micro level (i.e. the individual).

Therefore, the researcher presents this issue as a supportive evidence of the previous gaps that warrant more investigation in HE institutes to probe salient factors influencing the usage, acceptance, or adoption process at this sector. Also, this finding brings the topic of cloud computing at higher education sector to the forefront to empirically validate it.

#### **1.3.4 Cloud Computing and End-User Perspectives**

Notwithstanding of the amount of extant research on cloud computing, studies that specifically examined the field of cloud adoption (e.g., SaaS storage as a service) from



an end-user perspective is scarce (Burda & Teuteberg, 2015). Furthermore, while taking into account the studies conducted in Malaysian context, the research was merely based on the organizational level of the cloud computing adoption in Malaysia (Gupta et al., 2013; Hassan et al., 2017; Mokhtar et al., 2013; Tarmidi et al., 2014). Additionally, Hobfeld, Schatz, Varela, and Timmerer (2012) emphasized that to ensure continual business survival and improvements' satisfaction of cloud service providers, the end user's perception has to be valued and ensured to be in the same level before the adoption of these cloud services or migration to new featured ones provided

These authors inferred that end user is a crucial factor in promoting new cloud services, migrating to it and even continuing the usage. They also highlighted the need to verify different user populations especially those who are the primary users of this technology. Consequently, these arguments present further evidence to support this gap in the inclusion and exploration of the individual's perception of SaaS services and applications.

### **1.3.5 Cloud Computing and Gaps to Include Students and Teaching Staff**

In a recent research, Huang (2016) emphasized on the role of cloud services on educational sector; however, the author ensured that the perception of students has received little scholarly attention and their opinions are not taken attentively. Besides, Behrend, Wiebe, London, and Johnson (2011) recommended the inclusion of teachers/instructors on future studies of cloud computing adoption or implementations as their understanding and beliefs is crucial in the implementation, acceptance, and adoption process and their views differentiate with that of students.

Interestingly, Yuvaraj (2016) contended the scarcity of research dealing with the users' perception on cloud computing adoption or implementation and emphasized on the need to consider the users' perceptions when taking such decisions. The researcher addresses this gap in studying jointly both groups in a single framework and the comparison between these two groups is warranted to bring more insights in the area of usage, acceptance, or adoption of SaaS Cloud Computing.

### **1.3.6 Cloud Computing and Social-Technological Factors**

Moreover, Huang (2016) addressed the importance of social and technological factors in studying the intention to use Cloud services in literature review. However, the author contend that these two factors lent less attention in academia to be jointly studied in a comprehensive model to address the decisive factors for adopting cloud computing services. Therefore, this gap is addressed in this research, in addition to the previous gaps, to probe the social (i.e. subjective norms, superiors and peer influence) and technological (i.e. perceived ease of use, perceived usefulness, compatibility, and trialability) decisive factors' effects on the outcome of the model proposed.

### **1.3.7 Cloud Computing User Security Predisposition Issues (USecP)**

Another facet of cloud computing services is the security concerns that the user holds in terms of trust and credibility. First of all, Burda and Teuteberg (2014) demonstrated that there is consensus among scholars in different disciplines that trust is an effective element in enabling relationships that suffers from uncertainty situations, fear of opportunism, and risky environments (Burda & Teuteberg, 2014). Besides, in a recent study (Al-Shqeerat, Al-Shrouf, Hassan, & Fajraoui, 2017), at higher education institutes, the authors indicated the tangible benefits and immense opportunities that

higher educational institutes can gain from the adoption of cloud computing. On the other hand, they emphasized on the users concerns of security and privacy issues that may hinder the adoption on a large scale in various sectors of the universities.

Furthermore, Tarmidi et al. (2014) in their study on cloud computing at Malaysian SME contended that security and trust are the main barriers to adopt cloud computing. Consistent with extant literature in information systems that investigated the trust in online services such as: online Banking services (Hanafizadeh, Behboudi, Koshksaray, & Tabar, 2014; S. Y. Yousafzai, Foxall, & Pallister, 2010), cloud computing services such as: in e-Government (Lian, 2015) or in mobile payment services (Lu, Yang, Chau, & Cao, 2011), the current study is concerned about trust (that is in the current study included as one element of individual's security predisposition construct) in terms of what is expected rather than what is actually feared.

The rationale behind the inclusion of trust in the current study, however, is in line with former work conceptualization of Burda and Teuteberg (2014). Additionally, trust is in the current study is covering the legal, technological, transactional, and connection aspects of using, accepting, or adopting SaaS applications on personal use. Moreover, Burda and Teuteberg (2014) articulated that when the user accepts the risks and vulnerabilities underlying the usage of cloud storage, i.e. based on their beliefs to meet their expectations, competence, integrity, it is more likely to overcome the concerns, fear, and hesitance to use cloud technology services. Transferring these findings to the context of this study, whereby security concerns reside, the researcher believes that if the trustor (the user of SaaS technology) do not put in place trust on the provider (the trustee) of SaaS services and agree on their service contract (i.e., as user of the offered

services on the personal level), it is not possible for him/her to use or benefit from their services offered.

In light with these views and based on the previous works on different information system disciplines that affirm the role of positive and direct effect of trust on intention/adoption (Engwanda, 2014; Hanafizadeh et al., 2014; Lian, 2015; Lu et al., 2011; Siang, 2012; Yee-Loong Chong, Ooi, Lin, & Tan, 2010), the study includes trust as one component and dimension of user security predisposition construct (USecP) and borrowed the items from established and well-tested models. This attempts to attest trust's influence on the adoption process of the personal level of SaaS services in the current study, along with another dimensions (i.e. credibility), that relate to USecP towards the usage, acceptance, or adoption of SaaS services.

Secondly, and as a second dimension of USecP, in previous works credibility has proven to be a strong factor influencing the intention to adopt or use online services (Ariff, Yeow, Zakuan, Jusoh, & Bahari, 2012; Dasgupta, Paul, & Fuloria, 2011; Luarn & Lin, 2005). In addition, a recent study by S. W. Wang, Kao, and Ngamsiriudom (2017) contended that the more credibility perceived, the lower risk the consumer believes in taking an action or decision to adopt a behavior. Therefore, credibility is an important factor influencing the usage, acceptance, or adoption of SaaS services as any technology especially when it is based on unsecure environment such as the internet. Noteworthy, the credibility is a combination of privacy and security that the individual possesses towards the provider of SaaS applications and services.

To explain more, when the user has a positive feeling of security while performing any transaction with the cloud provider such as: sending/receiving e-mail, uploading

images and important personal data, this would facilitate the use, acceptance, or adoption of SaaS services. The user also has to have confidence in that during transactions, the data collected do not violate his/her privacy. So, the sense of security in the systems or transaction of data and not violating the privacy of the data collected during the transaction with the provider must be in place in order to achieve credibility of SaaS services provider.

In sum, the individual-related issues such as: Trust, privacy, and security, and social issues were found in previous works (Arpaci, 2016; Burda & Teuteberg, 2015; K. Wu, Vassileva, & Zhao, 2017). However, the inclusion of these constructs along with other individual beliefs in a single holistic model is lacked. Transferring these findings and views, the study perceived the inclusion of credibility and trust as dimensions of USecP construct is warranted due to their crucial importance in unsecure environments such as SaaS Cloud Computing environments.

### **1.3.8 The Demographic Effect of Educational Level as a Moderator**

Further, it has been revealed that demographic factors, such as educational level (ED), are vital in moderating the relationships toward the intention, acceptance, or adoption of technology (Giovanis, Binioris, & Polychronopoulos, 2012; Hew & Kadir, 2016; Jafarkarimi, Saadatdoost, Sim, & Hee, 2016). Moreover, it is noted that academic qualifications or the educational level make difference on the intention or the usage behavior directly or indirectly and are assumed to be pertinent to human-computer interaction studies (Hew & Kadir, 2016; Jafarkarimi et al., 2016). Consequently, and in line with the previous findings, the researcher decided to explore ED moderating effect on the current study pertaining the intention and user security predisposition towards usage, acceptance, or adoption of SaaS services.

## 1.4 The Problem Statement

The detailed background of the issues and gaps surrounding the cloud computing adoption and acceptance in the previous section made a clear cut in defining the issues that warrants the investigation of a proper model of the adoption with the related issues and gaps in the current study. They can be defined as follows:

- Lack of empirical studies on the adoption process in cloud computing in general (Marston et al., 2011; Saedi & Iahad, 2013a; Saya et al., 2010; Senyo et al., 2018) and at Malaysian HE institutes employing individuals as respondents (Hassan et al., 2017);
- The issues of security, privacy, and trust as one dimension of User Security Predisposition (USecP) and their crucial role in the cloud services' adoption process at HE institutes on the larger scale of acceptance (Al-Shqeerat et al., 2017);
- The moderating role of educational level (Giovanis et al., 2012; Hew & Kadir, 2016; Jafarkarimi et al., 2016);
- The inclusion of variety of influential factors that include the technological and social factors (Huang, 2016); and
- The inclusion of both categories of respondents (i.e., the lecturers and students) with their group differences analysis (Behrend et al., 2011).

Thus, in an effort to address the gaps and issues aforementioned and to ultimately explain the individual's perceptions pertaining the personal usage of SaaS Cloud Computing applications, the study strives to cover these gaps and issues found and the

viewpoints presented earlier that need further empirical evidence that this study is presumed to gain. Besides, special attention was paid with given interest of the recommendations to find out the salient and decisive factors and appropriate model in an endeavor to understand and probe the perceptions of individuals on the usage, acceptance, and adoption of SaaS Cloud Computing on the personal level of the services offered.

In sum, the scarcity of empirical studies on different models of cloud computing usage, acceptance, or adoption at Malaysian HE institutes and on the individual level, the scarcity of holistic model that includes different beliefs and security perceptions, combined by the moderating effect of educational level warrant the investigation of the usage, acceptance, or adoption SaaS Cloud Computing in this research.

### **1.5 Research Questions**

Based on the above gaps and issues highlighted in the problem statement Section 1.2, this study addresses the following research questions and attempts answering them:

1. Which are the salient predictors that have a significant influence on accepting, using, or adopting the personal level of SaaS services and applications among Malaysian individuals (i.e., academic staff and students) at northern Malaysian main campus public universities?
2. To what extent does User Security Predisposition (USecP) that individual possess influence accepting, using, or using the personal level of SaaS Cloud Computing among academic staff and students at northern Malaysian main campus public universities?

3. Does the educational level (ED) that the individual possesses moderate the relationships between behavior intention (BI) and user security predisposition (USecP), from one side, and using, accepting, or adopting the personal level of SaaS services and applications in the context of northern Malaysian main campus public universities?
4. Is there any difference between the two groups of respondents (i.e., academic staff and students) in the relationships toward using, accepting, or adopting the personal level of SaaS services and applications?

### **1.6 Research Objectives**

In line with the above research questions, the general objective of this study is to develop and validate a model to examine the different beliefs, combined with the individual security predisposition that individuals possess towards the personal use of SaaS Cloud Computing services at Northern Malaysian public universities main campuses. Therefore, the subobjectives are presented as in the following:

1. To explore the salient predictors that have a significant influence on using, accepting, or adopting the personal level of SaaS services and applications among individuals (i.e., academic staff and students) at northern Malaysian Public universities.
2. To examine if the User Security Predisposition (USecP) that individual possess influence using, accepting, or using the personal level of SaaS Cloud Computing among academic staff and students at northern Malaysian public universities.



3. To test if educational level (ED) that the individual possesses moderates the relationships between behavior intention (BI) and user security predisposition (USecP), from one side, and using, accepting, or adopting the personal level of SaaS services and applications in the context of northern Malaysian public universities.
4. To investigate if there is any difference between the two groups of respondents (i.e., academic staff and students) in the relationships toward using, accepting, or adopting the personal level of SaaS Cloud Computing.

### **1.7 Significance of Study**

Until recently, the adoption of cloud computing is still a hot topic that researchers are still investigating the salient factors that lead to proper implementation, usage, acceptance, or adoption of SaaS Cloud Computing in the higher education. In principle, the factors influencing cloud computing acceptance have not been clearly identified (Klug, 2014), although there are previous works investigated the individual-related issues such as: Trust, privacy, and security, and social issues (Arpaci, 2016; Burda & Teuteberg, 2015; K. Wu et al., 2017). However, there is a lack of holistic models that takes collectively the factors of different attitudinal, control, social, and security beliefs of the individuals in a single framework as is the case of the current study. Therefore, a prolific area of research is needed to investigate this phenomenon by empirical studies based on the perspective of HE individuals, not only focusing on the benefits, offers, or challenges, but rather the factors leading to its acceptance based on the individual perception. In the following, the significance of the current study is summarized in points:

- SaaS Cloud Computing providers are one of the key players and beneficiaries of this study. That is, the survival of their services offered or new ones that are SaaS based should receive acceptance and satisfaction in order to continue their services and develop new ones based on the individual beliefs and perceptions. If the SaaS services and applications are evaluated empirically such as this study by the users with different cultures, values, languages, beliefs, and academic background, it is more likely to get different perceptions that reflect these elements in the final appraisal of SaaS Cloud Computing usage, acceptance or adoption of the providers' services. These providers can either enhance or quit existing applications/services or develop new ones that comply with the satisfaction of the end-user.
- In literature review, studies affirm the importance and demand for cloud computing services among university's students and academic staff on one side, and the providers from the other side to obtain mutual benefits (Arpaci, Kilicer, & Bardakci, 2015). In other words, universities use different cloud computing services in an aim to reduce cost of implementing new hardware or upgrade. At the same time, the Cloud providers will increase the number of customers and gain more revenue. In this way, a twofold benefit lead to the collaboration between both entities. Based on this, the researcher argues that the current study will be beneficial for both entities in which unveiling the most relevant factors of accepting SaaS Cloud Computing will help the providers to overcome the obstacles, from one side, and the universities to cultivate the students' abilities and skills to foster or improve the quality of SaaS Cloud Computing in their premises in conjunction with SaaS Cloud Computing providers. Additionally, the universities are one major beneficiary of this study

to gain more insights of the technological, personal, social influence factors, and the security predisposition of the respondents. They can, therefore, build their future plans based on the trends of the students and academic staff that are revealed in this study.

- The recent disaster in Malaysia (i.e., flood in 2014) rose the need to think of cloud computing in case of such catastrophic events. The cloud computing providers ensures security of the data by conducting regular backups to avoid any data losses that may occur due to catastrophic events such as floods which is critical at universities (Okai et al., 2014). Thus, SaaS Cloud Computing can help in disaster recovery that everyone can get connected once a flood or any natural event occurs and retrieve his/her data. Consequently, the SaaS Cloud Computing better facilitate to access the data at any time and from anywhere to resume the activities of all educational aspects at the university. Hence, the government agencies are one of the targeted audiences of this study, especially related to the ministry of higher education, that can utilize the findings of the current to build policies to include SaaS applications and services at all universities' aspects, public or private, to avoid loss in data and maintain the streaming of the educational process in case of any catastrophic event.
- Extensive literature review shows that many of the studies, those based on theory of reasoned actions (TRA), focused either on two beliefs (i.e., attitudinal and normative belief), others extended to study the control belief using TPB theory. However, decomposed theory of planned behavior (DTPB) decomposed those three main beliefs with a comprehensive framework that is large, but provides more insight, which the current study uses as a primary

theory. Yet, this theory is less used in the acceptance or adoption of innovative technologies in general and in the usage, acceptance, or adoption of SaaS Cloud Computing studies in specific. Therefore, using DTPB brings more insight to the ability of this theory to explain the phenomenon under investigation. Based on this, the academia and researches based on theories can get comprehensive knowledge of the applicability and appropriateness of this theory in the context of SaaS Cloud Computing.

- Besides, the SaaS Cloud Computing is an innovative technology that warrants the inclusion of another supporting theory, i.e. Diffusion of Innovation (DOI), to explain the perceptions of the end-users. Therefore, the study uses this theory to further support the understanding and interpretation of the beliefs in SaaS Cloud Computing services. The integration of DTPB and DOI theories with the extension of the user security predisposition newly author-developed construct is an endeavor to get broader picture of the user perceptions that would facilitate in understanding innovative technologies. Hence, the academic researchers that are studying human-computer interaction can obtain better insights from the findings of this study. Besides, the limited knowledge of the theories applied in studies of cloud computing, as emphasized by the Senyo et al. (2018), make a good choice of studying them in the area of cloud computing, which will bring better understanding and a springboard not only to enhance our understanding, but also to help in practical developing of cloud computing. This would facilitate developing of new software or services by the SaaS providers or to stop providing it, or even make enhancements to the service provided when perception are understood thoroughly of the real users of the the technology. Additionally, the universties can be regareded as a test-

bed for the services of SaaS providers, where they can employ the findings in promoting services to help their pedagogical process. Lastly, governments can benefit from the study to develop strategies for the higher education sector.

### **1.8 Scope of Research**

This study pays attention on the underlying salient factors influencing the usage, acceptance, or adoption of SaaS Cloud Computing services at public universities in the Northern part of Malaysia. The rationale behind the choice of the higher education sector, represented by individuals (e.g., students and academic staff) at those universities is delineated in the following lines.

- The universities are a microcosm where all the mixtures of cultures, regions, races, beliefs, languages, and varieties of individuals from different background and districts (e.g., urban and rural areas) do exist that represent variety of Malaysian and Asian communities. Therefore, university encompasses diversity of cultures and social groups (Sabi, Uzoka, Langmia, & Njeh, 2016) that makes it worthwhile to be representative of the current study.
  
- It is known in Malaysia that the demographics of the students, also academic researchers and staff, at public universities encompasses different districts and areas of Malaysia. In that way, the diverse in cultures, languages, beliefs, academic background, and races affect the perceptions and decisions of SaaS services among different respondents. That would, consequently, lead to better understanding of the acceptance process of SaaS services from different prospects.

Also, this study pays major attention to HE sectors because: First of all, educated users are the yardsticks of the technology in which they represent users, accepters, and adopters. Besides, they are mostly perceived to have more open minds, and are, consequently, more open to use - accept or adopt - new technologies (e.g., SaaS services) compared with others with less education as suggested by Lleras-Muney and Lichtenberg (2002). In line with that, Venkatesh, Morris, Davis, and Davis (2003) conducted a study and stated that knowledge, which is inferred in this study as the educational level background, is a motivation of the acceptance of new technologies.

Moreover, this study aims to conduct a cross-sectional, quantitative study based on survey instrument to cover four main campuses in public universities in Northern Malaysia with focus on the individuals (i.e. student and lecturers), as a unit of analysis and measurement, who are from different categories (i.e. of different gender, race, age, and universities major specialty, and educational level). In principle, the HE sector is composed of the private and public universities in addition to other institutes under HE. In principle, it is not logical and feasible to cover all HE in a single study; therefore, it is narrowed to focus on the public universities with main campuses in the North of the peninsula.

More importantly, there are lack in studying SaaS services in those universities based on the services questioned in the survey. Besides, these selected universities have different major specialty in the field of study (i.e. sciences, engineering, business, and education). This gives meaningful justification to such scope in terms of variety of specialty and characteristics of the respondents. Pertinent to the limited resources (i.e., time, money, and accessibility to larger scope) of the study, the researcher perceives that the selection is representative for the purpose of this study than other universities.

Finally, scope of the study aims to focus on SaaS applications on the personal level, based on SaaS classification of Benlian, Hess, and Buxmann (Benlian, Hess, & Buxmann, 2009), IBM (2015) and Marston et al. (2011), with daily usage of these applications inside the universities (i.e., the university portal), or as SaaS application usage in personal computers or smartphones and Tablets. For instance, online storage (e.g., Dropbox, Google Drive, Microsoft OneDrive), social media communication (e.g., Facebook, twitter, Instagram, telegram, WhatsApp, Skype, etc.), e-mail (e.g., Google mail, Microsoft mail), collaborative SaaS Cloud Computing applications (e.g., Google Docs, Microsoft office 365 applications, university educational portals), communication and calling services (e.g., Tango, imo, Viber, etc.).

### **1.9 Organization of Thesis**

The study is organized in the following manner: Chapter 1 starts with the background of the study giving an introductory section of the issues related to the current study. Then the problem statement, research objectives and questions, significance of the study, and the scope that is further explained. Chapter 2 presents review of relevant literature of the topic under study, giving special attention to the research context of Malaysia and related MyREN network infrastructure as an initiative of Malaysian government to support the higher education institutes. Then, cloud computing domain is explored with its related technologies and aspects, followed by its concept, classifications, issues and concerns, and ending with higher education sector and cloud computing. Chapter 3, underpinning theories are explained with the rationale behind the selection of the theories in the current study, followed by the relevant latent constructs of the proposed model were discussed in-depth with their relationship with the dependent variable of the study. Lastly, definitions of the variables are summarized

at the end of the chapter. Next, Chapter 4 demonstrates the methodology that was followed in this current study, which the quantitative cross-sectional approach is adopted using survey instrument adopted from literature. Hypothesis developments are further explored, and the integrative and extended conceptual framework is presented and justified with the proposed hypotheses. Sampling, data collection, and instrument are also explained in this chapter. Moreover, definition of operational terms is also summarized in a table. After that, Chapter 5 presents data analysis and findings with a summary of the hypotheses' results in a table. Finally, Chapter 6 demonstrates discussion of the results, the revised model, the theoretical and practical implications are highlighted, as well as methodological contributions. The chapter ends with the limitations and future studies, and finally the conclusion.

### **1.10 Summary**

This chapter starts with a background of the study to give an entry to the problems presenting the issues related with the problem under investigation. Then, the research issues are presented at the problem statement section, followed by the research questions and objectives. Next, the scope and the significance of the study explained, and the organization of the thesis is presented. Finally, the chapter ends with a summary.



## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

The technology has developed rapidly in the recent decade and brought innovative ideas into practice to facilitate life for human beings, businesses, manufacturers, and simplifies management and agility of the companies and firms. On the other hand, development in IT can bring a negative impact on environment and life on the planet. Besides, a growing call from technology practitioners, citizens, as well as governments to incorporate Greener practices lead to create a new era of research that could meet the requirements of the users, increase the performance and productivity of organizations and government entities, while increasing the revenue of business entities. Additionally, the high demand for energy coupled with the need to preserve environment, reduce physical space of datacenters and electronic devices, reduce carbon footprint, improve software deployment and testing, prolong the lifecycle for technology products, reduce e-waste of IT products, produce technology devices with less harm on the environment, and cut the cost in investing in IT infrastructure lead to posit new practices and strategies to avoid such issues (Bose & Luo, 2011). As a result, the cloud computing has come to the surface as a facility to avoid all aforementioned issues.

In essence, cloud computing concept uses the virtualization in the heart of its technology that reduces the need of the physical space of Datacenters, the energy consumption, cooling facilities, carbon emission, maintains IT sustainability, and prolong the infrastructure of hardware with efficiency and better investment of IT equipment. Moreover, cloud computing with its technology of virtualization reduces

floor space of datacenters by 80%, power consumption by 40%, while achieving cost-cutting benefits, preserve IT sustainability and lessen carbon emission that is a result of high energy consumption (Bose & Luo, 2011).

The following sections of the chapter are organized as follows. Firstly, an overview of Malaysia as the research context of the current study. Secondly, an extant and extensive literature review on cloud computing domain, the concept, the classification, and issues and concerns related to cloud computing.

## **2.2 Malaysia as the Research Context**

Malaysia has an important location of being the heart of ASEAN countries and is one of the leading countries in industry and Information Technology. The technology has brought many benefits for the economy and the populace as well. Therefore, ICT is one of the crucial priorities of Malaysia through its successive governments. Additionally, the higher education sector has been given the utmost priority with the successive governments in Malaysia. Therefore, several steps were taken to enrich the education sector through innovative technologies and projects to facilitate the education and research sector and to connect it with the regional and global research and education networks. For these reasons, cloud computing emerged as a possible and reliable remedy for the escalated issues that face the world technologically, educationally, economically, and environmentally and research on solving these issues gain greater demand among technology professionals and researchers on different related fields as well as the governments, which Malaysia is one of the pioneers in developing the education through promising technologies such as the research and education networks projects and cloud networks.

In line with these efforts, the former Malaysian Prime Minister, YAB Dato' Sri Mohd Najib bin Tun Abd Razak declared,(IGEM, 2010), that the new economic driver for Malaysia is to have sustainable development strategy by using Green technology. As such, Malaysia entered the race in cloud computing with great emphasis to cope with other Asian Pacific Countries to support its economy, adopt new technologies based on Green initiatives such as cloud computing, and save the environment.

Cloud computing is one of the hottest topics in the past decade, which is a term coined by Google CEO-Eric Schmidt in 2006 -when announcing the initiative of Google and IBM- that gain interest among technology researchers, academicians, business strategists, and ecologists in the following years (Aymerich, Fenu, & Surcis, 2008). The Asia Pacific countries are focusing on cloud computing as a way to solve the aforementioned issues. It has gained interests from the governments of Asia in the recent decade. Take for example, in a Cloud Readiness Index (CRI) report (Asia Cloud Computing Association [ACCA], 2014), the report classifies the countries of Pacific Region into three classes: the ever-ready leaders on cloud computing (e.g., Japan), the dedicated improvers (i.e., Taiwan, Malaysia, Thailand, and Philippines), and finally the steady developing countries (e.g., India and China).

It is worthwhile knowing that CRI is classifying countries based on the improvements, where the movers into higher level means improvements in the scale. The indices of CRI are based on the following criteria: a) size and attractiveness of the market, b) capability and suitability of the economy, c) the existing and nascent demand drivers, d) affordability of the tools on the economy, and d) the level of financial and government support for different entities (Hassan et al., 2017).

The report presents the improvement in ranking, compared to 2013 report, for some countries. However, non-movers in their position include Malaysia that remained in the 8<sup>th</sup> position with no change. In addition, a recent CRI report in 2016 shows that Malaysia is still not moving in its rank (since 2013) and still in the 8<sup>th</sup> position (Asia Cloud Computing Association [ACCA], 2016). For details, Tables in Figure 2.1 and Figure 2.2 depict the results of CRI for 2014 and 2016 reports.



	1. Privacy	2. International Connectivity	3. Data Sovereignty	4. Broadband Quality	5. Government Regulatory Environment and Usage	6. Power Grid and Green Policy	7. Intellectual Property Protection	8. Business Sophistication	9. Data Centre Risk	10. Freedom of Information	CR12014 SCORE	RANK	CHANGE
<b>JP Japan</b>	9.5	5.5	8.0	9.1	5.0	7.1	8.1	8.2	6.6	9.7	76.8	1	-
<b>NZ New Zealand</b>	8.8	4.6	7.9	7.6	5.6	9.2	8.6	6.8	7.8	9.5	76.3	2	+4
<b>AU Australia</b>	8.8	4.4	7.6	8.0	5.3	7.8	7.6	6.7	9.4	9.6	75.1	3	+4
<b>SG Singapore</b>	6.0	8.2	7.8	8.8	6.1	5.9	8.7	7.3	7.4	8.6	74.8	4	-
<b>HK Hong Kong</b>	6.8	7.7	7.6	9.3	5.1	5.6	8.1	7.5	7.4	9.6	74.7	5	-2
<b>SK South Korea</b>	9.7	5.5	7.2	9.4	5.1	6.6	5.7	6.9	8.6	8.6	73.3	6	-4
<b>TW Taiwan</b>	4.6	6.3	6.8	8.5	5.0	6.7	7.4	7.4	6.9	8.6	68.2	7	-2
<b>MY Malaysia</b>	5.8	5.8	6.7	7.1	5.2	4.9	6.9	7.2	8.5	8.2	66.2	8	-
<b>TH Thailand</b>	4.0	5.0	6.2	8.0	3.7	6.3	4.4	6.3	7.6	7.8	59.3	9	+4
<b>PH Philippines</b>	5.8	5.4	5.9	4.1	3.7	5.5	5.1	6.1	5.5	9.0	56.1	10	+2
<b>CN China</b>	5.9	3.0	4.8	5.9	4.3	4.3	5.6	6.2	6.5	7.0	53.3	11	-1
<b>ID Indonesia</b>	4.4	2.9	6.2	3.1	3.9	5.7	5.6	6.3	6.4	7.9	52.4	12	-1
<b>IN India</b>	4.6	2.3	6.5	3.6	4.1	5.0	5.3	6.3	3.4	7.8	48.8	13	-4
<b>VN Vietnam</b>	3.6	3.2	5.6	4.2	3.8	4.7	4.1	5.3	6.4	7.0	47.8	14	-1

Figure 2.1. Cloud Readiness Index (CRI) Report 2014

Source: ACCA (2014)

Rank / Country	CRI#01 Internatioanl Connectivity	CRI#02 Broadband Quality	CRI#3 Power Grid, Green Policy, and Sustainability	CRI#4 Data Center Risk	CRI#5 Cybersecurity	CRI#6 Privacy	CRI#7 Government Regulatory Environment and Usage	CRI#8 Intellectual Property Protection	CRI#9 Business Sophistication	CRI#10 Freedom of Inforamtion	Tofa CRI 2016 Score	Rank Change
1- Hong Kong	8.1	9.1	6.7	8	6.2	9.5	7.2	8.6	7.4	7.2	78.1	+4
2- Singapore	6.4	9.4	6.5	7.8	6.8	9	8.6	8.9	7.3	6	76.7	+2
3- New Zealand	4.6	8.2	7.6	6.8	7.4	9	8.1	8.7	6.9	7.2	74.4	-1
4- Australia	4.3	8	6.6	6.3	7.6	9.5	7.4	8.3	6.7	8.3	73.2	-1
5- Japan	3.9	8.9	6.7	5.9	7.1	8	7.8	8.7	8.3	7.8	73	-4
6- Taiwan	4.1	8.8	6.7	6.4	7	9.5	6.7	7.4	7.1	7.2	71.1	+1
7- South Korea	3.8	9	6.3	6.2	7.1	9	7	6	6.9	6.7	68	-1
8- Malaysia	3.3	7.6	5.4	5.9	7.6	8	7.4	7.7	7.6	5.8	66.3	-
9- Philippines	3.3	5.5	6	3.5	3.5	7.5	5.5	5.6	6.1	7.3	53.8	+1
10- Thailan	3.8	8.6	6	5.2	4.1	5	5.1	4.6	6.3	3.8	52.6	-1
11- Indonesia	1.8	6.3	5.4	2.7	4.7	6	5.6	6.1	6.1	5.8	50.6	+1
12- India	1.7	5.6	5.1	1.9	7.1	4.5	5.5	6	6	5.8	49.1	+1
13- China	1.6	6.6	5.3	2.5	4.4	5.5	6.2	5.7	6.1	1.3	45.4	-2
14- Vietnam	3	6.7	5.4	2.6	3.2	5	5.4	5.1	5.1	2.4	44	-

Figure 2.2. Cloud Readiness Index (CRI) 2016

Source: ACCA (2016)

Additionally, there are number of concerns that made obstacles towards the acceptance of SaaS cloud computing in Malaysia and the lower rate of adoption such as: security, privacy, and trust in the governments measures and cloud computing providers regarding hosting private data off-premises clouds (Abolfazli et al., 2015).

However, Malaysian government in its 10th plan emphasizes on the continual of the developing of economies using innovative technologies, e.g. cloud computing. Moreover, the 10th Malaysian plan gives a greater emphasis on the energy consumption and fostering the implementation of efficient energy on different sectors, which cloud computing is considered one of these important initiatives aiming to reduce greenhouse gas emissions. To make things clearer, Sultan (2010) stated that one of the most advantageous outcome of cloud computing is the reduction of carbon foot print in where ICT is responsible of around 2% of the global carbon emissions. For these reasons, cloud computing became a crucial element for Malaysian government to achieve 10th Malaysian plan through the reduction of negative aspects of IT, reduction of cost which would boost the economy, and improve the education through the proper use of innovative technologies such as cloud computing services that is more likely to improve the quality of higher education sector in Malaysia.

In principle, the educational sector in Europe and UK has made strict regulations on power consumption in which the higher education is one of the targeted organizations to boost the sustainability of IT resources (Sultan, 2010). On the context of Malaysia, the universities are taking a big share of the budget to have separate ICT infrastructure with advanced technologies that are cloud based technologies (Shahzad, Golamdin, & Ismail, 2016). Also, the Malaysian government reserved 20% of the Federal budget

for education with 54 RM billion for the Ministry of Education on 2014 with emphasis on developing and investing on its people (Shahzad et al., 2016).

Education in Malaysia has the potential to build the economy based on human development and to develop a systematic education that can be provided with cloud computing (Shahzad et al., 2016). Therefore, the idea of Malaysian research and education network (MyREN) emerged to reflect the focus of the government on higher education and the emphasis to improve the quality and research in this sector to improve the economy and the wellbeing of Malaysian populace.

### **2.2.1 The Malaysian Research and Education Network (MyREN)**

Education in Malaysia has the potential to build the economy based on human development and to develop a systematic education that can be provided with cloud computing (Shahzad et al., 2016). One of the outstanding projects of the Malaysian government is the establishment of the Malaysian research and education network (MyREN) on March 2005. MyREN, as a government-funded project (Rohani & Ow, 2012), represents a great stride of the Malaysian consecutive governments to cater the higher education sector and provide a springboard to achieve the goal of being an international educational hub globally.

MyREN provides virtual, high speed, dedicated connectivity, and collaboration platform to hundreds of thousands of researchers, students, academics in Malaysia (The Malaysian Research & Education Network [MyREN], 2017). Also, MyREN is under the umbrella of the Ministry of Higher Education (MoHE) and the management of Malaysia Digital Economy Corporation (MDEC), which reflects the governments support of the higher education sector and the emphasis to improve it based on the 10<sup>th</sup>



Malaysian plan. Moreover, by means of this MyREN high-speed connectivity, all public, private, polytechnic and college communities in addition to some teaching hospitals can exchange information and have a common platform to facilitate education and research activities throughout the country.

Additionally, MyREN is connected to other national research and education networks (NREN) that provide an access to more than 8000 research centers and international research communities in Europe, Asia Pacific region, North America (Norhizat, Zorkifli, Hakimie, & Din, 2008). By means of MyREN through NREN, the possibility of the collaboration among these higher education institutes, advancing national and global education and research, speeding up the multidisciplinary research, and eliminating the obstacles that face researchers, academics, and students to achieve the maximum outcome of the educational process is possible and the dissemination of knowledge is inevitable locally in Malaysia and globally.

Moreover, Abidin, Ramlan, and Yasin (2011) highlighted the importance of the National Research and Education Network (NREN) over other networks, provided by internet service providers, in that they offer a high-speed backbone infrastructure with a dedicated channels and offers a versatile support for all types of traffic. These features outweigh other services provided by ISPs in that they offer not only high-speed connectivity, but also non-interruptible services that would help researchers and educators a proper platform for a test-bed on technological projects, data-intensive applications, or even sharing knowledge (Abidin et al., 2011).

### **2.2.2 Second Generation of Malaysian Research and Education Network (MyREN2) and Cloud Computing**

The main objective of MyREN in its first generation is to elevate the education sector in Malaysia through the augmentation and enrichment of research capacity and capability. The infrastructure of MyREN is a high-speed dedicated network connectivity that is not affected in any way by the number of users as it is not connected to any commercial network such as Facebook, Twitter, YouTube, or the others (S. C. Lin & Yen, 2012). However, the second phase of MyREN was in progress until the second-generation inauguration of MyREN in April 2010 was announced, where it was called MyREN2 with advanced capabilities that offers cloud services under the private community cloud MyRENCLOUD.

The second generation offered cloud services that go in line with the fast development in the IT infrastructure and the usage of cloud services in its different service or deployment models in the research and education networks. Therefore, MyREN2 offers a range of cloud services under MyRENCLOUD with a long-term infrastructure availability.

MyREN2 is expected to facilitate the collaboration with international research sites of around 158 concurrent sites and will offer them different cloud services such as virtual meetings, VideoBridge, uCAST video sharing portal, and on-demand media rich learning. There are number of objectives that MyREN2 is aimed to achieve (S. C. Lin & Yen, 2012). One of the main objectives of MyREN2 is to maintain the level of security of the data hosted such as the research data stored, the security of transaction services, the database hosting the services of the collaborative research efforts, and the application of encryption mechanism of 256-bit. Other objectives are the provision of

on-demand virtual servers (OnVM), web collaboration services, on-demand disk storage for researchers where it is called OnDisk and establishing connectivity bridges with research and education sites in Europe, the U.S., Asia Pacific region, and other Asian countries.

The MyREN2 project will continue its progress and extend its outreach efforts to Myanmar, Cambodia, and Laos globally. In the local aspect, MyREN2 projected to provide its cloud services to different government agencies, health sector, and community centers (S. C. Lin & Yen, 2012). Through this educational and research network, the higher education is expected in the near future to have a quality spring in its capacity and capability locally inside Malaysia and regionally with surrounding Asian countries.

### **2.3 Cloud Computing**

Many technologies have emerged, and the need to adopt new technological devices increases day after day. That led to more services provided and offered to the public that shifted to be a technology consumer, user technology addict, or technology dependent. The business tries to tackle the increasing need for the enormous and growing curve of technology to adopt new, innovative, and high-performance technology. Consequently, the business cost has risen for such adoption of new technologies to meet the increasing demand by the consumers and, as a result, many small to medium sized companies as well as higher educational sectors turned to look for higher performance, cost wise, friendly to the environment, and reliable technology. Hence, cloud computing surfaces and a new horizon of friendly technology emerged to achieve these perceived objectives.

Cloud computing is the utilization of IT services on vastly distributed datacenters across the world by means of Internet connectivity. It can be utilized in any market sector, including educational sector, which requires scalable, reliable, affordable, and easy to manage IT services for students, academic staff, and researchers (Yaghmaei & Binesh, 2015). The clients of cloud computing do not need to have prior knowledge on the internal systems and they can access services transparently over an Internet connection on the bases of pay-per-use and from anywhere and anytime as convenient. Cisco white paper (Cisco, 2011) shows that the cloud computing is becoming a demanding technology and expected its growth from \$40 billion in 2011 to \$240 billion in 2020 (Yaghmaei & Binesh, 2015).

The term cloud computing has its seminal since the sixteens of the last century; however, the term spread around in October 2007 with the announcement of collaboration of IBM and Google (Vouk, 2008). The escalating environmental issues and the growing need to the development of sustainable resources spurred interest of researchers in Green IT (Akman & Mishra, 2014) and created a new area of research. Armbrust et al. (2010) ensures that the cloud computing is essential in its usage and benefits to cope with business demands. The vital importance come into presence with the concept to pay for what you actually use. This explained by Armbrust et al. (2010) in which the usage of a thousand of hours in the premises can be achieved by thousands of servers located somewhere on the Internet to get job done in an hour.

Cloud computing is becoming a commodity as the four traditional utilities (i.e., water, electricity, gas, telephone) where customer can benefit from them according to their need and pay as they use (Buyya, Yeo, Venugopal, Broberg, & Brandic, 2009; Firdhous, Hassan, & Ghazali, 2013). In principle, cloud computing changed the

concept of delivering IT services and became a utility that made a revolutions in IT industry (Soliman, Firdhous, Hassan, Ghazali, & Mahmuddin, 2015; W. Y. C. Wang et al., 2011). Without using cloud computing, the business has to frequently cope with the higher demand of upgrading IT resources. This traditional method needs the expertise and professionals along with high capabilities of hardware to achieve the business goals in a way that creates a financial and technical burden on service companies to be in competitive position among other business opponents. In cloud computing, the way is different and no worries of such issues and computing is becoming a utility that you pay as you utilize (Soliman et al., 2015; W. Y. C. Wang et al., 2011) and the hurdle of maintenance is eliminated by the service providers.

In sum, there is an increasing need for Green products, environmentally sustainable practices, and growing calls for protecting the environment either from environment supporters, public, or researchers and academics in the technical field (Subramanian, Abdulrahman, & Zhou, 2014). That need stimulate and drive the adoption and acceptance of cloud computing in an endeavor to overcome the harmful effects of IT (Subramanian et al., 2014).

### **2.3.1 Cloud Computing Concept**

Cloud computing is in its simplest definition is IT-related capabilities that are provisioned as a service in a data center type, which have advantages of higher performance, scalability, availability, and with low cost service that has better features compared with conventional data centers (Bhardwaj, Jain, & Jain, 2010). These data centers connect many of its servers together locally and connect with other data centers together by means of cloud computing. The aim is to provide IT services to customers that are close to these scattered data centers without having knowledge of the

underlying technology infrastructure. The proliferation of smart mobile devices, increasing need for high performance computing, the high growth of the Internet usage, and the need to reduce cost and energy paved the way for a new and different computing model that provision IT-related resources as utility (Bhardwaj et al., 2010).

Moreover, cloud computing is a new paradigm of computing services that relies on existing technologies such as: Internet, grid computing, virtualization, web services, etc. and is provided on pay-as-you-use bases via Internet connection (Sultan, 2010). However, various studies in the area of cloud computing adopted the definition of U.S National Institute of Standards and Technology (NIST) of its final draft (Ghosh, Chakraborty, Saha, & Mahanti, 2012; Klug, 2014; Mitchell & Meggison, 2014; Pearson, 2013; Simamora & Sarmedy, 2015). In this study the definition of cloud computing is also adopted from NIST in which it defines it as “a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of five essential characteristics, three service models, and four deployment models.” (Mell & Grance, 2011, p. 2).

Furthermore, W. Kim, Kim, Lee, and Lee (2009) give explanation and definition of cloud computing in a simplified way. First, the cloud is referred to as a remote data center, and cloud computing definition separated with two parts: first, the access to computer processing that remotely and dynamically allocated/deallocated as required with means of Internet Web browser; secondly, payment of the services provided. They added, the allocation/deallocation of computer resources eliminates the need to buy new hardware for the peak time use and then leaving them unused most of the

times. Additionally, they noted that accessibility to computer resources outside the premises eliminates the need to maintain the hardware, storage, and additional financial burden of electricity or professional administration staff. Moreover, Low, Chen, and Wu (2011) noted that cloud computing is a new paradigm shift of technology that includes storage, distributed systems, and computing resource services in addition to shift applications of millions of users from local computers to be an accessible and scalable services that can be utilized via Internet.

W. Kim et al. (2009) speculated that if cloud computing has strong roots of adoption, it will make major changes for IT that we know today. They demonstrated three reasons: Firstly, if software vendors serve their applications from the cloud, in which the burden of upgrade will be done on the cloud, the way of distributing and pricing the software applications will differ. Also, the licensing procedure will change to have fees for the product, training, consulting on the use, and an annual charge for maintenance. Secondly, as the need to keep or install the software packages is eliminated because of Cloud applications deployment, the computers will become lighter and less expensive. Take for example, the recent trend of smart phones, Tablets, and some models of laptops do not have large hard drives and refers the user to transfer the data to cloud that is offered for free from the vendor of the hardware for a limited time. Consequently, the move towards the cloud is becoming a necessity and inevitable. Thirdly, the new paradigm of cloud computing will create new IT ecosystem that will make some Cloud providers to support other Cloud service providers in an exchange of interest.

In sum, several studies (Jlelaty, 2012; Marston et al., 2011; Misra & Mondal, 2011) noted that the cloud computing new service model is provided independent of location,

time, and device requesting the service and is offering its services by interconnected powerful computers that use virtualization technology to be accessed any time, from anywhere, from any device on/out the globe.

### 2.3.2 Domain of The Benefits of Cloud Computing

The recent climate issues and global warming escalated issues and their effects cannot be ignored on human's life. These escalated issues lead governments to think of finding ways to reduce carbon footprints because of technology advancements. Therefore, cloud computing emerged as a possible solution to overcome these issues through its concept that covers power consumption and savings, virtualization, sustainability, E-waste and environmental issues (Badie, Hussin, & Lashkari, 2015; Jing, Ali, She, & Zhong, 2013; Subramanian et al., 2014; Zissis & Lekkas, 2012). Figure 2.3 illustrates and summarizes the cloud computing domain and the concepts underpinning its importance to overcome the side effects of technology advancements. Further details are explicated in the following subsections.

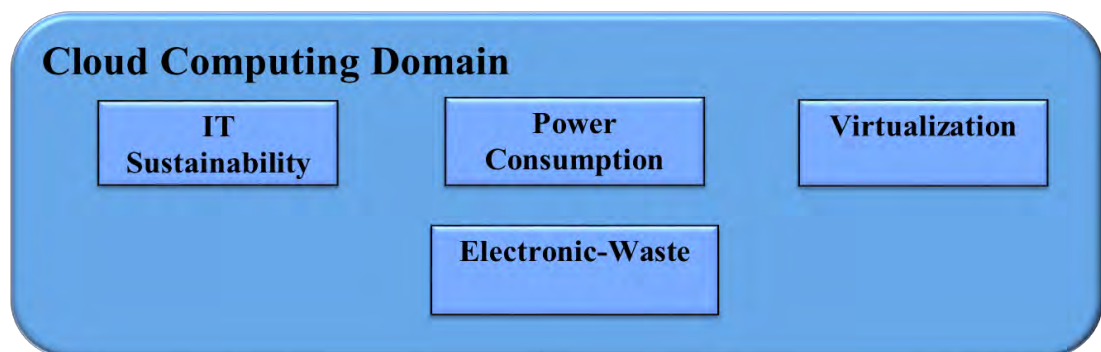


Figure 2.3. Cloud computing domain



### 2.3.2.1 Virtualization

The fast-growing demand for scalable systems and changing information system architectures with the dire need to adopt greener technology by better utilizing hardware resources, led to the acceptance and adoption of cloud computing with its virtualized capabilities. Also, ‘virtualization’ with its capabilities to deliver high level of services with a reasonable cost, made it the first choice to adopt and the driver behind the next wave of IT growth (Vouk, 2008). This technology is the heart of cloud computing in which machines (i.e., servers) can be virtualized or can be built as a software machines that can be copied, deleted, or even replaced in an easy way. In this way, the power consumption is reduced (Jing et al., 2013) and the hardware efficiently utilized instead of being idle with energy losses.

Besides, virtualization technology facilitated many IT aspects and improved performance, security (i.e., by isolating virtual different servers), reliability (i.e., by copying them or transferring them to other hardware machines), and flexibility in management of the hardware and software. This makes it the choice for being the promising technology and the heart of the cloud computing. Somani and Chaudhary (2009) stated that these advantages made it the proper choice for Data Centers in which different software packages and different operating systems are hosted in the same hardware machine. Additionally, Jlelaty (2012) defined virtualization as giving the end user the computing power needed, while hiding the hardware resources.

Remarkably, the seminal of virtualization is back to the 60s of the last century in IBM mainframe systems (Vouk, 2008). Popek and Goldberg (1973) defined virtual machine as, “Efficient, isolated duplicate of the real machine. (It is) as a piece of software (and) VMM has three essential characteristics. First, the VMM provides an environment for

programs which is essentially identical with the original machine; second, programs run in this environment show at worst only minor decreases in speed; and last, the VMM is in complete control of system resources.” (Popek & Goldberg, 1973, p. 413).

Moreover, there are number of applications and software packages to manage the Virtual Machines from different vendors. For example, Microsoft has the Hyper-V technology, VMWare is another opponent, and Xen is also one of the key players of this technology (Jing et al., 2013). For instance, according to Microsoft official website (Microsoft, 2014), virtualization has many benefits such as: better usage of hardware resources to expand private clouds on on-demand bases, increase efficiency by consolidating the hardware and workloads, and reduce physical space and the downtime of workloads. Further, according to VMW, their products not only aim to reduce number of servers and expenses, but also attempting to be Green to protect earth and conserve energy consumption (VMWare, 2015). Other key players that develop and get use of the virtualization are EMC (Storage and Cloud Providers), NetApp, and Hitachi, Intel, Sun, HP, etc. (Vouk, 2008).

Getting these features of virtualization and the growing demand of this technology made it the core element of cloud computing. That is why virtualization is an essential component of cloud computing generally and SaaS specifically, which deals with the physical hardware (i.e., storage, memories, CPU) and software to manage these components to work in concert with each other efficiently and effectively. Moreover, SaaS cloud computing works heavily on virtualization as it is essentially a multi-tenant model of cloud computing. This concept is probed in the current research and asked the respondents to reflect their views on this issue by accepting and adopting SaaS services and applications.

### 2.3.2.2 Power Consumption and Savings

Today's imperative need of technology and its application led to rely on numerous thousands of servers around the globe to offer around the clock services to billions of people on the globe. This tremendous number of servers running around the clock consumes high rates of power energy, even though at their idle states. Barroso and Hölzle (2007) stated that the energy consumption of servers is in high rates most of the times. The power efficiency is achieved at the peak hours of server operations more than half per cent when it is in the idle state with no actual work. So, energy is dissipated and causing a lot of natural resources to be consumed, harm the environment, and increase the CO<sub>2</sub> footprint rates. Consequently, the researchers directed their attention to look for ways to increase power efficiency and better power management (Jing et al., 2013) for the sake to decrease the side effects of enhancements of new technology innovations.

Armbust et al. (2010), additionally, inferred that computers in idle state are consuming almost two-thirds of power of a heavy loaded computer, thus leading to consume natural resources. Also, they asserted that cloud computing already uses techniques to better use energy. They inferred that the trend of leaving the systems on in an attempt to overcome the startup time, escalate this problem and a better solution would be using the snapshot tool. The snapshot tool can be accomplished through virtualization that is easy, useful, and effective way to utilize hardware resources with power efficiency and without impacting the environment (Armbrust et al., 2010).

Hence, cloud computing gain the popularity of being the promising technology to better utilize hardware resources that leverage the performance, power usage, scalability, and flexibility in managing all aspects of data center (Berl et al., 2010).

That is, when power consumption is reduced, the efficiency of the systems would be more stable, and the virtualized services that are running to support the SaaS applications can serve the users in efficient and balanced environment. This makes the SaaS services better performing and therefore more inclined to suit the users to get better services that are fast, reliable, and meeting their expectations. In sum, using SaaS applications and services is contributing to power consumption using SaaS applications by reducing the processing power of their hardware, which achieves better usage of resources on the SaaS clouds, and therefore, conserving the environment. This concept is probed in the current research and asked the respondents to reflect their views on this issue by accepting and adopting SaaS services and applications.

### **2.3.2.3 IT Sustainability**

Technology advancements has driven the industry and business in the past two decades, which led to prosperity of different businesses and created fortune to so many IT organizations and firms around the globe. On the other hand, this economic growth has created another side effects to nature and the natural resources are depleting (Dao, Langella, & Carbo, 2011). The depletion of the raw materials used in IT industry emerged new concerns to management as well as practitioners and addressed the acknowledgement of sustainability (Akman & Mishra, 2014).

IT products in its life cycle start with the production process, then the usage of the product that consumes the time till reaching its end of operation, and finally the disposal, which is the major concern that affects the eco-sustainability (Hilty et al., 2006). Additionally, the estimates of Gartner of the global CO<sub>2</sub> emissions is 2%, which is the impact of the life cycle of IT products (Mingay, 2007). Therefore, to accomplish the idea of sustainability, prolonging the life cycle of hardware is under a great concern

and is the core of sustainability concept. Furthermore, Chou and Chou (2012) gave their view of sustainability as the enduring capacity and long term wellbeing for the present and future to come not only for humans, but also for any creatures on this planet. They confirm that sustainability has become a norm because of the catastrophic events that is happening on the environment. That led, in their view, to enact regulations and laws from governments to protect the environment.

Therefore, organizations have many challenges to cope with that and can be summarized as: Complying with environmental regulations, challenging with business rivals, improving the image of the organization, exploring and maintaining existence in new markets, and adding value to the products. These are some of the reasons that makes these organizations re-think of sustainable products that are environmentally friendly (Y. S. Chen, 2010). Educational sector, with no exceptions of other industries, is concerned about the sustainability as a moral obligation and healthy procedure to reduce the spending on IT hardware to prolong the life of the IT datacenters. Hence, cloud computing comes again to the forefront to achieve the sustainability of IT resources through its life cycle. To explain more, when a technology such as cloud computing is utilizing the hardware efficiently, reducing the amount of power consumption, utilizing a compacted size of hardware used in servers, and reliably allocating/de-allocating the hardware resources, this would dramatically prolong the life cycle of IT hardware resources. Based on the above justification, the sustainability is one of the core concepts of cloud computing. On the same token, the higher education sector achieves sustainability through using SaaS services that are deployed around the globe from different providers. This would make them less dependent on the regular upgrade of their hardware and transfer this concept to the students through enhancing the use of SaaS application and other cloud computing services provided

by the university. In sum, using SaaS applications and services is contributing to sustainability through prolonging hardware the life cycle as explained previously. This concept is probed in the current research and asked the respondents to reflect their views on this issue by accepting and adopting SaaS services and applications.

#### **2.3.2.4 E-Waste and Environmental Issues**

The mass production of IT products created an escalating problem for the environment at the end of their life cycle, which is called E-waste. E-waste is becoming the crucial threat for environment with its piles in the landfills. In Australia, for instance, over 1.6 million of E-waste computers annual disposal overwhelm the amount of municipal waste in the landfills (Australian Bureau of Statistics, 2006). Additionally, Murugesan and Gangadharan (2012) assert that discarded computers and electric components (i.e., the E-waste) are growing globally that needs attention. Further, they argue that two thirds of the PCs made, after 5 years of usage, render to landfills. The authors added that 20-50 million tons of E-waste are generated annually, and this number is expected to increase dramatically as reported by United Nations Environment Program ([www.unep.org](http://www.unep.org)).

More importantly, these electronic devices have toxic materials (e.g., lead, chromium, cadmium, and mercury) that are broken down and infiltrates into waterways, which is environmentally dangerous and therefore causes harmful effects to beings (Ansari, Ashraf, Malik, & Grunfeld, 2010). The authors, additionally, suggest recycling used and old electronic components and refurbish them to be used as a raw material that can be used in manufacturing new devices.

Away from that, although based on the same concept of the reduction of E-waste, SaaS Cloud computing emerged as one solution to reduce the amount of E-waste in the technological field. That is, when a person uses the SaaS services and applications, the processing power will fall upon the cloud computing services and thus less need for a powerful computing capability on user owned computers. That, consequently, lead to keep the owned computers and not to purchase new ones or replace it with high computing capability. In this way, one would decrease the regular purchase of new computers, and therefore the number of outdated computers or electronic devices will decrease dramatically that eventually reflect on the amount of E-waste produced by IT devices. In this way, the reduction of E-waste causes to lessen the harmful impact of IT on its life cycle and environment and that makes cloud computing again a prominent solution for the escalating issues of E-waste.

In sum, using SaaS applications and services is contributing to saving the environment and reducing the E-waste of the hardware as explained previously. This concept is probed in the current research and asked the respondents to reflect their views on this issue by accepting and adopting SaaS services and applications.

#### **2.4 Classification of Cloud Computing**

Cloud computing can be categorized into two main categories: service model or deployment model. The U.S National Institute of Standards and Technology categorized cloud computing as having three service models and four deployment models (Mell & Grance, 2011). The service model comprises: SaaS (i.e., Software as a Service), PaaS (i.e., Platform as a Service) and IaaS (i.e., Infrastructure as a Service) (W. Y. C. Wang et al., 2011). However, deployment model consists of: Private, Public,

Community, and Hybrid clouds (W. Y. C. Wang et al., 2011). In the following subsections, more details do exist.

## 2.5 Service Models of Cloud Computing

Cloud computing has a growing trend in the world as more businesses are merging to it. There are many providers of cloud services available that offer different services as requested by the customers based on their budgets, policy, and business needs. Some of the major service providers are presented in the following Table 2.1 as adopted from W. Y. C. Wang et al. (2011).

Table 2.1

### *Service Providers*

Service Type	Providers	Example of Services
Software as a Service (SaaS)	Salesforce.com Google NetSuite Apple	Sale Cloud Google Docs NetSuite CRM+ iCloud
Platform as a Service (PaaS)	Google Microsoft Salesforce	Google Apps Azure Force.com
Infrastructure as a Service (IaaS)	Amazon Savvis GoGrid	Amazon Services Colocation hosting Cloud Hosting

*Source:* Wang et al. (2011)

The following diagram, Figure 2.4, depicts the service model of Cloud computing, based of literature review, in which the following subsection will explain more this model. The diagram is a summarization of cloud computing service model based on the researcher's findings from literature.



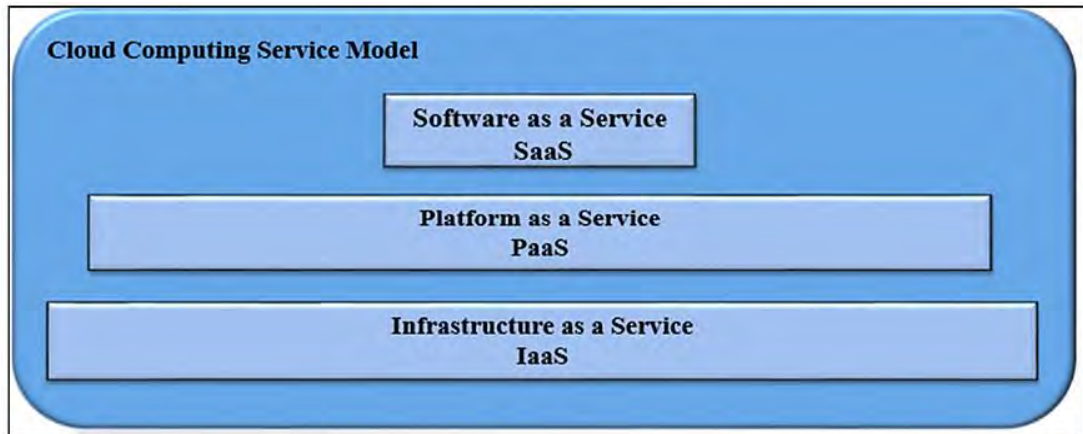


Figure 2.4. Cloud computing service model

### 2.5.1 Software as a Service (SaaS)

In the 1990s, Application Service Providers (ASP) appeared as an innovative IT service delivery paradigm to provide services on demand (S. G. Lee, Chae, & Cho, 2013). However, it could not meet the demand of having variety of high quality of software due to number of issues that made its survival losing its sustainability. Software as a Services, which is usually referred to as SaaS in academia and businesses, emerged as a successor of ASP, which is simply using the applications on the Cloud provider's infrastructure by consumer (Mell & Grance, 2011). SaaS is a type of ASP that has similar features of provision of services over the Internet, but unlike ASP it has variety of software packages on demand to customer (S. G. Lee et al., 2013). These applications can be accessed by client's devices by using application such as web browser to access the resources offered and provisioned by the SaaS provider.

It is noteworthy to know that under SaaS, the responsibility of any updates or changes, of the provided application to clients are under SaaS providers responsibility in which they supply these services over the Internet as per usage bases (W. Y. C. Wang et al., 2011). Additionally, SaaS is the top layer of the cloud service model that offers its

software services to immense number of clients (Okai et al., 2014). Moreover, SaaS uses a technology called multi-tenant to provide various software packages to many users on a single instance (Bhardwaj et al., 2010; S. G. Lee et al., 2013).

### **2.5.1.1 Software as a Service Classification**

It is noteworthy that SaaS has different classifications that were found in literature. For example, Benlian et al. (2009) classified it as office and collaborative applications such as Google packages (e.g., Google Apps), CRM applications (e. g. Salesforce.com), and Enterprise Resource Planning or ERP (e. g. SAP's Business By Design). On the other hand, IBM (2015) has its own commercial categories of SaaS as follows: commerce and marketing applications, social and email applications, human resources applications, industry applications, analytics applications, smarter process applications, operational visibility, and security applications.

Interestingly, Marston et al. (2011) divide SaaS cloud computing applications into two simple categories, namely: enterprise-level applications (e.g., Salesforce, NetSuite or Google Apps) and personal applications (e.g., Gmail, TurboTax Online, Facebook, or Twitter). In the context of this study, the category of SaaS applications that is being focused upon in the current research is the personal level of SaaS Cloud Computing applications that are used on daily bases by students and lecturers.

Based on the above classification of SaaS services, the researcher took into consideration the level of personal use of SaaS services and applications to investigate in the current study. Besides, the different classes identified are based on the daily use of these services. That is, these services can be summarized as: the entertainment or educational video/audio SaaS services (e.g., YouTube or MP3 online streaming videos

and audios), social media communication SaaS applications (e.g., Facebook, twitter, Instagram, telegram, WhatsApp, Skype), collaborative SaaS applications (e.g., Google Docs, Microsoft office 365 applications, university portal), E-mails services running on SaaS Clouds (e.g., Google, Microsoft, or university emails), communication and calling services (e.g., Tango, imo, Viber, etc.), online storage (e.g., Dropbox, Google Drive, Microsoft OneDrive, etc.), and most importantly university portal used by students as well as academic staff. These services were chosen to be investigated to study the perception of users of SaaS at higher education sector in public Malaysian universities main campus.

#### **2.5.1.2 Software as a Service Related Literaturer**

The popularity of the cloud storage (i.e. a type of SaaS services) led to an increase of users in China from 23 million in 2011 to 380 million in 2014 and, consequently, the number of internet or telecommunication cloud storage providers increased in accordance to meet the increasing demand of this service (K. Wu et al., 2017). This situation led to a fierce competition due to lack of maturity in business model especially with imperfect government intervention, and caused critical consequences perceived from users that lead them to switch the providers frequently (K. Wu et al., 2017). Thus, the prior research investigated these individual-related issues such as: Trust, privacy, and security, social issues (Arpaci, 2016; Burda & Teuteberg, 2015; K. Wu et al., 2017); yet not paying sufficient research on a holistic model taking collectively the factors of different attitudinal, control, social, and security beliefs of the individuals. This triggered the need of the current research to fill this gap with a more holistic model of SaaS usage, acceptance, or adoption.

Additionally, previous works indicated that 95% of the SaaS users are in the SMEs sector in Korea and did not extend to large enterprises (S. G. Lee et al., 2013). The reasons behind that as claimed by the authors are lack of awareness of the economic benefits of SaaS and its concepts, availability, security, and insufficient differentiation from ASP due to technical immaturity of SaaS suppliers. All these issues hinders the rate of adoption of SaaS services (S. G. Lee et al., 2013). This infer to the need to probe more in the area of SaaS usage, acceptance, or adoption to help the SaaS providers to get more insight of the attractive services from user perspectives. In doing so, the results would shed more light on the perception and the provider can then get hints on developing or extending the services provided to users. Therefore, this study aims to fill this gap.

Besides, the consumerization is one of the crucial concepts that explain the phenomena of low adoption rates of SaaS. This concept is referred to as the emergence of new IT solutions or services and the effect that falls on the suppliers because of this emergence. In other words, the market is consumer-driven and not supplier-driven. That is, the end user of the technology is the key element to drive the high rate of adoption that suppliers of SaaS are aiming to (S. G. Lee et al., 2013). More specifically, the consumerization can explain the low rate of expansion of SaaS and other cloud computing services' acceptance in that the user or consumer if not studied well with all the factors that drive his/her behavior, the result could be the low rate of acceptance.

It is important to notice from literature that SaaS acceptance and usage has been studied in a number of works in terms of different contexts and dimensions with two levels, namely: organizational level and individual level (Gashami et al., 2016). For instance, Benlian and Hess (2011) studied German companies with adopter or non-

adopter of SaaS services and found that the salient factor is the security threat to influence the adoption/acceptance process. Having the same view, Shin (2013) has empirically investigated and compared the perceptions of individuals on private and public sectors companies. Findings reveal that there are no major differences between the two sectors, although the access, reliability, availability were drivers in the private sector acceptance, while the security concerns and usefulness proven to be more dominant in the public sector.

On the other hand, at the individual's level, the prior research on cloud computing in general, and SaaS acceptance in specific, found that the security concerns are seemed to have consensus among researchers that are dominant factors when referring to SaaS Cloud Computing services used, accepted, or adopted by individuals (Gashami et al., 2016; Shin, 2013). Additionally, other studies pointed out that the privacy concerns prior to cloud computing acceptance are important factors. Such risks appear when the cloud computing service provider provides data to legal or governmental requests, and in this case exposing the privacy of the client by modifying his/her private key (Hu, Yang, & Matthews, 2010). Additionally, Hu et al. (2010) conclude that the user's right to keep safe their privacy is not fully guaranteed in case of cloud as this data is in their own datacenter, i.e. the cloud computing provider's.

In regard to security and privacy concerns of cloud computing providers, Ion, Sachdeva, Kumaraguru, and Čapkun (2011) indicated that there is a focus on these issues in relation to the companies and not the individual's views, perceptions, expectations, and attitude pertaining cloud computing storage providers. They tested 36 interviewees, in India and Switzerland, having different security and privacy perception. They concluded that the privacy requirements for individuals differ and

that individuals are uncertain of using Cloud SaaS storage; therefore, they prefer to keep sensitive data in their local storage. The authors added that users of SaaS storage have misconception in terms of their rights that the SaaS Cloud Computing providers offers them and their actual privacy belief of their own data.

More importantly, Gashami et al. (2016) emphasize that little empirical studies verification of privacy, security, and risks surrounding SaaS Cloud Computing has been conducted in previous studies as well as its benefits from the perspective of the individuals. Consequently, there should be more research on this area to fill this gap and to give a special focus on the individuals. Hence, this study took into consideration studying privacy, security, and trust as constructs of the study. Furthermore, the users are the targeted respondents of the study at the public universities main campus, where the micro-level is less focused on the previous works.

### **2.5.2 Platform as a Service (PaaS)**

Platform as a Service (PaaS) has a different paradigm than SaaS in that capabilities are given to the clients to deploy their applications (or applications provided to clients) using the programming languages, application's libraries, tools provided by the PaaS provider on the Cloud infrastructures. The client is given the control over these developed or deployed applications by the clients of PaaS and can, therefore, make configurations according to their needs with control over the application-hosting environment (Mell & Grance, 2011). Additionally, the PaaS resides between the SaaS layer and the Infrastructure layer of the cloud computing service model. Okai et al. (2014) state that PaaS is a useful environment for developers in creating, storing, and hosting applications on.

Markedly, Low et al. (2011) presented a simpler explanation of PaaS layer of the deployment services model. They presented PaaS as pool of computers, storage systems, and databases working in virtualized environment that are delivered over the Internet by means of connectivity by providers (e.g., Salesforce.com, Microsoft Azure, and Google App Engine). Moreover, PaaS Cloud services can be accessed over the Internet and at the same time eliminates the need to manage several instances of virtual machines that are usually part of the developers' working process.

Additionally, Okai et al. (2014) declared that PaaS is giving facilities to developers, especially students at universities, in the process of developing and deploying the applications to overcome difficulties in terms of cost, upgrade, manage, and configure underlying hardware infrastructure in which the PaaS providers are offering as part of their service contracts. Besides, PaaS providers facilitate access to the different programming languages, libraries, and tools for the students to work by simply connecting to the cloud providers (e.g., Force.com, Microsoft Azure, Google App Engine).

In line with the above study, Yaghmaei & Binesh (2015) indicated that in the past, the developers had the burden to manage the hardware, operating systems, web servers, and databases locally on their machines in the premises, which was expensive for educational institutes that has fixed and limited budgets. PaaS providers (e.g., Google Application Engine or Windows Azure) have eliminated these obstacles and additionally given more processing power and storage scalability for developers to use in convenient way without worries of the limitation of premises hardware (i.e., upgrade, maintain, manage, etc.).

Additionally, W. Y. C. Wang et al. (2011) in their research stated that under PaaS the tools needed by developers to build applications are provided by PaaS providers over the Internet and can be accessed by means of web browser. This access of tools eliminates the need to install such tools on the local machine. Further, the applications developed by the customers gives the opportunity for the developers to test them over the Internet easily.

### **2.5.3 Infrastructure as a Service (IaaS)**

Infrastructure as a Service (IaaS) is the lower layer of cloud computing service model. In this layer, the computing resources, storage, and networking resources (e.g., host firewall) are provisioned to clients where they have control over operating systems, storage, limited networking resources, and deployed applications (Mell & Grance, 2011). Okai et al. (2014) in their study delineated IaaS layer, in which they referred to as everything as a service, in terms of hardware, storage, and networking, and gave a special focus on the virtualization technology of cloud computing. For instance, they indicated that virtualization is provided by IaaS to eliminate booting up new servers to a few minutes -instead of long waiting periods of times in hardware servers-, scaling the needed resources to expand or shrink by means of virtualization technology, and provide virtualized computing environment with cost-effective manner. They provide, also, a large research data that can extremely help in provisioning learning resources and e-learning scalability for educational institutes. Further, this area of providers has its own key players as Amazon E2C (Amazon Elastic Compute Cloud), HP, Go Grid, Rackspace, just to mention.

In the same vein, Yaghmaei and Binesh (2015) further express the usefulness and ease of use of IaaS services compared with former practices in past years in which



companies had to buy physical servers with relevant hardware. In IaaS, consumers can share the same hardware components with others from IaaS providers that have these infrastructures readily for use. These providers can supply/rent disk storage, RAM, and IP addresses on as needed bases with certain fees paid to the providers according to agreed service contract. With the invention of virtualization, these hardware resources are possible to be used, shared, managed, and scale up or down as needed by the consumer.

Moreover, Low et al. (2011) expressed the IaaS service layer as a delivery of computer infrastructure as a service in which providers owns the equipment of servers, storage, and network components and taking care of housing, running, and maintaining them. Providers such as: Amazonaws.com, Sunnetwork.com, IBM-Blue-Cloud, and Verizon CaaS do provision these resources by means of pay-per-use bases for organizations outsourcing equipment to support their business in a cost wise, efficient, and effective way.

In another research, W. Y. C. Wang et al. (2011) summarized and highlighted the gaps, trends in cloud computing research in addition to the opportunities. They explained that IaaS gives the opportunity to client to use complete set of equipment such as: servers, storage, and networking devices. The use of such services is based on the payment per usage.

## **2.6 Deployment Models of Cloud Computing**

Cloud computing has a growing trend that made businesses embracing it. There are four categories in the deployment model of cloud computing in which the following

subsections explain more on each. The following diagram, Figure 2.5, depicts the deployment model of cloud computing as found from reviewing the literature.

### 2.6.1 Private Cloud Computing

The private Cloud is one of the deployment models of cloud computing in which the infrastructure is provisioned, developed, and provided for a single exclusive organization that has different business units (Mell & Grance, 2011; W. Y. C. Wang et al., 2011), refer to Figure 2.5.

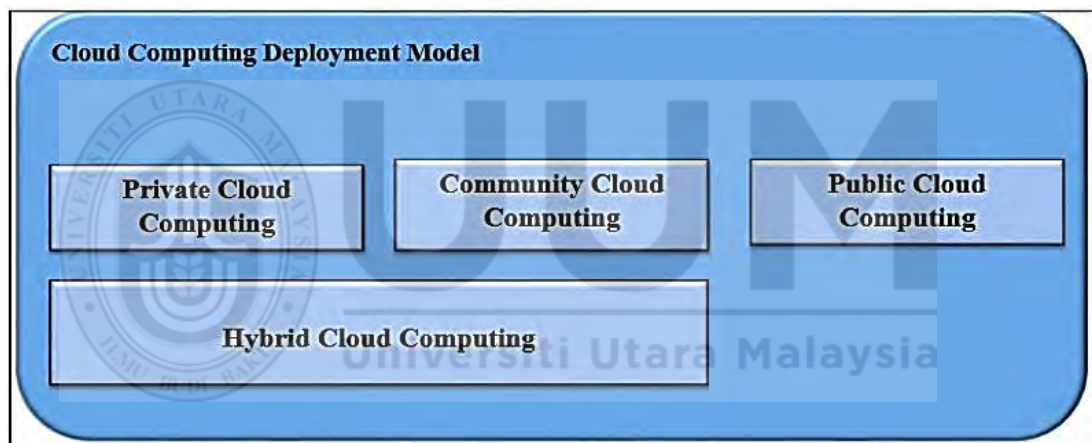


Figure 2.5. Deployment model of cloud computing

This model is managed, operated, owned either by the organization, a third party, or a combination of both. Additionally, it can exist in the same premises or even off premises. One example of the private cloud is Windows Azure in which private cloud can be built using Windows Server environment (W. Y. C. Wang et al., 2011).

Low et al. (2011) add that private cloud is implemented using the virtualization technology, industrialized and standardized services, and multi-tenant applications provided by the IT department. The business units, consequently, pay back the IT department with agreed charges for usage. Further, Low et al. (2011) state that the

deployment of private cloud is more secure and creates less hazards than moving entirely to public cloud from the perspective of many firms. Generally speaking, there is a consensus that the most secure cloud is the private cloud, although the most expensive one in the deployment model (Savu, 2011; Soliman et al., 2015). Moreover, Jlelaty (2012) argue that private cloud differs from public cloud in that the bandwidth restriction are lessened and clients of the private cloud can manage and process their data with greater control and more effectively. This yields more resiliency and security in the premises.

### **2.6.2 Public Cloud Computing**

In public cloud of the deployment model, the infrastructure and services are provisioned for open use by the general public over the Internet on bases of pay-per-use (W. Y. C. Wang et al., 2011). This model of cloud computing is owned, managed, administered and operated by organizations in government, academic institutions, or businesses (Mell & Grance, 2011). It resides on the cloud providers to offer its services for clients over a means of Internet connectivity. One example of this deployment model is Amazon Elastic Compute Cloud (Amazon EC2).

Jlelaty (2012) explained the word public of the public cloud model in that it is not always free but is less expensive to obtain compared with other deployment models. Moreover, the client's data is not accessible or visible publicly to everyone; instead it is accessible and visible only for the client with established agreement between the client and the public cloud provider. Additionally, public clouds have the advantage of being a cost-effective and flexible solution compared with other deployment models.

### **2.6.3 Community Cloud Computing**

The community cloud is a deployment model of cloud computing in which different entities (e.g., group of organizations or companies) having the same interests, such as: security requirements, shared policy, and common mission interests, work together to share resources in the cloud to be accessed by the members of the community cloud (Jlelaty, 2012; W. Y. C. Wang et al., 2011).

Community cloud may reside on/off premises and can be managed by members of the community, a third party, or a combination of both (Mell & Grance, 2011). A good example of community cloud is the Google's GovCloud that was created to help the City of Los Angeles to have isolated cloud environment to be accessed by different agencies in the city (W. Y. C. Wang et al., 2011).

### **2.6.4 Hybrid Cloud Computing**

The hybrid cloud is the last deployment model of cloud computing that consists of two or more distinctive cloud infrastructure (i.e., private, public, community cloud) (Mell & Grance, 2011; W. Y. C. Wang et al., 2011). Another view is given by Jlelaty (2012) in which they specify the hybrid cloud as a combination of only private and public clouds and suggests that non-critical information are outsourced to public cloud and confidential data to be kept in the private cloud inside the premises.

Mell and Grance (2011) added that these clouds in this configuration model not only keep the uniqueness of these clouds, but also at the same time bound them together in such a way to facilitate information, data, and application portability between these entities (e.g., cloud bursting for load balancing between clouds). In this form of cloud computing, the entities joined can create, manage, administer, and share resources

between each other or among them (W. Y. C. Wang et al., 2011). As an example of this mode, Juniper Networks and IBM are joined together to supply infrastructure services for other companies (W. Y. C. Wang et al., 2011). In this case, companies create, manage, administer, provide, and share resources with other organizations.

Okai et al. (2014) in a recent article argue that hybrid cloud is better suited for universities in threefold. Firstly, it offers cost-effective benefits for the management and enables smooth and easy way for sharing resources inside the university and with other universities on the globe. Secondly, the cloud would facilitate the lecturers' work in having accessibility to their notes anywhere anytime. Thirdly, concerns of security, privacy, and confidentiality issues are eliminated as this data is kept in the private cloud of the university inside their datacenters. Fourthly, the hybrid model of using private and public configuration is better for student and lecturers and the authors suggest that the university should have different public cloud providers to avoid being vendor-locked.

## **2.7 Cloud Computing Issues and Concerns**

An on-depth research in literature shows that cloud computing is still an emerging technology and not reached the maturity level (M. S. Ibrahim et al., 2015; Marston et al., 2011; Saedi & Iahad, 2013a; Senyo et al., 2018; W. Y. C. Wang et al., 2011; W.-W. Wu et al., 2011). For example, W. Y. C. Wang et al. (2011) noted that cloud computing has new challenging issues came from the adoption and acceptance of cloud computing at both levels, i.e. the organizational and individual level, and is still at the infancy that needs more exploration and investigation concerning different aspects. In the same vein, Saya et al. (2010) emphasized on that cloud computing is still at its emergence phase that extensive research has to cover its different aspects.

Additionally, according to Saedi and Iahad (2013b) and Saya et al. (2010) the extant research on cloud computing focuses on computer architecture (Rochwerger et al., 2009), potential applications for cloud computing (Liu & Orban, 2008), costs and benefits (De Assuncao, Costanzo, & Buyya, 2009); however, the decision to adopt cloud computing have not been empirically investigated. Saedi and Iahad (2013b) added that previous research focuses on specific service or model of cloud computing (W.-W. Wu et al., 2011) or technological aspects of cloud computing adoption such as: complexity, compatibility, trust and privacy, interoperability, reliability, security requirements, and future expectancy of cloud computing (Brohi & Bamiah, 2011; Low et al., 2011), where these are viewpoints that lacks the empirical explorations.

Another concern of the issues surrounding the cloud computing adoption and its acceptance is the perception of the end user of this innovative technology. Notwithstanding of the amount of extant research on cloud computing, studies that specifically examined the field of cloud adoption (e.g., SaaS storage as a service) from an end-user perspective are scarce (Burda & Teuteberg, 2015). Additionally, to ensure business continuity, improvements, and satisfaction of cloud service providers, the end user's perception should be ensured to be in the same level before the adoption of these cloud services or migration to new featured ones provided (Hobfeld et al., 2012). This infers that end user is a crucial factor in promoting new cloud services, migrating to it, and even continuing its usage. In the same sequence, M. S. Ibrahim et al. (2015) opined that the cloud computing bottom pyramid's users came from the educational sector that occupies only (4%), whereas the service sector (12%), business (10%), and manufacturing services sector (10%). Hence, this addresses an issue of concern in the academia to further probe this sector with empirical investigation. More importantly, in a recent research, Huang (2016) contended that the perception of students have

unexpectedly received little scholarly attention with regard to cloud computing adoption and acceptance research. Likewise, Yuvaraj (2016) contended the dearth of articles dealing with users' perception on cloud computing adoption or implementation and emphasized on the need to consider their perceptions when taking such decisions. Consequently, these arguments present further evidence to include and explore the individual's perception of SaaS services and applications.

The higher education sector is another concern in academia that previous works emphasized the importance to cover it in terms of cloud computing usage, acceptance, or adoption. For example, Mokhtar et al. (2016) in their recent research emphasized the crucial role of cloud computing technology at higher education institutes. Yet, they contended that many of them did not fully benefitted from this feasible and flexible innovative technology adequately. In the same sequence, Mokhtar et al. (2013) asserted that adoption of cloud computing at higher educational institutes is low that warrants the investigation of the influencing factors in this sector.

Additionally, in literature review, small number of studies are found studying the adoption of cloud computing at higher education sectors in different aspects. For example, Masud and Huang (2012) proposed a roadmap for higher education institutes to adopt cloud computing. However, this framework did not include any empirical investigation of the salient factors that influence the adoption process. Besides, Mokhtar et al. (2016) investigated the adoption of cloud computing from an organizational point of view and identified the adoption factors at higher educational institutes. However, the individual perceptions were overlooked, although they are the yard sticks to adopt this technology. M. S. Ibrahim et al. (2015), in their explicated systematic literature review on cloud computing studies at higher education institutes,

asserted the dire need to empirically investigate cloud computing acceptance and adoption at this sector. These findings, consequently, further highlight this issue and spot the light in the dire need to investigate the usage, acceptance, or adoption process of cloud computing empirically at the higher education institutes.

One of the major concerns of cloud computing is the trust on the service provider and the issues and concerns of security and privacy perceived from the user of this innovative technology. To explain, W. Y. C. Wang et al. (2011) conducted an extensive literature review on cloud computing and highlighted some of the main issues concerning the adoption and acceptance of this innovative technology. They stated that despite the various benefits of cloud computing, there are still some issues regarding the major concerns of consumers. For example, if there is a technical problem with the cloud service provider, what would be the impact on the beneficiaries? In principle, the technical problems that occur in conventional datacenter maybe solved in some hours, so what would be the case if cloud computing failure occurs of one of its services? These concerns are highlighting the trust on the service providers and therefore warrants the investigation on the current study.

Additionally, Mujinga and Chipangura (2011) highlight the importance of the physical location of data that resides on the overseas providers' Clouds instead on the premises itself in many developing countries and thus creates a major concern with the adopters. Additionally, the authors noted that data security and standardization are obstacles of a proper adoption of cloud computing especially in terms of privacy and security concerns that threatens not only the cloud computing providers but also the consumers. To explain, in SaaS Cloud Computing the security is of the responsibility of SaaS providers; therefore, consumers are uncomfortable with invisibility of the security



measures followed by them to protect their stored data that can be vulnerable to security breaches, risk, and privacy violations (Mujinga & Chipangura, 2011).

Further, the increasing incidents over the Internet triggered the identity theft that made consumers of the cloud computing worry about reliable verification mechanisms to avoid risks of impersonation and data loss. The Service Level Agreement (SLA) is an additional obstacle and a challenge for both the consumer and the provider and is the legal bond between the two parties that controls the level of service, the quality of service, the reliability, in addition to the risk that covers the security and privacy of the data (Mujinga & Chipangura, 2011). Based on the above review of literature, the researcher concludes that these concerns warrant the investigation of the trust that the user put on the providers, the feeling of security and privacy that the user possesses towards the SaaS providers.

Also, one of the issues are still challenging and falls under the cloud computing acceptance, is the socio-technical factors such as confidentiality, control over cloud computing services subscribed, performance, and usefulness. Understanding cloud computing usefulness is, also, another major concern of the acceptance and usage of cloud computing (Misra & Mondal, 2011) that still misses the empirical extensive research (Nasir & Niazi, 2011) and need further investigation.

Lastly, in a most recent literature review on cloud computing adoption, remarks of Senyo et al. (2018) highlighted the limited knowledge on the theories, frameworks, and models underpinning the understanding cloud computing research. The authors emphasized that the research on this area as it is still lacking the comprehension and holistic understanding.

To wrap up things, the benefits and shortcomings of cloud computing should be evaluated with care of specifics of cloud computing model adopted, current and future business requirements, and long-term business objectives (Feuerlicht, Burkon, & Sebesta, 2011). Therefore, exploration of these related issues is warranted to provide a springboard for future studies, deep understanding of cloud issues, and this consequently would lead to enhance the contribution to the practical implementation of cloud computing in all its different categories; deployment and service models.

## **2.8 Higher Education Sector and Cloud Computing**

### **2.8.1 The Tangable benefits of Cloud Computing at Higher Education Institutes**

The fast growing development of technology, the availability of various types of access to Internet, with growing speeds and rich education content have led to the transformation of education methods of cloud computing (Masud & Huang, 2012). Myriad of institutions in the higher educational sector recognized the crucial role that cloud computing could play in the learning/teaching process. In principle, numerous benefits upon adoption in terms of monetary and imparting information is obtained when cloud computing is embraced (H. M. Ibrahim, 2014; Mircea & Andreescu, 2011). A way from that, having variety of teaching-learning methods helped students in Malaysia to possess myriad of skills and competencies to participate in the education process as well as global development with continuous improvements of their disciplines (Razak, 2009).

In literature, some studies focused on the benefits and offerings that can be gained when using cloud computing in higher education sector (Arpaci et al., 2015; Bora & Ahmed, 2013; Pocatilu, Alecu, & Vetrici, 2010; Tout, Sverdlik, & Lawver, 2009;

Yaghmaei & Binesh, 2015), others focused on giving answers to issues and challenges of cloud computing service (Katz, Goldstein, & Yanosky, 2009; Masud & Huang, 2012; Razak, 2009; Tout et al., 2009; Veeramallu, Navya, & Pavani, 2013).

For example, Bora and Ahmed (2013) demonstrated the benefits of embracing cloud computing in educational institutes especially those utilizing E-learning facilities for students inside or outside the university campus. These benefits cover the students as well as the lectures in terms of time (i.e., students can access academic courses at any time on convenience such as Podcasts and other materials without restrictions of time), location (i.e., accessibility to resources such as tutorials, course materials, discussion forums from anywhere inside or outside classes), and communication (i.e., facilitates the collaboration and communication among students themselves and with the lecturer). Bora and Ahmed (2013), additionally, declared that other benefits such as: reduction of cost, travel, improved performance, and increased productivity is feasible.

Further, Pocatilu et al. (2010) in their effort to study cloud computing indicated the important role cloud computing could play in the educational sector, especially in e-learning. Additionally, they added that the low cost of cloud computing and its benefits that are obtained can be best suited for the educational sector. Likewise, a recent study by Yaghmaei and Binesh (2015) demonstrates that cloud computing is a better choice for educational institutes in which it brings essential infrastructure and other relevant educational resources at hand such as: centralized storage, virtual computing capabilities, lower cost of operations. They suggested, additionally, that cloud computing is an alternative solution for educational sector. It has an impact on the teaching and learning process and leads to a more focus on research and teaching systems rather than other conventional software.

Besides, Arpaci et al. (2015) affirmed the demand for cloud services among university students and academic staff from on hand, and the cloud services' providers from the other hand to gain mutual benefits. To explain more, when universities use the cloud computing services they reduce cost of implementing new hardware or upgrade and the cloud computing providers will increase number of customers and gain more revenue. This twofold benefit leads to the collaboration between both entities. For instance, the universities should acquire proper skills for the lecturers, provide free services and training for them to be conveyed to the students. On the other hand, the cloud computing providers should provide most advanced services, low cost, and free training of the features and services provided.

On the other aspects of cloud computing, Masud and Huang (2012) in their aim to identify an architecture using cloud computing within higher education tried to define the characteristics of E-learning education and combine it with cloud computing concept to explore different aspects of educational cloud computing in its form of E-learning. These characteristics are: architecture, construction method, and external interface with the model proposed. They tried to introduce an e-learning cloud to go hand in hand with the fast-growing development of Internet fast broadband connectivity, proliferation of low priced computers, and rich education content and to redesign the education system.

Additionally, Veeramallu et al. (2013) proposed an online web services using the cloud computing and its infrastructure and services to build a system to help students and lecturers in learning/teaching process with extra features. Their framework model, as proposed by the authors, would facilitate the communication and interaction between the professors and students, provide wealth of educational content accessible on line,

and provide communication among professors themselves by means of Microsoft Azure platform. The authors noted that this model would lower the cost, simplify accessibility of educational content, and help building new skills for students.

Despite the high level of technology innovation's existence nowadays that could help in the educational process at higher level institutes, there is an additional cost that universities are unable to afford due to less financial support from governments. This issue can be solved by cloud computing in which high tech is offered and low cost is achieved. For example, In Jordan a study conducted by Massadeh and Mesleh (2013) found that cloud computing is a good way to overcome the financial issues and to cope with the increasing demand to improve IT resources and to enable better usage of IT resources that are needed at the academic facilities. In line with that, Okai et al. (2014) argued that cloud computing helps universities to reduce cost and IT expenses in addition to facilitate adopting Green Technologies that is assumed by the usage of cloud computing.

Moreover, the shift toward cloud computing should be financially analyzed and based on business needs that follows a strategic plan of the university. Further, Tout et al. (2009) recommended to transition should take place in phases and in line with the university strategic plan. Markedly, the study recommended the educational institutes, which are financially supported by the government, to study a nation-wide cloud computing for higher education sector to reduce the concerns of cloud computing and enhance the collaboration among universities and with official organization that establish the standards to fortify acceptance and usage of cloud computing.

To sum up, as explained in the above paragraphs, cloud computing can be a strong driver and a complementary component to higher educational institutes in its myriad of services and applications combined by the reduction of cost that higher education institutes can avoid. Also, the flexibility of shifting many of the curriculum to the cloud and create a virtual environment for students and lecturers make its benefits outstanding. One of the most popular services of cloud computing is SaaS, where different entities such as students, lecturers, administrative staff, and technical department can utilize for its easiness and flexibility combined by low cost for the universities to adopt and familiarity of the software based on SaaS to achieve different tasks and assignment in the learning-teaching process. Therefore, cloud computing can boost the change of learning-teaching paradigm at higher education institutes.

### **2.8.2 Cloud Computing and Higher Education in Developed Countries**

In developed countries, there are myriad of higher educational Institutions that embraced cloud computing. For instance, in the U.S. the university of Washington adopted cloud computing to help staff and students in using SaaS Cloud Computing services from Microsoft (e.g., E-mail, Calendaring, SkyDrive, office Docs, etc.) and Google Apps (e.g., E-mail, Calendar, Docs, Sites, and Talk) (H. M. Ibrahim, 2014). Another example is the university of Texas and the North Carolina State university that were given IT equipment with encouraging prices. Further, storing courses using Amazon Web Services (AWS) in the cloud by university of California is another good example of the cloud computing SaaS services at universities (Sultan, 2010).

Moreover, the practices of cloud computing have many examples that made educational institutions reduce the expenses of licensing and updating software, maintain their own datacenters, and better usage of IT resources by researchers and

students. For instance, in Commonwealth the formation of Virginia Virtual Computing Lab was an opportunity for universities and colleges to collaborate. Also another example is the North Carolina State university in which cloud computing helped in the reduction of expenses of software licensing and IT staff as well (Mircea & Andreescu, 2011). Additionally, the authors reported that Kualu Ready, which is a community-source project chartered to provide a business continuity planning service utilizing cloud computing for educational institutes, is another good example.

Furthermore, the promotion of cloud computing is one of the main factors that encouraged the higher education institutes to adopt this innovative technology that is practiced by the main providers of cloud computing. Take for example, Microsoft, IBM, and Google are the key players in provisioning cloud computing services and they facilitate it as a useful research tool for lecturers, researchers, and students in the higher education institutes to improve imparting the knowledge and information technology (Yaghmaei & Binesh, 2015).

Mircea and Andreescu (2011) addressed the potential of cloud computing in many educational institutes and universities in the U.S., Africa, UK, and many others in Asia. Additionally, they added, cloud computing gave the opportunity for universities to focus on research and teaching instead of complexity of activities in managing their in-house datacenters and other software systems by utilizing cloud computing features of quick implementation of IT resources needed. The authors, also, proposed a model for university structure based on their perception of university needs as shown in Figure 2.6 (adapted slightly from the original illustration of the authors).

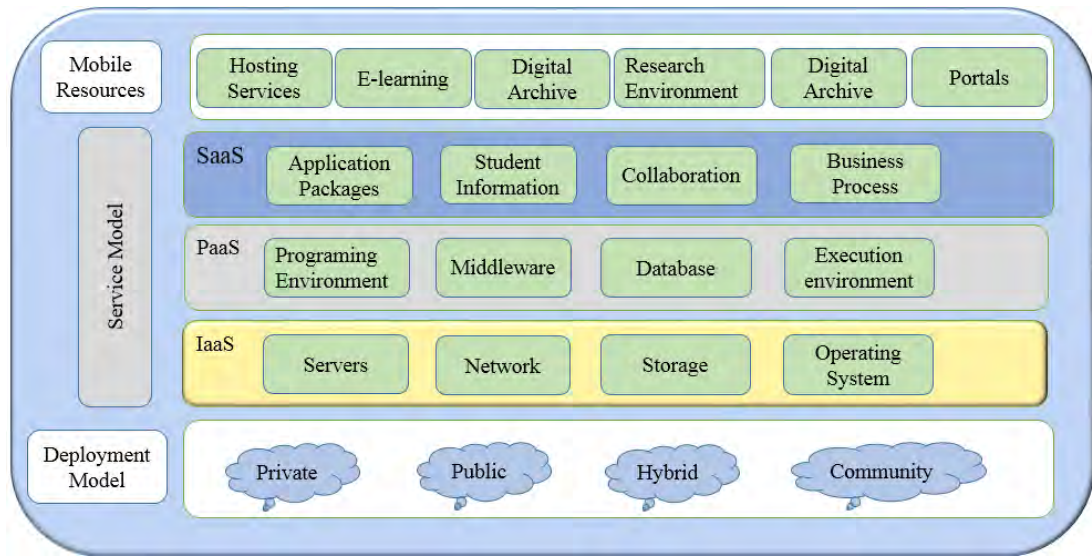


Figure 2.6. Cloud architecture for the university

Source: Adapted from Mircea and Andreecu (2011)

In higher education sector, the universities are challenged to have better standards to adopt technology that is needed to help students in the educational process of learning with latest technology and teaching methods to have better outcome, and to provide a good technical environment to help researchers and academics (Razak, 2009). Razak (2009) suggests in his study that students at Malaysian universities, due to the fast pace of technology in the 21st century, have different perceptions of teaching-learning of the conventional pedagogy that need further development at universities.

Also, Razak (2009) points out to a change in the conventional methods of teaching-learning to meet the students' expectations especially when they are more technology savvy that conventional teaching-learning methods cannot cope with the new and tangible perception of this generation. Additionally, the higher educational institutes, represented by the universities, have to follow the queue of other good reputation universities to gain good image and be one of the pioneers of the educational institutes



that have the latest technologies in their universities not only for research purposes, but also to attract more students from the globe.

### **2.8.3 Malaysian Higher Education and Cloud Computing**

In the context of Malaysia, the government has invested substantial lump sum to implement cloud computing in government sectors and universities as well. The universities are taking a reasonable share to have separate ICT infrastructure with advanced technologies (Shahzad et al., 2016). Moreover, the government reserved 20% of the Federal budget for education with 54 RM billion for the Ministry of Education on 2014 with emphasis of developing and investment on its people (Shahzad et al., 2016). Therefore, education in Malaysia is potential and is an ongoing process to build the economy based on human development. This can be achieved through cloud computing to develop systematic education that will harvest the needed outcomes (Shahzad et al., 2016).

There are, to the best of our knowledge, limited empirical studies on cloud computing in Malaysian and in higher education in specific found in literature. The ones found are focusing on general issues of cloud computing such as benefits and challenges (Razak, 2009; Shahzad et al., 2016), others focused on the total cost of ownership, identify low rate of acceptance causes, challenges, and suggesting adoption model with strategic guide lines for universities (Okai et al., 2014; Omar, 2012). For instance, Razak (2009) conducted a study on Malaysian higher education universities giving a special attention on the benefits, offerings, and challenges when adapting to cloud computing into teaching-learning environment at universities. Notwithstanding with their research, Razak (2009) did not provide any empirical investigation but merely provided descriptive research.

Another study conducted by Shahzad et al. (2016) on Malaysian HE sector discussing the benefits and challenges. The authors addressed the need to migrate to cloud computing in HE and their expectations on benefits of the HE institutes to have a reduction on cost of the infrastructure, on IT equipment with higher speed and secure intra-organization connections. Additionally, they emphasized that there are still issues to be focused on in adopting cloud computing at Malaysian universities to be successfully adopted. They highlighted the main universities in Malaysia and the deployment of different cloud computing services (i.e., SaaS, IaaS, PaaS) with the systems and applications in use in each premise. Moreover, the authors shed the light on the expected benefits of cloud computing services at the universities. On the other hand, their study did not provide any empirical study on cloud computing in higher education sector in Malaysia, despite the detailed information provided on that sector.

Also, Okai et al. (2014) conducted a research in a recent study to identify causes of low rate of acceptance of cloud computing at Malaysian universities, to identify challenges, and to suggest cloud computing adoption model with strategic guide lines for universities. The study was tested on the university level (i.e., organizational level or meso level) and did not contain any empirical tests on both the students and academic staff in terms of acceptance of cloud computing. Therefore, the aim of the researcher is to cover this gap and include the micro-level as respondents to investigate the usage, acceptance, or adoption of SaaS Cloud Computing.

Further, a study was conducted by Omar (2012) using a Malaysian higher educational level of one universality, UniMAP. The study compared the total cost of ownership between traditional datacenter of computing and cloud computing in higher education. The problem addressed on UniMAP was having difficulties to cope with the ongoing

cost for maintenance, growing need for space and servers. The study proposed cloud computing as having a lower cost option with many advantages. Also, the study used to analyze the results based on five steps: project initiation, cost modelling, cost collection, evaluating the results, creating final report and ongoing refinement of Total Cost of Ownership model using Microsoft Excel. The study did not include any empirical results on the reasons behind the acceptance of cloud computing rather focused on the cost reduction benefits.

#### **2.8.4 Necessity for Empirical Investigation of Cloud Computing at Higher Education**

Cloud computing acceptance needs to be investigated from different aspects and not only on the benefits, offers, or channelings but rather factors leading to its acceptance based on the individual perception of academic staff and students in higher education in specific. In principle, despite the fact that the influencing factors of cloud computing have been explicated in extant research of cloud computing , for example (Chebrolu, 2010; Low et al., 2011; Tweel, 2012), the factors influencing the cloud computing acceptance have not been identified (Klug, 2014). Therefore, a prolific area of research is needed to investigate this phenomenon by empirical studies based on the perspective of higher education individuals.

Moreover, Tout et al. (2009) noted that cloud computing is still not mature and will undergo several changes in the future. However, the researchers opined that cloud computing acceptance and usage have many advantages that can be provided for higher education sector with tight budgets. Besides, they added there are matters that should light be shed on, despite the potential benefits that are gained. That is, the area is still at the infancy and early adopter should follow the industry standards with

organizations such as NIST to ensure smooth flow of transition towards the Cloud. Secondly, the authors suggested the adoption of hybrid model so as to keep confidential data in-house of the university while transferring other data to be serviced over the cloud computing.

In line with this, Behrend et al. (2011) identified factors that lead to successful implementation of cloud computing in educational sector. They recommended to include in addition to students, instructors or teachers for further investigation of the drivers of cloud computing acceptance. This could raise a flag to address this gap to include these two categories in future research of cloud computing, where this study is aiming to cover.

Additionally, Mircea and Andreescu (2011) addressed the need for cloud computing acceptance in HE due to the increasing cost, frequent and increasing students' access to electronic resources, and the competition among higher education institutions to provide the required technology for students, teachers, and researchers. They also noted that business and government sectors are on the lead to adopt cloud computing, whereas the higher education sector still lagging. This is another gap where the higher education sector institutes are lacking the sufficient attention to be studied.

Moreover, Katz et al. (2009) inferred that the delay and reluctance of the acceptance of cloud computing is due to the nature of higher education. Further, they report that 70% (population N = 308) of IT leaders' emphasis on the improvement of IT services in this sector in case of adopting cloud computing, whereas 38% view that costs reduction is a factor of the adoption. In line with this view, Sultan (2010) and Yaghmaei and Binesh (2015) stated that many universities, in the U.S. and UK, use

cloud computing services but still there are some issues surrounding that hinder higher education to fully adapt to cloud computing . Consequently, cloud computing is seeming to be under less attention and thorough focus in the academia and this warrants the need to probe further on different issues in terms of its different implementation service models such as SaaS services at the higher education institutes.

Lastly, universities are the source of imparting the knowledge and technological skills for the community it resides in and are a microcosm that encompasses diversity of cultures and social groups (Sabi et al., 2016). Therefore, when studying the acceptance, usage, or adoption of SaaS Cloud Computing inside universities, we are actually studying the whole community that is representative of the society of the Malaysian context, and the Asian in general. Therefore, these reasons trigger the researcher to explore further in the educational sector and propose it as the context of research represented by Malaysian universities.

Based on these studies, it is clear that cloud computing acceptance is still in need for further investigation from different aspects and to empirically study the dominant factors in higher education institutes as they are a collective of different cultures, languages, beliefs, and perceptions. Also, the universities are preparing the students to be the workforce of different fields in the future. Consequently, those students are the key element to drive the adoption and acceptance of cloud computing as they are armored with skills, knowledge, and confidence to persuade the management of their organization to adopt such technology. In sum, cloud computing services, such as SaaS, are one of the main streams of education that more focus has to be paid upon to further build insight of this innovative technology and encourage more research on

different aspects that are still undergo low attention as aforementioned in literature especially at higher education sector (Okai et al., 2014).

## **2.9 Summary**

This chapter starts with an overview of the context of the current study of Malaysia. After that, the Malaysian Research and Education Network (MyREN) is explained as an important research network for the higher education sector, followed with the second generation of this network (i.e., MyREN2), which is an improvement of the first generation with cloud computing capabilities. The next sub-section provides an overview of the concept of cloud computing followed by the identification of the domain of cloud computing benefits in terms of virtualization, power consumption, IT sustainability, and E-waste.

After that, the classification of cloud computing is delineated based on the literature review works with the service model and its classes (SaaS, IaaS, and PaaS) and deployment model with its classes (Private, Public, Community, and Hybrid cloud computing). Next, the issues of cloud computing are delineated based on the findings of previous works. Following that, the study demonstrated the connection between higher education sector and cloud computing with special focus on the tangible benefits of the cloud computing in the higher education sector.

Next, the cloud computing at developing countries and its role in improving the learning and teaching process as well as the reduction of cost and increased performance is explored. Then the study probed the cloud computing at the higher education sector in Malaysia. Also, the study highlighted the importance of studying cloud computing empirically at the higher education sector, as there are paucity of

studies covering this issue, and discussed the literature previous works on this sector to reflect the nature of the study and probe the issues of cloud computing of this sector in previous works. Finally, a summary of this chapter is provided.



## **CHAPTER THREE**

### **THEORITICAL FOUNDATION AND RELATED VARIABLES**

#### **3.1 Introduction**

Firstly, the chapter gives an overview of the concept of having integrative models in quantitative empirical studies and their strengths in having better lenses to investigate the objectives of research studies; followed by the related and underpinning theories in this study, giving more focus on the reason behind the selection of the two theories selected to undertake the current study. Lastly, the study delineates the dependent variable with its antecedents from different contexts and perspectives in literature.

#### **3.2 Integrated Models and Theories**

There are different ways of using theories or models to conduct empirical studies. In-depth review of literature shows that some researchers use the theories or models in the original form or a slightly modified version for their studies, for example Im, Hong, and Kang (2011) and Mathur and Verma (2014), others extend the models or theories (Arpaci et al., 2015; R. K. Baker & White, 2010; Borgman, Bahli, Heier, & Schewski, 2013; Fung, 2014; H. M. Ibrahim, 2014; Mokhtar et al., 2013; Siang, 2012; Velázquez, 2014), and the others integrate two or more theories and models with extension (Hsu, Ray, & Li-Hsieh, 2014; Joglekar, 2014; Lawal, 2014; Lian, Yen, & Wang, 2014; Opala, 2012; Tan & Lin, 2012). Noteworthy, recent studies of SaaS Cloud Computing brought their own models based on the objective of the studies (K. Wu et al., 2017).

More importantly, some scholars emphasize the importance of the integration of theories and models to obtain clearer view of the adoption process. For instance, this view is explained as to determine the adoption process of innovative technologies and



integrative model is needed with different theories as it is not possible to cover all aspects of technology in a single theory or model (Mohammed, Ibrahim, Nilashi, & Alzurqa, 2017). Therefore, the focus of this study is the integration and extension of theories with inclusion and extension of other constructs that are relevant to the cloud computing area of research and found in literature to be crucial elements to investigate in this study. Table 3.1 illustrates the theories used in the area of Information Systems based on former studies.

Table 3.1

*Literature Review of Extended and Integrated Theories and Models*

Source	Theory or Model	Type of Application of Theory/Model	Area of Study
(Mathur & Verma, 2014)	DOI	Original theory with minor modification	Cloud computing adoption
(Udoh, 2010)	TAM	Original theory with minor modification	Grid computing adoption
(Im et al., 2011)	UTAUT	Original theory with minor modification	Technology adoption
(Arpaci et al., 2015)	Theory of Planned Behaviour (TPB)	Extending the theory	Cloud computing services usage
(R. K. Baker & White, 2010)	TPB by group norm and self-esteem	Extending the theory	Predict use of SNS
(H. M. Ibrahim, 2014)	Technology Acceptance Model (TAM)	Extending the theory	Usage of cloud computing
(Subramanian et al., 2014)	Innovation Diffusion Theory (DOI)	Extending the theory	Cloud computing adoption
(Velázquez, 2014)	TPB	Extending the theory	Cloud computing adoption
(Fung, 2014)	Porter Five Forces (Porter, 1980) and revised TAM	Extending the theory	Cloud computing adoption

Table 3.1 continued

(Siang, 2012)	Unified Theory of Acceptance and Use of Technology (UTAUT)	Extending the theory of	Cloud computing Adoption
(Mokhtar et al., 2013)	Technology Acceptance Model (TAM)	Extending the theory	Cloud computing adoption
(Mokhtar et al., 2016)	Technology-Organization-Environment (TOE)	Extending the theory	Cloud computing adoption
(Borgman et al., 2013)	Technology-Organization-Environment (TOE)	Extending the theory	Cloud computing adoption
(Lian et al., 2014)	Mainly integrates the TOE framework and HOF-fit (Human-Organization-Technology fit) model	Integrating theories	Cloud computing adoption
(Hsu et al., 2014)	TOE framework and DOI	Integrating theories	Cloud computing adoption
(Lawal, 2014)	Dynamic capabilities theory (DCP)	Integrating theories	Flexibility and effectiveness of cloud computing adoption
(Opala, 2012)	UTAUT and DOI	Integrating theories	Cloud computing adoption's decision by managers
(Tan & Lin, 2012)	TOE and DOI	Integrating theories	Cloud computing adoption
(Mohammed et al., 2017)	DOI, TOE, and FVM	Integrating theories	Cloud computing adoption

The rationale behind that can be delineated in a number of studies. For instance, Tweel (2012) agrees with other researchers that incorporating other constructs from other models or theories found in literature to enhance the understanding of the adoption and gives more insights on the issue under investigation (Al Nahian Riyadh, Akter, & Islam, 2009; C. Zhang & Dhaliwal, 2009). Additionally, M.-C. Lee (2009) argues on integrating theories concept by indicating that TAM and TPB were widely examined in IT usage and e-services acceptance; however, they did not show consistent superior explanation or behavior predictions. Further, the researcher affirms that a growing

body of research used the integrated model of both as they are complementary of each other and have better exploratory power as found in literature (Bosnjak, Obermeier, & Tuten, 2006; C.-D. Chen, Fan, & Farn, 2007; I.-L. Wu & Chen, 2005).

Amin, Abdul-Rahman, and Abdul-Razak (2013) asserted that combining theories has been applied in various fields and the benefits can be listed as follows: Firstly, it offers comprehensive and clearer understanding and presentation of the relationships, in addition to offer a broader explanation of a particular situation or phenomenon by providing multidimensional approach to understand intentions of adoption; secondly, it provides the strengths of the integrated models or theories and provides comprehensive research model; and lastly, the integration increases the explanatory power such as the indicator of behavior intention and produces better results, i.e. better than in using a single model. Additionally, these viewpoints are in line with other researchers (Fang & Shih, 2004; Margaret Tan & Teo, 2000; Taylor & Todd, 1995) and they added that the reliable and valid outcomes of the final integrated model is gained.

From the above justification, it can be inferred that the study is examining the acceptance of SaaS Cloud Computing services which lines with the adoption, usage, and acceptance of innovative technology. This also lines up with the individual's characteristics and intertwined with social characteristics and perceived control of the individual. Besides, USecP (i.e., user security predisposition) high order latent construct in using innovation technology is added that includes: trust, security and privacy as second order dimensions. According to these reasons, in addition to the above paragraphs on delineating the integration of theories in former works, the current study perceives the need to integrate theories in the current study along with

constructs found in literature of concerns on using cloud computing innovative technology.

### **3.3 Theoretical Framework**

In past literature review, there are many theories that were used to explain the acceptance, usage, adoption, and perception to use technological innovations in information system area. These theories have proven to be appropriate lenses to investigate the real reasons behind the hinderance or adoption, usage, and acceptance of technologies and innovations. These theories are, for example, the Theory of Reasoned Action or TRA (Fishbein & Ajzen, 1975), Diffusion of Innovation or DOI (Rogers, 1983), Technology Acceptance Model or TAM (Davis, 1989), Theory of Planned Behavior or TPB (Ajzen, 1985), and Decomposed Theory of Planned Behavior or DTPB (Taylor & Todd, 1995).

The following subsections present a review of related theories (i.e., TRA and TPB), the DTPB related literature review with its advantages and superiority (i.e., over TRA and TPB) to cover various aspects of human behavior, the DOI related literature review, and finally, the rationale behind the selection of the DTPB and DOI as an integrative framework of the current research.

#### **3.3.1 Theory of Reasoned Action (TRA)**

The Theory of Reasoned Action (TRA) by Fishbein and Ajzen (1975) suggests that a target behavior of individual is modeled as a direct function of behavior intention (BI), and that BI, in turns, is jointly determined by attitude (ATT) , either negatively or positively, in addition to subjective norms (SN) that influence the perception of

individual from important others. The main constructs of TRA are the specific behavior, BI, and its antecedents of ATT and SN beliefs. Additionally, it is noteworthy that one of the important line of research is the application of intention-based models using intention as a predictor of actual behavior and the focus is on the determinants of intention (Taylor & Todd, 1995). The following Figure 3.1 illustrates the framework of TRA as adopted from Fishbein and Ajzen (1975).

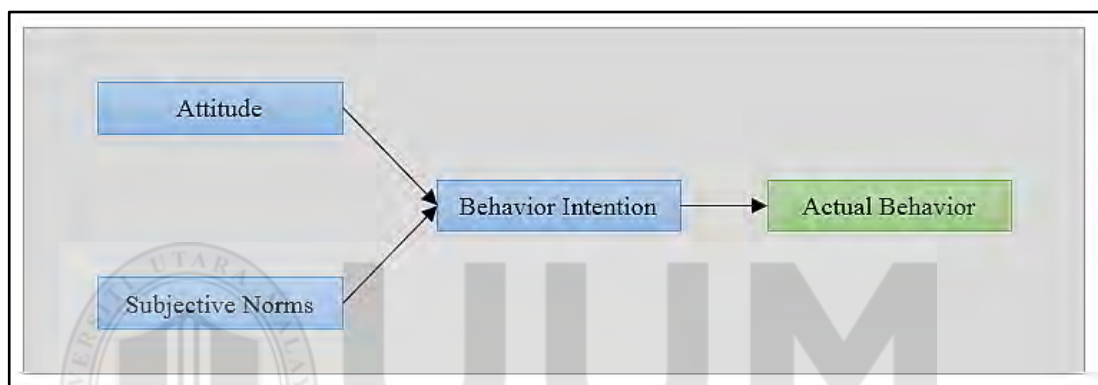


Figure 3.1. Theory of reasoned actions (TRA)

Source: Fishbein and Ajzen (1975)

Mishra, Akman, and Mishra (2014) indicated the importance of TRA since its initiation as an important theory over Information Integration Theory to study behavior intention. They, additionally, affirm that it was implemented in different studies to investigate the behavior intention toward computer use. Moreover, there are various approaches and models that were used in prior studies to investigate and define the determinants of acceptance, usage, or adoption of new technologies. One of the competing theories used in information system research is TRA, which is considered the mother of other theories. Other theories such as: TAM, TPB, and DTPB are actually based on it (Hernandez & Mazzon, 2007).

Additionally, many research articles and studies found in literature applied TRA to investigate the behavior of individuals and intention. This theory is considered to be one of the most important theories to explain human's behavior (Hernandez & Mazzon, 2007). For instance, Al-Majali (2011b) in his study based on TRA investigated the determinants of attitude towards the adoption of Internet banking using data collected and refined from 700 employees at Jordanian public university, who are using these services. He has found that intention to use Internet banking is determined by attitude and subjective norms. This, as a result, confirms the proposition of TRA that was proven by the study and shows the applicability and ability of the theory to be used within various sampling frames and target technologies (Al-Majali, 2011b).

In another study conducted by Benlian and Hess (2011) in the area of cloud computing to analyze risks and opportunities in adopting SaaS Cloud Computing by IT executives in firms, they used data of 349 respondents in Germany and a model theoretically based on TRA. The focus was on the opportunities and risks surrounding adoption of SaaS. Results show that perceived opportunities and risks constructs explained 83 per cent of the variance of the intention to increase the level of SaaS adoption among IT executives. This shows the ability of TRA to cope with the adoption and acceptance of the latest technologies to give explanation to concurrent issues in social psychology.

In another context, TRA model is used to study adoption of Green IT employing a total number of 157 IT professionals (Mishra et al., 2014). Findings show that behavior is driven by intention as postulated by TRA. Additionally, the author asserted the importance of TRA in studying behavior in environmental studies. In line with this, TRA was used in a study by Marandu, Moeti, and Joseph (2010) as a framework to

explain residential water conservation in Botswana utilizing 462 respondents. The aforementioned authors confirm that findings are in line with TRA and support it in that attitude and subjective norms are statistically significant predictors of behavior intention. Ok and Shon (2006), moreover, conducted a study employing 300 participants of Internet banking customers to investigate the influential factors on the usage of this service. Their model is based on TRA and the findings revealed that intention is a driver of the actual use of Internet banking services.

On the other hand, there are number of issues surrounding TRA that makes other theories more acceptable than it. Al-Majali (2011b) referred to a number of these issues that are considered as limitations of TRA. Firstly, it is a must to differentiate between intention and behavior as intention and avidity factors are determinant of behavior in question. Then, the probability of failing to perform is as a result of intention or the behavior itself. Lastly, behaviors that are not consciously considered, habitual and irrational actions or decisions, are not possible to explain using this theory.

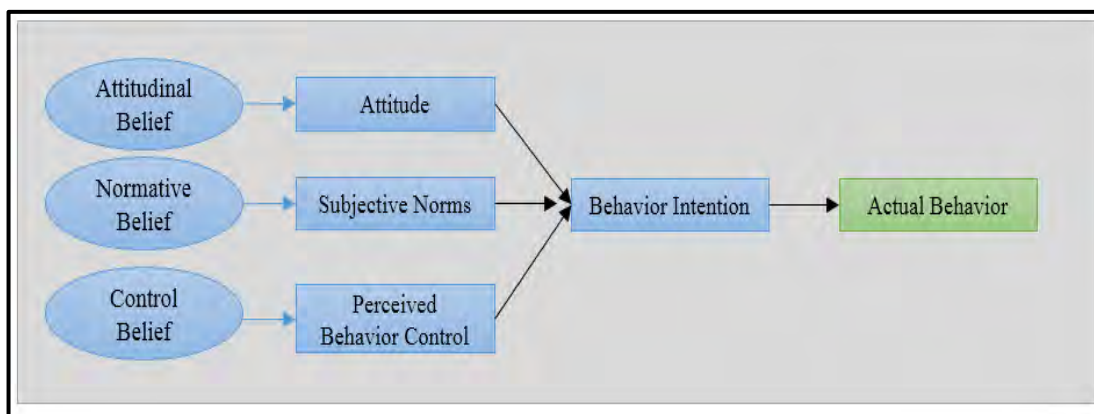
Further, number of comparative studies investigating different theories that are used in information technology and acceptance found that TRA has achieved lower than other models in the prediction power of actual behavior. For example, Shih and Fang (2006) compared in their study TRA, from one side, and TPB and DTPB, from the other side, in an aim to describe the influence of beliefs of attitudes, subjective norms, and control beliefs on customers intention to adopt Internet banking. The results reveal that TRA achieved the lowest prediction power among the three models. Also, Huh, Kim, and Law (2009) compared TRA, DTPB, and TAM to investigate the intention to use information technology in hotels. The findings confirm the results of other studies in that TRA has the lowest prediction power on actual behavior.

Based on the above literature works, TRA seemed to have its drawbacks in terms of covering the broader facets of the psychological characteristics of human being. One of them is not including the user capabilities and control, which is called the perceived behavior control. Besides, the explanatory power of TRA proved to have its lower value compared with other theories. That is why the researcher shifted to explore the next candidate theory of TPB that covered both issues and limitations of TRA, i.e. covering PBC and low predictive power. The following subsection explores TPB in more details.

### **3.3.2 Theory of Planned Behavior (TPB)**

The Theory of Planned Behavior (TPB) by Ajzen (1985) was an improved and extended version of TRA by Fishbein and Ajzen (1975). In TRA, the behavior is a function of behavior intention which, in turn, is determined by attitude and subjective norms. However, the TPB added a new construct of control belief to be an additional determinant of behavior intention that, therefore, is another driver of behavior. This construct is added to account for situations where the individuals lack of complete control over their behavior as explained by Ajzen (1985, 1991). In the following Figure 3.2 depicts TPB to illustrate the main constructs of the theory and its relationship with behavior intention and behavior control.





*Figure 3.2.* Theory of planned behavior (TPB)

*Source:* Ajzen (1985)

As it is shown in Figure 3.2, the behavior (AB) is a direct function of behavior intention (BI) and behavior control (PBC), and behavior intention is a weighted sum of attitude, subjective norms, and perceived behavior control as explained by Ajzen (1985, 1991). As a result, behavior intention and perceived behavior control jointly determine the behavior directly or indirectly (Al-Majali, 2011a).

To explain more, attitude is formed by attitudinal beliefs, and subjective norms are formed by normative beliefs concerning particular referent, and perceived behavior control reflects control beliefs either internal beliefs (i.e., self-efficacy) or external beliefs (i.e., facilitating conditions such as time, money, or resources) needed to perform a behavior. In sum, the behavior is directly predicted by actual behavior control and intentions, and affected by attitude, subjective norms, and perceived behavior control indirectly (Ozkan & Kanat, 2011), where these are the essence of TPB.

### 3.3.2.1 Advantages and Limitations

TPB was successfully applied in various research studies in different areas of information systems and with different contexts. For instance, Arpaci et al. (2015) in the area of cloud computing, studied the effects of security and privacy on educational use of cloud computing based on TPB model and employed 200 pre-service teachers as respondents. The findings show that security and privacy determine attitude, and attitude, in turn, is an influencer of intention towards cloud usage in educational setting. Moreover, predictive power of TPB was validated. In another study, Baker and White (2010) used an extended version of TPB to test its validity by using the main constructs of the theory with additional two constructs of group norms and self-esteem. A number of 160 adolescents were the targeted respondents at schools that reported the social network sites usage. The model has proven its support of variables of attitude and perceived behavior control in addition to group norms to influence intention and, in turns, the use of SNS frequently.

Similarly, in another study by Ramayah, Wai, Lee, and Lim (2012), who investigated the determinants of recycling behavior of university students (N = 200) using TPB. The findings show that environmental awareness is a significant predictor of attitude. Moreover, it is noteworthy that TPB show appropriateness in examining nature issues and that attitude and social norms are key predictors of behavior on recycling. Additionally, Velázquez (2014) employed TPB as a bases to build the model used to examine the predictors (perceived knowledge, attitude, perceived behavioral control) and the mediator (perceived risks and subjective norm), and their effects on the dependent variables (trust intention and behavioral outcome). The data used 170

respondents and the model was validated with results showing that social media and friends are good predictors of adoption of Cloud services.

In a past study conducted by Mathieson (1991) aiming to uncover the individual's intention variables to use information system, by comparing two models, namely: TAM and TPB, the study confirms the predictability of the two models on intention to use IS. On the other hand, although TAM shows slightly empirical advantage over TPB, the author affirms that TPB has detailed specific information that better guide the development.

In the venue of limitations of TPB theory, prior literature works have tackled the issues related to prediction power of different models and theories. Some studies found that TPB has similar predictive power as TAM with difference of having additional predicting constructs (i.e., subjective norms and perceived behavioral control) and consider it to be applicable and capable of explaining social psychology of human's behavior. For instance, Taylor and Todd (1995) assessed different models of (TAM, TPB, and DTPB) to predict the best model that helps explaining the adoption of information technology using students of a computer resource center at the university in the U.S. The results revealed that the predictive power of TPB is similar to TAM. Conversely, others consider taking into account that TPB is having issues of not owning constructs such as: perceived moral obligations, image or self-identity, and habits in which they may predict intentions and behaviors of individuals (Al-Majali & Mat, 2011). Moreover, there are problems surrounding the identification of attitudinal salient belief dimensions that is why Davis et al. (1989) and Mathieson (1991) indicate that TPB did not explain usage intentions, as emphasized by Taylor and Todd (1995).

Moreover, the previous theories, i.e. TPB and TRA, have shown their drawbacks to explain broader aspects of human psychological characteristics, where TRA lacks the perceived behavior control in its original mode and TPB overcomes this drawback but lacks the breakdown of the general beliefs of ATT, PBC, and SN. That is, TPB has managed to cover some of the drawbacks of TRA; however, it lacks the clarity of the general beliefs aforementioned. Taylor and Todd (1995) explained that the measures of beliefs were based on salient belief elicitation measure that created ambiguity of the scale under specific setting and, therefore, they may become less ideal to define the general beliefs (i.e., ATT, PBC, and SN) themselves correctly. Consequently, the relationship between the belief and attitude may be more obscure (Taylor & Todd, 1995). That is why the decomposition of beliefs is required. Based on this argument, the researcher shifts to delineate DTPB in the following subsections.

### **3.3.3 Decomposed Theory of Planned Behavior (DTPB)**

TRA theory (Fishbein & Ajzen, 1975) is considered to be the bases of other theories such as TPB (Ajzen, 1991) and DTPB (Taylor & Todd, 1995). In other words, the TRA has the main beliefs of attitude and subjective norms. These beliefs are the drivers of the intention that is, in turn, the main driver of the actual behavior or acceptance of certain behavior. Additionally, TPB (Ajzen, 1991) added perceived behavior control to TRA model that is adopted by DTPB. However, the theory of DTPB (Taylor & Todd, 1995) is regarded to be an extension of TPB with the difference of decomposing the general three beliefs (i.e., attitudinal, normative, and control beliefs) into more specific beliefs. In other words, Taylor and Todd (1995) joined two distinct concepts from two different theories, namely: DOI and TPB (Hernandez & Mazzon, 2007). That is, DTPB decomposed those main beliefs, (i.e., normative, attitudinal, and control

beliefs), into multi-dimensional constructs to increase the predictability of the model and to further give insight of the main beliefs.

Taylor and Todd (1995) explained that monolithic belief structures that represent various dimensions are unlikely to be related to intention's antecedents. This view is in accordance with other researchers (Bagozzi, 1992). Additionally, Taylor and Todd (1995) added that by the decomposition of these beliefs, the relationship will be more understandable and applicable in more settings. Moreover, they asserted that by decomposing these beliefs, the disadvantages of operationalization are avoided of traditional intention models. In other words, going further into specific beliefs makes understanding of factors influencing the usage, acceptance, and adoption manageable and more applicable (Taylor & Todd, 1995). Further, the authors declared that using the decomposition makes advantages similar to TAM, but with more complex fashion as DTPB has more variables that gives more understanding of IT usage than TAM.

In DTPB the actual behavior is determined and modeled as a direct function of Behavior Intention (BI). The Behavior Intention, in turn, is determined jointly by three factors, namely: Attitude (ATT), Subjective Norms (SN), and Perceived Behavior Control (PBC). Each of these antecedents are generated by number of beliefs. That is, the attitudinal belief is decomposed into three main constructs, namely: perceived ease of use, perceived usefulness, and compatibility. Additionally, subjective norms beliefs are a weighted function of two main constructs and decomposed into: peer influence and superior influence. Lastly, the perceived behavior control consists of three main beliefs: self-efficacy, resources facilitating conditions, and technology facilitating conditions. Figure 3.3 illustrates DTPB framework.

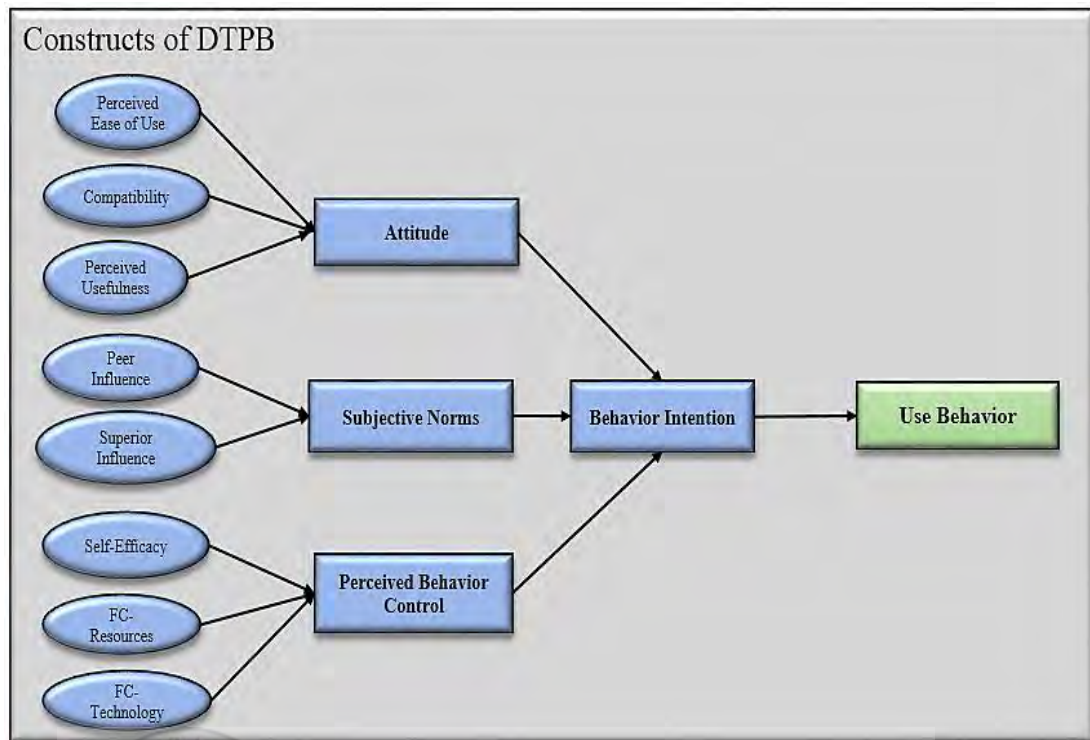


Figure 3.3. Constructs of decomposed theory of planned behavior (DTPB)

Source: Taylor and Todd (1995)

### 3.3.3.1 Advantages of DTPB

One line of research is focusing on the usage of technology from innovation diffusion perspectives as in DOI (Rogers, 1983). Another line of research as the study of Moore and Benbasat (1991) in which they came up with different approach to include concepts of TRA. They focused on the attitude and intention, and innovation characteristics from DOI (Rogers, 1983). This integration is helpful in better explaining the general behavior and to find more about the determinants of acceptance of technology. Another line of research is extending this view into more holistic approach (Taylor & Todd, 1995) to include user characteristics, innovation characteristics, information and communication channels, as is the case of this research that uses DTPB. Markedly, Taylor and Todd (1995) tested different theories, i.e. TAM, TPB, and DTPB and found that TPB and TAM achieve similar predictive power, while

DTPB has achieved better predicting power than the other two theories. This highlights the importance of DTPB in its predictive power and its holistic approach to cover wider characteristics of human social sciences.

DTPB model is drawn upon innovation characteristics, but further incorporates and explores other characteristics of social influence and perceived behavior control. Additionally, the general belief of attitudes, social influence, and behavior control are decomposed into dimensions to give better insight of the belief. This decomposition provides practical benefits over other models (Susanto & Goodwin, 2013).

Moreover, the decomposed TPB model has advantages of specifying important beliefs, as it is in TAM, in which it determines the IT adoption and acceptance. Further DTPB incorporates the significant others and ability perceived by the users that are important to include in the model as they provide more insight of IT usage and acceptance (Taylor & Todd, 1995). This is an advantage over TAM that does not include those beliefs.

In-depth literature review highlights the importance and advantages of using DTPB with the decomposition of main belief constructs. For example, Fang and Shih (2004) in their study made a comparison between TRA, from one side, and TPB and DTPB, from the other side, in an aim to describe the influence of beliefs of attitudes, subjective norms, and control beliefs on customer's intention. The results showed that DTPB has better predicting power of the main three beliefs than in the other two models of TPB and TRA.

Similar findings of the predictive power of the three models (i.e., DTPB, TAM, and TRA) on investigating the intention to use information technology in Korean hotels

revealed that DTPB has the most predictive power on the intention to use the technology, followed by TAM, and finally TRA (Huh et al., 2009).

Additionally, Ramayah, Soto-Acosta, Colomo-Palacios, Gopi, and Popa (2014) conducted a study to find out determinants of behavior intention to adopt Internet stock trading in Malaysia utilizing 144 respondents. They used an integrated model of DTPB (i.e., IDTPB) and compared it with different models of DTPB, TPB, TAM, in addition to integrated model of TPB (i.e., ITPB). The results showed that TPB and DTPB have a better predictive power of the intention than TAM. Also, when they integrated constructs to TPB and DTPB, the prediction power of the integrated version of DTPB produced better results than TPB and its integrated version (i.e., ITPB). The results gained from this study give a strong evidence of the critical and influential effect of the integration of different theories. Also, it was revealed that TPB and DTPB have better explanation power in their original model and the integration of other constructs enhanced their predictive power and explanation. Hence, DTPB is taken into consideration in the current study with integration and extension to its original model.

In a recent study by Hsiao and Tang (2014) reported that DTPB has advantages in identifying the important specific factors in using e-textbook like TAM, but has more factors (i.e., social and personal control factors) that are important determinants of behavior in which they are not included in TAM. Accordingly, the authors suggest that DTPB provides more comprehensive framework of using e-textbook than TAM. Moreover, their results revealed that in comparing different models the explanatory power of DTPB overcomes TAM, TPB, and the combined model of TAM and TPB.



Finally, number of advantages of DTPB has been noted and can be summarized as: In the first place, DTPB is easy to understand and grasp the relationship among the main constructs of attitude, normative, and control beliefs. In the second place, applicability of the DTPB model in different contexts and variety of situations. In the third place, it assists in determining specific factors that are drivers of usage, acceptance, and adoption of technology (Hernandez & Mazzon, 2007).

Based on the above explicated literature and benefits of DTPB, the researcher articulates to use this theory as a main lens to unveil the different aspects of user perception of SaaS services and to cover different aspects that lead to its use, acceptance, or adoption. That is, the user characteristics that cover the attitude of the individual, innovation and information characteristics (i.e. focuses on the capabilities of the individual in the process of adoption), and the communication channels (i.e. the social influence that may play in the decision to use, accept, or adopt this SaaS services) are all covered in this theory. Besides, this theory provides a holistic model and a wider view of the main beliefs (i.e., attitudinal, social, control beliefs), in which they are decomposed into a more granular antecedents that forms these main beliefs. DTPB, unlike TRA or TPB, gives more explanation for the human behavior in the decomposition of these main beliefs, and thus, shed more light on the behavior by studying various facets of the antecedents of the behavior itself.

#### **3.3.4 Diffusion of Innovation (DOI)**

One of the popular models used in research of information technology and innovative systems is the Diffusion of Innovation theory (DOI) by Rogers (1983). It has been used in a wide scale to explain the acceptance, adoption, or usage of innovative systems and new technologies. Rogers gave a definition of innovation as a process that

communicate with three elements of certain communication channels, time, and members of social society (Rogers, 1983). Further, he described innovation as an idea or object that is considered by the individual or entity of adoption to be new. The communication channels are the processes of sharing information with one another to obtain shared understanding. This communication channel is within the social system that the adopter of innovation resides in. Additionally, this process reduces the uncertainty surrounded by the innovation in elapsed time within the social system.

The main five constructs that rate the diffusion according to Rogers (1983) are: Relative advantage (i.e., superiority to its predecessor), compatibility (i.e., that is compatible with values, beliefs, experiences and needs of adopters), complexity (i.e., difficulties faced by new innovation and is comparable to ease of use construct of TAM but in opposite direction), trialability (i.e., experiment of new innovation for certain period of time), and observability (i.e., the benefits that are observed by using the innovation).

Some researchers conclude the importance of three constructs of innovation: relative advantage, complexity, and compatibility (Carter & France, 2005; Tornatzky & Klein, 1982). Others, however, extended DOI with other constructs such as: voluntariness (i.e., the feeling of having the choice to use or not use innovation), demonstrability, image (i.e., that is having status symbol in social circle), and visibility (i.e., relevant to the adoption of new innovation) (Moore & Benbasat, 1991). This extended model is referred to as perceived characteristics of innovation (PCI) (Moore & Benbasat, 1991).

In an extensive literature review, many studies used DOI as a lens to investigate the acceptance, adoption, or usage of innovation in information system arena. For

instance, Nor and Pearson (2007) in an aim to investigate online environment, represented by Internet banking acceptance, used innovation constructs from DOI and trust construct. The results revealed that two constructs of Rogers' theory of innovation, namely: Relative advantage and trialability in addition to trust have shown significant effect on attitude to adopt online Internet banking.

In another study conducted in New Zealand to implement Facebook in public universities using Rogers' DOI theory, Neo and Calvert (2012) conducted a survey to investigate adoption and non-adoption of Facebook and results identified motivation factors of adoption and persuasion stage attributes. Besides, complexity, compatibility, and relative advantage were found to be the critical factors explaining the adoption. The authors concluded that prior conditions of DOI (i.e., ex-experience, recognized needs, innovativeness, and norms of the social system) were met.

To explore the factors contributing in the adoption rate of e-journal publishing, Sanni, Ngah, Karim, Abdullah, and Waheed (2013) used attributes of DOI, three organizational attributes— experience of editor, size and age of the journal- and awareness to examine their role in the adoption rate of e-journal publishing. Results showed that only two attributes of the five attributes of DOI were significant, but all the three organizational variables were significant. Additionally, these five variables explain 57.8% of the variance in adoption and acceptance rate.

Lastly, Lin and Chen (2012) used DOI and knowledge-based trust literature to explore the effects of knowledge-based trust and three innovative attributes of Rogers' (1983) model (i.e., ease of use, relative advantage, and compatibility) on attitude and behavior intention to adopt mobile banking. Results reveal that three attributes of Rogers, as our

focus on Rogers attributes, are significant predictors of attitude that eventually lead to adopt and accept mobile banking.

#### **3.3.4.1 Advantages and Limitations**

In reviewing literature, it is clear that DOI is among the most important theories that were developed to comprehend the technology assessment, adoption of innovative technologies, and usage and implementations of innovation in different areas of research. In addition, it was used in qualitative and quantitative research to assess the diffusion of innovation, identifying factors that enables or hinders the adoption and acceptance of innovation (Fichman, 1992).

Furthermore, Brown (1997) indicates the importance of this theory in understanding the diffusion and social change at different stages of time. Also, DOI was used in different contexts and explained the motivations of adopting, accepting, or uses of innovations in organizations as well as individuals. This was confirmed by an extensive analysis of theories used in IT innovation adoption research in literature by Jeyaraj, Rottman, and Lacity (2006). The authors reached to the point to confirm that DOI is one of the important theories that are used for both individuals and organizations and that the five attributes of Rogers have predictive weights above 0.50. On the other hand, they noted that Rogers attributes did not show list of best predictors for aggregate IT adoption factors in both individual and organizational settings.

Additionally, one of the limitations that should be taken into account is that there is no evidence on how attitude evolves in decisions taken positively or negatively, and how innovation process fit in this process (Al-Majali, 2011a). Besides, Alotaibi and Wald (2013) in their view of DOI demonstrated that the theory does not provide in-depth

explanation for numerous innovations and failed to show detailed interaction-based explanation concerning innovation and the way it is adapted and refined. It is, however, generally explains the innovative characteristics of beliefs. They added that attitude does not have support in this theory on how it becomes a decision or on how innovation fits into such process.

### **3.3.5 Rational behind The Selection of DTPB and DOI in The Study**

DTPB has an advantage in covering different facets of human characteristics and can be regarded as a multi-faceted theory. The individual characteristics, the information and innovation characteristics, and the communication channels (i.e., social circle that play a crucial role in shaping the individual's perception and his/her actual behavior) are perceived by the researcher to bring broader picture of human behavior. This warrants a holistic model with comprehensive variables that cover human behavior. When studying these beliefs of human characteristics, it is more likely to shed the light of each of the three main beliefs if they are decomposed into smaller aspects as explained by Taylor and Todd (1995). The superiority of this theory over other theories in its coverage of many aspects are explained in the previous sections Therefore, the research articulates to use DTPB as the underpinning theory in an aim to get a holistic model to uncover the salient variables that influence the usage, acceptance, or adoption of SaaS Cloud Computing.

Additionally, as it is explained earlier, DOI has proven to be a suitable theory in the assessment and explanation of the adoption of innovative technologies with organizations and individuals. The use of innovative technology, based on DOI, is an interaction of three main elements that includes: firstly, the communication channels to exchange information. Secondly, the social environment in which this innovative

technology does exist. And thirdly, the process that starts with use, then acceptance, and finally adoption of innovative technology where it consumes time in which it leads to decrease the uncertainty of an innovative technology. These elements are important in the current study as to explore them in the adoption process of SaaS Cloud Computing that starts with the usage, then acceptance, and finally adoption where it is in line with the explanation of innovative technologies by Rogers (1983).

More importantly, the adoption of innovation goes in stages as emphasized by Rogers (1983) and further supported by previous works (F. T. S. Chan & Chong, 2013; Martins et al., 2016). Therefore, the researcher articulates the starting phase by using the technology, where it is evaluated for a certain time. Then, the acceptance is created, where a positive appraisal is gained from the testing period and the user is acquainted by the innovation and gains knowledge and skills of using it. After that, when the presumed benefits are gained, the adoption process is taking place, where it is used in a large scale.

Additionally, the integration of both theories, DOI and DTPB, facilitates the understanding of the perception of individuals in a wider scale of variables. Moreover, by using an integrated theoretical model of the two theories, the researchers expect to get better insights, get strength of both theories, and a broader picture of the phenomena under study. That is, the acceptance, usage, or adoption of SaaS Cloud Computing, where this integration is confirmed by many researchers as explained in the former subsections.

Also, this integration is aimed to gain advantage of having higher predictive power and better explain the outcome of the current study, while combining the strength of

both theories to explain the innovation acceptance of this study of SaaS services. Hence, these two theories are extensively probing the human characteristics, the capabilities, the social environment, and taking into account the communication channels and time to reduce the uncertainty of such innovation to explain the SaaS adoption process in this explorative study.

Additionally, the integration of the two theories with the inclusion and extension of the constructs aforementioned is aimed to capture various aspects of individuals (i.e., attitudinal-technology-related, social-related, and control-related constructs in addition to security-related constructs) and to develop a theoretical based model that investigates the salient factors influencing SaaS Cloud Computing adoption, which these aspects go in line with the nature of these two theories.

The study's conceptual framework, therefore, is built upon DTPB, as a primary theory, and supported by DOI. Also, DTPB is chosen to be the primary theory as it covers many aspects of individual's perceptions. Unlike other theories (e.g. TRA and TPB), where they explain the actual behavior with general beliefs of attitude, subjective norms, or control beliefs, DTPB is more explained theory in terms of these beliefs and brings more insights to discover these beliefs in more granular way. Based on this argumentation the conceptual framework of the study is built upon DTPB and DOI.

### **3.4 The Dependent Construct of Usage, Acceptance, or Adoption of SaaS Cloud Computing (AUSaaS)**

Okai et al. (2014) emphasized on the remarkably low rate of cloud computing adoption in developing countries, while other researchers stressed on the dearth of empirical investigation of the adoption at higher education sector based on systematic review

conducted, where their findings emphasized on that the top users only represent 4% in this sector (M. S. Ibrahim et al., 2015). Besides, Mokhtar et al. (2016) stressed on that higher education sector did not fully benefitted from cloud computing adequately. Therefore, the outcome of the study warrants more empirical investigation.

Moreover, previous works investigated the adoption of cloud computing and measured it in different ways by

- the intention (Burda & Teuteberg, 2015; Macedo, 2017);
- binary variable anchored by “adopt or not adopt” (Gutierrez, Boukrami, & Lumsden, 2015);
- a range of cloud-based technologies used - anchored by Likert scale ranging from “not used at all” to “used very extensively” (Hassan et al., 2017);
- the level of adoption in terms of public cloud, private cloud, community cloud, MicroCloud (Maqueira-Marín, Bruque-Cámara, & Minguela-Rata, 2017);
- experimental/departmental/interdepartmental cluster (Maqueira-Marín et al., 2017); or
- with a multi-item Likert scale that has been built up using IS measurements that assured its reliability and validity in different theories and contexts (Gupta et al., 2013).

However, in the current research, the measurements adapted from previous works (Ajjan & Hartshorne, 2008; Bélanger & Carter, 2008; Davis, 1989; Fang & Shih, 2004;



Koenig-lewis, Palmer, & Moll, 2009; H. F. Lin, 2007; Mohammadi, 2015; Moore & Benbasat, 1991; Y. Park & Chen, 2007; Taylor & Todd, 1995; Venkatesh & Davis, 2000; Y. Wang, Wang, Lin, & Tang, 2003; Zolait, 2014) that have proven their reliability and validity. Moreover, the measurement of the current study focused on a range of innovative SaaS services and applications that are used on the personal level. These services, presented in the questionnaire, have various types that are classified in 6 categories, where they provide variability that lacks in former SaaS adoption studies. The services and the applications' classes are listed as follows: Collaborative services, social media and communication applications, e-Mail services, entertainment or educational video/audio streaming services, storage services.

The outcome of the study focused on four items that includes: the frequency, the preference of these services over the traditional ones, the ability to express its advantages to others and explain different services with no difficulties (refer to the measurement section for details). The use, acceptance, or adoption of SaaS services and applications were anchored with 5-point Likert scale items ranging from “Strongly disagree” to “Strongly agree”, which are in line with former works measuring this dependent variable of usage, acceptance, or adoption.

### **3.4.1 Definition of The Dependent Variable (DV)**

In literature works, adoption, usage, or acceptance is defined in terms of implementation, usage, acceptance, utilization, and actual behavior or use (Al-jabri & Sohail, 2012). In the same sequence, Rogers (1983) affirms that the Usage, acceptance or Adoption behavior toward technology is a process that has many phases that need to extend over time and under the individual's will to perform or not to perform it. Further, he defines it as, “a decision to make full use of an innovation as the best course

of action available “ (Rogers, 1983, p. 172). In the Theory of Reasoned Action (TRA), the behavior is defined as, “a function of salient information, or beliefs, relevant to the behavior” (Ajzen & Madden, 1986, p. 454).

Additionally, it is worth mentioning in reviewing literature, the terms of adoption, acceptance, use, and diffusion are termed in different fields and settings in prior research and are often used interchangeably in information system research (Dwivedi, Williams, & Schwarz, 2008). However, in this study the term usage is meant to use the innovative technology regardless of liking or disliking it and using it voluntarily or obligatory. Besides, the acceptance is meant to use the innovative technology for some time and believe it suits the user of its advantages and produce appraisal of positive feelings. Moreover, the adoption is meant to use an innovative technology, accepting it, and as a later stage continue to use it and adopt it entirely in everyday errands. This goes in line with DOI theory that innovative technology goes into different phases. Therefore, and based on the argumentations presented, these three terms are assumed in the current study to refer to using, accepting, or adopting SaaS Cloud Computing (i.e., AUSaaS) as the final outcome of the study.

In the context of this study, the use behavior, acceptance, or adoption, is referring to the application, acceptance, or usage of SaaS Cloud Computing services by individuals in HE academic studies.

### **3.5 Antecedents of DV**

The TRA of Fishbein and Ajzen (1975) categorizes the formation of behavior with two antecedents (i.e., behavior beliefs that influence attitudes, and normative beliefs that constitutes the determinants of subjective norms). However, the DTPB and TPB adds

a new construct, that is the control belief. Further, DTPB decomposed the three main constructs (i.e., the attitudinal beliefs, the normative beliefs, and the control beliefs) to better explain the behavior intention that leads to the actual behavior (Taylor & Todd, 1995).

On the other hand, the main three beliefs (i.e., attitudinal, normative, and control beliefs) do not directly predict the behavior, rather they are indirectly predicting behavior through the intention (Taylor & Todd, 1995). Moreover, the actual behavior (i.e., acceptance, usage or adoption of technology that are used in this study interchangeably) is believed to be an outcome of the behavior intention and proven to be supported theoretically, namely by DTPB (Taylor & Todd, 1995), UTAUT (Venkatesh et al., 2003), TPB (Ajzen, 1991), and TRA (Fishbein & Ajzen, 1975).

Additionally, this relationship between the intention and the behavior is proven empirically in using, accepting, or adopting technologies in various areas in past studies (Ajjan & Hartshorne, 2008; Hartshorne & Ajjan, 2009; Pinheiro, Aparicio, & Costa, 2014; Velázquez, 2014; H. C. Yang & Zhou, 2011; S. Yousafzai, 2012) that will be further delineated in the following subsections. In Figure 3.4, the antecedents of behavior are depicted to show the direct relationship between behavior and behavior intention (with their antecedents) in the current study.

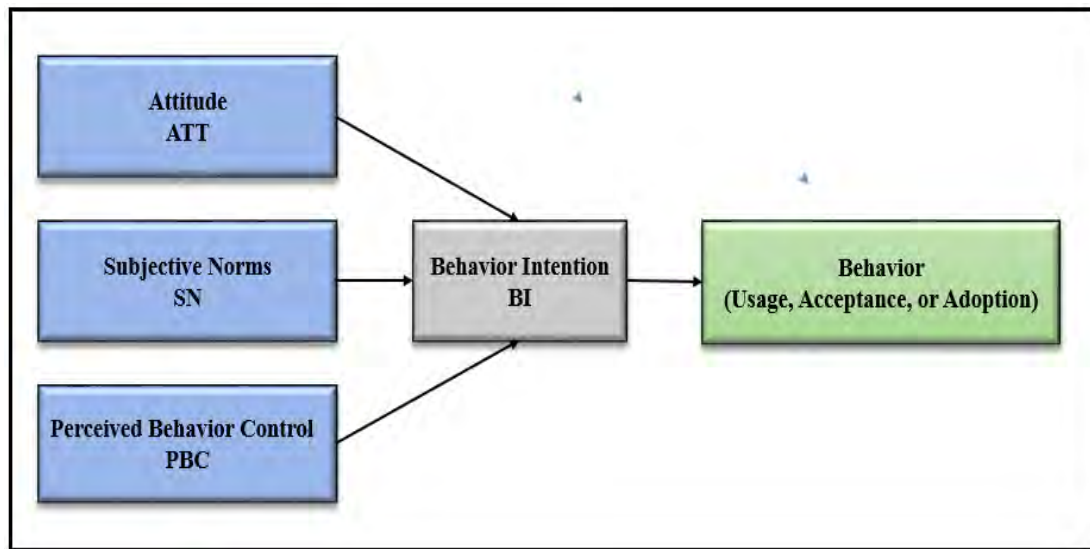


Figure 3.4. Antecedents of behavior (e.g., usage, acceptance, or adoption)

### 3.5.1 Behavior Intention Definition (BI)

Behavior intention (BI) can be defined as, “the degree to which a person has formulated conscious plans to perform or not perform some specified future behavior.” (Warshaw & Davis, 1985, p. 214). In the same vein, the definition of behavior intention can be said to be, “the degree to which a student has formulated conscious plans to use or not use cloud services in the future.” (Arpaci et al., 2015, p. 95). In the context of this research, the definition of behavior intention is the degree in which the individual, student and academic staff, using SaaS Cloud Computing services has formulated conscious plans to use or not use some services of SaaS Cloud Computing.

### 3.5.2 Relationship between BI and AUSaaS Cloud Computing

The theory of TRA (Fishbein & Ajzen, 1975), TPB (Ajzen, 1991), and DTPB (Taylor & Todd, 1995) affirm that the BI is the main driver of behavior. More specifically, Fishbein and Ajzen (1975) assert that to carry out a specific behavior, the formation of intention is essential and necessary precursor to perform the behavior. Additionally,

the predictive power of models such as TRA and TAM has increased when intention is included in the model compared by less prediction power when excluded or not taken into consideration in other models (Fishbein & Ajzen, 1975). Consequently, BI is presented as a mediating variable in the models.

In addition, many studies has included it in their models and gain support in literature in a wide scale to be a significant determinant of behavior (Actual behavior, Usage, Adoption, or Acceptance) in diverse models (Ajjan & Hartshorne, 2008; Alalwan, Dwivedi, & Rana, 2017; Hartshorne & Ajjan, 2009; Pinheiro et al., 2014; Sonthiprasat, 2014; Taylor & Todd, 1995; Thoradeniya, Lee, Tan, & Ferreira, 2015; Velázquez, 2014). These studies find that BI is significantly and positively predicts the behavior in different settings and fields in academic research.

In the field of information technology and education, the literature works show a strong and significant prediction of BI and usage behavior (Ajjan & Hartshorne, 2008, 2008; Taylor & Todd, 1995). Taylor and Todd (1995), for instance, assessed different models (TAM, TPB, and DTPB) aiming to predict the best model that helps explaining the adoption of information technology using 786 students of a computer resource center at the university in the U.S. over a period of 12 weeks. The results show that BI is a strong and significantly positive predictor in influencing the behavior usage of technology in the three models.

In literature's educational studies, two empirical studies found to focus on different respondents (i.e., the students and the academic staff in universities), and the results revealed that there is a significant relationship between BI and adoption (Ajjan & Hartshorne, 2008; Hartshorne & Ajjan, 2009).

For example, Ajjan and Hartshorne (2008) studied the adoption decision by the university faculties to adopt Web 2.0 technologies in classrooms targeting 136 instructional personnel (visiting, assistant, associate, and full professors) at a large university in the U.S.. The results revealed that the intention is a strong positive and significant predictor of the behavior.

In the same sequence, Hartshorne and Ajjan (2009) investigated the students perceptions and decisions to adopt Web 2.0 in classrooms and its pedagogical benefits for the learning process during the fall semester in a large university in the southern part of the U.S. targeting 423 respondents with different levels. The findings revealed that intention has a significantly positive relation with the behavior usage of the utility of Web 2.0.

Additionally, in marketing context using technology, Yang and Zhou (2011) found that American young consumers' viral marketing intent is positively predicting the viral marketing behavior in a study conducted in the U.S. Also, in auditing and accounting sector, Thoradeniya et al. (2015) found a positive and significant relationship between the managers' intention to engage in sustainability reporting and corporate sustainability behavior.

Moreover, in the cloud computing context, number of recent studies investigated the effect of intention of the behavior and found a significant and positive relationship between intention and the use behavior (Pinheiro et al., 2014; Velázquez, 2014). For example, Pinheiro et al. (2014) examined their model on the acceptance of cloud computing systems adoption on active professionals and university students with total

number of respondents of 312. The results of this empirical study show that intention has a significant and positive influence on the use of cloud computing systems.

In the same vein, Velázquez (2014) investigated the cloud computing acceptance and adoption on senior management of system managers, IT staff, and decision makers with total number of respondents of 170. The study found that higher intention to adopt cloud computing, the higher the behavior outcome. In other words, the intention is found to be a significant and positive predictor to the behavior of adopting cloud computing.

Furthermore, Sonthiprasat (2014) conducted a study in the United States and targeted middle managers and decision makers with total number of 100 respondents in small and med size enterprises, found that BI does have a strong and positive correlation with the actual system usage. Supporting the former works, in a recent study conducted by Alalwan et al. (2017) in banking sector in Jordan, the results proved the significant and positive relationship between BI and the adoption behavior. The following Table 3.2 gives a summary of the previous literature in different contexts to examine the relationship between the BIs and the usage and adoption (i.e., the actual behavior).

Table 3.2

*The Relationship between BI and AB*

Source	Area	Relationship	Result
(Pineiro et al., 2014)	Cloud computing in business	BI → AB	Significant (positive)
(Taylor & Todd, 1995)	Technology in educational sector	BI → AB	Significant (positive)
(Ajjan & Hartshorne, 2008)	Technology of web 2.0 at educational sector	BI → AB	Significant (positive)

Table 3.2 continued

(Hartshorne & Ajjan, 2009)	Technology of web 2.0 in educational sector	BI → AB	Significant (positive)
(H. C. Yang & Zhou, 2011)	Marketing	BI → AB	Significant (positive)
(Velázquez, 2014)	Cloud computing and management	BI → AB	Significant (positive)
(Sonthiprasat, 2014)	Cloud computing and management	BI → AB	Significant (positive)
(Thoradeniya et al., 2015)	Accounting and auditing	BI → AB	Significant (positive)
(Alalwan et al., 2017)	Banking sector	BI → AB	Significant (positive)

### 3.5.3 Mediating Effect of BI

When a third latent construct is between two latent constructs, it is said that the mediating effect is created to intervene between these two latent constructs (Albarq & Alsughayir, 2013). In other words, the mediation occurs or hypothesized when or by what means the independent variable (IV) affects the dependent variable (DV) through one or many of intervening variables that are referred to as mediators (Preacher & Hayes, 2008). In addition, Preacher and Hayes (2008) stressed on the theoretical support of the causal effect and ordering of these variables in causal effect relationships, which this criterion holds on the current study with theoretical foundation support of BI mediation effect. If there is only one mediating variable (M), as is the case of the current study to investigate BI mediating role, the simple mediation is assumed (Preacher & Hayes, 2008).

By referring to Figure 3.5, the simple mediation occurs when the causal effect of IV is apportioned or shared into direct effect of its DV ( $path = \bar{c}$ ), where Mediator do exist, and indirect effect through M to DV ( $path ab$ ). To explain,  $path a$  is the effect of IV



on the proposed M, while *path b* is the partial effect of IV on the DV. Hence, the *indirect effect* of IV on DV can be quantified by the product of ( $a \times b$ ). On the other hand, the *total effect* can be quantified as unstandardized regression weight  $c$  ( $c = \bar{c} + ab$ ) using Sequential Equation Modeling regression, as indicated by Preacher and Hayes (2008). Therefore, the *direct effect* is expressed as  $\bar{c} = c - ab$ .

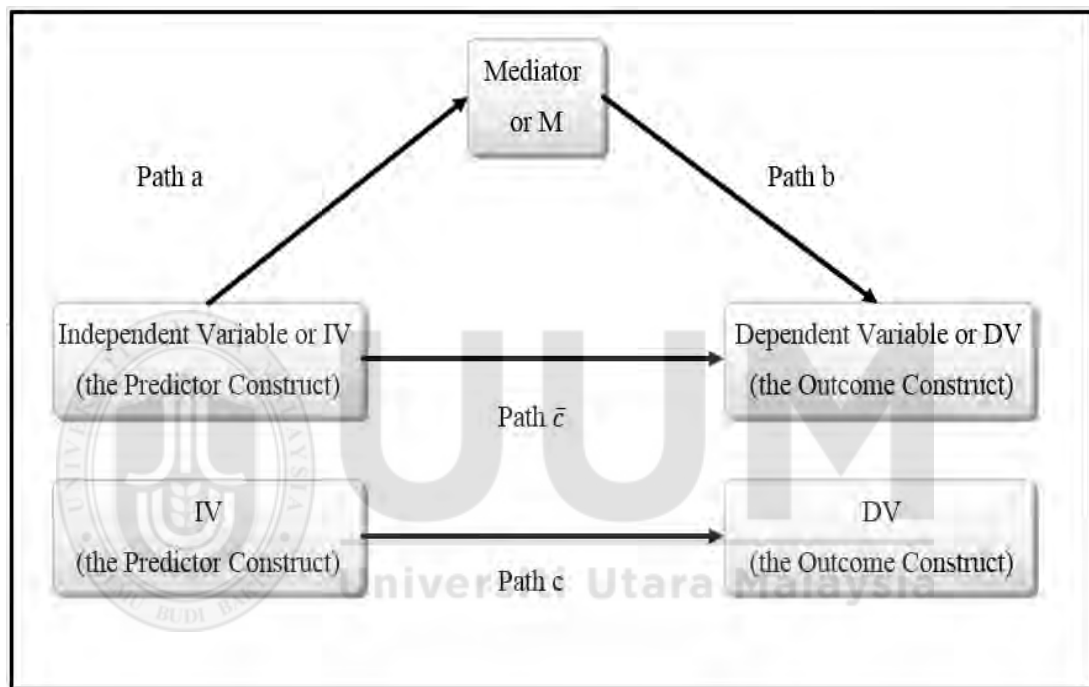


Figure 3.5. Mediating effect concept

Source: Preacher and Hayes (2008)

While reviewing the previous works on the mediation topic, three procedures were found, where two are the traditional ones (i.e., Baron and Kenny (1986) and Sobel (1982) testing procedures) and one is the recent trend in extant literature by Zhao, Lynch, and Chen (2010) that is further supported by number of researchers in the academia (Hair, Hult, Ringle, & Sarstedt, 2017).

The traditional procedure of Baron and Kenny (1986) has number of assumptions that can be summarized in the following: The relationship between IV and DV (path c) has to be significant in addition to the relationship between IV and M (path a) and the relationship between M and DV (path b) -while controlling for the IV-, and finally if the aforementioned conditions are met, the effect of IV on DV should decrease in the presence of the mediator (Baron & Kenny, 1986). To summarize this method, in case of the three steps are significant and the path coefficient or the beta value becomes less and significant in the relationship between IV and DV (with the presence of IV and M), a direct or mediating effect of M decreases the direct effect of the relationship between IV on DV and there is a full mediation. Otherwise, (i.e., when beta levels become non-significant), the mediation becomes partial and it can be called partial mediation.

The second traditional approach followed in literature is the Sobel (1982) test to examine the mediating effect between IV and DV and comparing it with the relationship between IV and DV in presence of M (Helm, Garnefeld, & Eggert, 2010). however, this method has some drawbacks such as the distribution assumptions of normality in the data, the need for unstandardized path coefficients, and in small sample sizes it lacks the statistical power (Hair et al., 2017).

On the other hand, the recent trend in literature is using bootstrapping method, where it is regarded as a strong procedure to test the mediating effect of the mediator as recommended by many researchers in the academia (Hair, Hult, Ringle, & Sarstedt, 2014; Hair et al., 2017; Hayes, 2009; Preacher & Hayes, 2004, 2008). It is regarded as an amendment of the Baron and Kenny (1986) method for assessing the direct and indirect effect on a relationship. Additionally, Hair et al. (2014) recommend following

Preacher and Hayes (2004, 2008) procedures in bootstrapping for the mediation indirect effect for either basic or complicated mediator models. The procedure in this approach is to ignore the significance of the direct effect of the relationship between the IV and the DV (X. Zhao et al., 2010) and focus initially on the indirect effect using the bootstrapping procedures (Hair et al., 2017).

Additionally, taking the indirect effect alone works well with large to small size number, and no normality distributional assumption of data is required in this test (Hair et al., 2014; Preacher & Hayes, 2008). In this way, this approach overcomes the drawbacks of using Sobel (1982) test. To explain more this procedure, it initially tests the indirect relationship between IV to DV through M (path  $a \times b$ ), then if the results reveal a significant relationship, further analysis is required.

More importantly, there are different scenarios when previous condition is met. Firstly, if the direct relationship between IV and DV is significant, the relationship is assumed to have an accumulated partial mediation if the product value ( $ab$ ) is positive. On the other hand, if the product value of ( $a \times b$ ) is negative, the competitive partial relationship is considered. Secondly, if the indirect effect is not significant, it is said to have direct only non-mediation effect. The last scenario is when the direct and indirect effects are not significant; it is assumed a non-effect non-mediation (Hair et al., 2017).

It is noteworthy to understand that the mediating effect of BI with different beliefs (i.e., attitudinal, normative, and control) where overlooked empirically in literature, although theoretically supported in many Information Systems theories and models as in TRA, TPB, DTPB, TAM2, UTAUT. This view is emphasized in a recent study by

Mafabi, Nasiima, Muhimbise, Kasekende, and Nakiyonga (2017). More importantly, the mediation effect is considered when there is a logically or theoretically supporting justification as emphasized by researchers Preacher and Hayes (2008). Therefore, in the current study the latent constructs of ATT, SN, and PBC are investigated and explored of being mediated by the BI towards the outcome of the study.

### **3.6 Antecedents of Behavior Intention (BI)**

The antecedents of BI are attitude (ATT), subjective norms (SN), and perceived behavior control (PBC) as originated in TPB and its successor theory DTPB.

#### **3.6.1 The Attitude (ATT)**

The attitude can be defined as an overall evaluation of specific behavior, either positively or negatively, after one evaluates the perceived consequences of an action (Ajzen & Fishbein, 1977). Another definition of ATT toward the behavior can be said to be, “the degree to which a person has a favorable or unfavorable evaluation of the behavior in question.” (Ajzen & Madden, 1986, p. 454). From the perspective of TPB and its extension (DTPB), the more favorable of a specific behavior that the person evaluates, the more likely that this person will intend to perform that behavior (Taylor & Todd, 1995). Bagozzi (1992, p. 2) in line with the above defines attitude as, “Expressing the degree of favorability/unfavourability felt by the person in relation to that act or object”. According to the above definition, the study defines attitude as the degree of favorability or unfavourability felt/evaluated by the individual in HE in relation towards the usage, acceptance, or adoption of SaaS Cloud Computing.

The relationship between ATT and BI has been studied in literature in a wide scale with different models and gain the support from different theories (e.g., TAM, TRA, TPB, and DTPB) that precisely and strongly support the significant and positive relationship between the two and that ATT is one important antecedent of BI (Taylor & Todd, 1995). Moreover, there are various and majority of empirical studies, in different contexts and fields, in past literature that support the strong and significant relationship between ATT and intention (Ajjan & Hartshorne, 2008; Hartshorne & Ajjan, 2009; Huh et al., 2009; Hung, Ku, & Chien, 2012; M. Kim & Qu, 2014; Thoradeniya et al., 2015; P.-L. To, Liao, Chiang, Shih, & Chang, 2008).

In the field of information technology and in educational context, Taylor and Todd (1995) in their study to find out the best model to represent the behavior, tested three models (i.e., TAM, TPB, and DTPB). The respondents were 786 of students using computer resource center at a university in the U.S. and they reported that the three models predict the positive and significant relationship between the intention and use of technology behavior in the three models.

Huh et al. (2009), in another context of the hotel sector, conducted a study to investigate the behavior intention of employees, to use the hotel information system of 13 upscale hotels in South Korea, using three models namely: TAM, TPB, and DTPM. They reported a positive and significant relationship between the intention and behavior in using the information system in hotels. In the same context, M. Kim and Qu (2014) investigated the factors affecting travelers of different categories' usage of self-services kiosks and results revealed a significant and positive relationship between the intention and the use of the hotel services. In another context of information technology in studying factors influencing the adoption of instant messaging at

organizations, (P.-L. To et al., 2008) conducted a study on 313 employees and the results revealed that ATT is a strong and significant predictor of adopting IM in organizations.

Past literature in educational context studying the relationship between the intention and behavior found that ATT affects BI with different respondents (i.e., students and academic staff) and has a significant and positive relationship between them (Ajjan & Hartshorne, 2008; Hartshorne & Ajjan, 2009). To further explain, Ajjan and Hartshorne (2008) questioned 136 academics at large university to investigate Web 2.0 adoption decision and found that ATT is having a positive and significant relationship with the intention. Similar results were revealed when investigating the same relationship among students (a total number of 423 students with different levels) aiming to study the Web 2.0 in teaching and academic classes (Hartshorne & Ajjan, 2009).

Hung et al. (2012) conducted a study, in the medical field utilizing information technology, on 224 physicians using Medline system in Taiwan. The results revealed that the physicians' intention to use the system is significantly and positively influenced by ATT and is found as one major influencer of the intention. Thoradeniya et al. (2015), in the auditing and accounting sector, investigated different relationships of TPB in the sustainability reporting in Sri Lanka and found that manager's ATT is positively and significantly related with intention. Similarly, Jain, Khan, and Mishra (2017) in studying luxury and good buying behavior found a positive and significant relationship between ATT and BI.

Another aspect to address here, ATT is used with multi-item Likert scale that was adapted from measurements that assured their reliability and validity in previous published works (H. F. Lin, 2007; Mohammadi, 2015; Taylor & Todd, 1995), in addition to the pre-test and pilot tests stages that were followed to have a strong and concrete measurements. These items were anchored with 5-point Likert scale ranging from “Strongly disagree” to “Strongly agree”, see section Research Instrument Measures on Chapter Four. Further, Table 3.3 summarizes the prior literature review.

Table 3.3

*The Relationship between ATT and BI*

Source	Area	Relationship	Result
(Taylor & Todd, 1995)	Technology educational sector	in ATT → BI	Significant (positive)
(P.-L. To et al., 2008)	Instant messaging organizations	in ATT → BI	Significant (positive)
(Ajjan & Hartshorne, 2008; Hartshorne & Ajjan, 2009)	Technology of web 2.0 in educational sector	ATT → BI	Significant (positive)
(H. C. Yang & Zhou, 2011)	Marketing	ATT → BI	Significant (positive)
(Hung et al., 2012)	Information technology in medicine	ATT → BI	Significant (positive)
(Huh et al., 2009; M. Kim & Qu, 2014)	Information technology in hotel sector	ATT → BI	Significant (positive)
(Thoradeniya et al., 2015)	Accounting and auditing	ATT → BI	Significant (positive)
(Jain et al., 2017)	Lusury and good buying behavior	ATT → BI	Significant (positive)

**3.6.1.1 Antecedents of Attitude (ATT)**

In the following subsections, the antecedents of ATT in this study are delineated with in-depth literature review in different fields of using, accepting, and adopting innovative technologies. Figure 3.6 depicts the antecedents of ATT, as postulated in the current study, and its relationship with BI and AUSaaS.

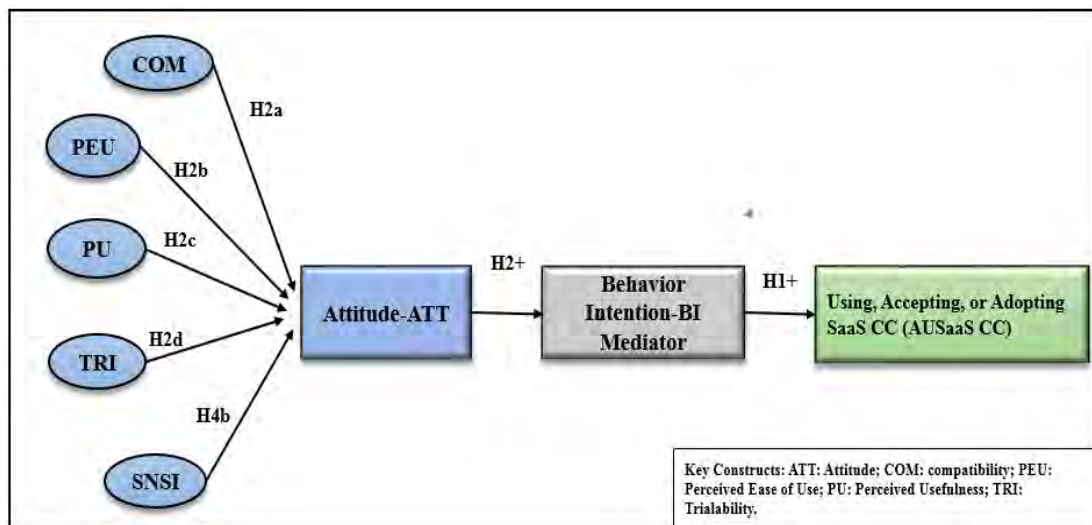


Figure 3.6. Antecedents of attitude (ATT)

### 3.6.1.2 Compatibility (COM)

Compatibility is defined as the extent to which the technology fits or perceived to be consistent with the existing one available and experienced by the user (Rogers, 1983). Additionally, Roger gave more self-explained definition for compatibility as, “the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters” (Rogers, 1983, p. 224). This means that the more compatible and accordance of the technology to user, the more likely that this technology is used, accepted, or adopted.

Moreover, Rogers (1983) argues that if an idea is not compatible with a well-known, common, or highly accepted values and norms, it will not be adopted and accepted rapidly as the one compatible in any social science. According to the above definitions and based on Rogers’ definitions and explanations, this study defines compatibility as the extent to which SaaS Cloud Computing services fit or perceived to be consistent with the services that the individual, in higher education, use in a computer in his/her



university or privately. Additionally, it can be referred as the extent in which the SaaS Cloud Computing services' usage, acceptance, or adoption fit or perceived to be consistent with the existing technological services, past experiences, and needs that the individual, in higher education, use in a computer in his/her university or privately.

In terms of theoretical support of COM influence on ATT, DTPB in addition to DOI give significant support of compatibility as an antecedent of ATT (Rogers, 1983; Taylor & Todd, 1995). On the empirical side, many studies in different contexts in literature supported COM as an antecedent of ATT (Ajjan & Hartshorne, 2008; Hartshorne & Ajjan, 2009; Huh et al., 2009; M. Kim & Qu, 2014; Lai & Hitchcock, 2017; Suki & Ramayah, 2011). On the other hand, other studies found insignificant relationship between COM and ATT (Amin et al., 2013; Fang & Shih, 2004; Gallos, Daskalakis, Katharaki, Liaskos, & Mantas, 2011; Nor & Pearson, 2007; Taylor & Todd, 1995). Further, Taylor and Todd (1995) recommend further investigations on compatibility to better understand IT usage behavior, which make this variable as one of the major predictors of ATT.

To explain more, in the educational context, Taylor and Todd (1995) reported that COM is an insignificant influencer of ATT to use computer center services at a university in the U.S. when using respondents of 786 students. In line with that, Nor and Pearson (2007) surveyed 1164 business students and MBAs in four public universities in Malaysia, using some DOI factors, to investigate the trust with other factors, being COM one factor, on the adoption of Internet banking. The results reveal that COM is not a significant influencer of ATT of the students to adopt the Internet banking. Similar findings found in an article on the Islamic home financing adoption (Amin et al., 2013) in which the study used 237 respondents of home financing of

Malaysian banks and found validity of the model is achieved; however, COM is found not a significant and positive predictor of attitude as hypothesized.

In the same trend on using technology of Electronic Health Record (EHR) at University of Athens in Greece, undergraduate students in the Faculty of Nursing (90 respondents) were investigated to measure their perception on using the EHR system and the respondents' future ATT toward using it. Results show that COM is insignificant predictor of ATT (Gallos et al., 2011). The authors pinpoint this result as the students do not have enough experience with the system. Lastly, Fang and Shih (2004) used DTPB to examine 425 respondents in Taiwan on using internet banking and the study findings show that compatibility is having insignificant results towards ATT. The following Table 3.4 summarizes the insignificant relationship between COM and ATT.

Table 3.4

*The Positive and Insignificant Relationship between COM and ATT*

Source	Area	Relationship	Result
(Taylor & Todd, 1995)	Technology in higher educational sector	COM → ATT	Insignificant
(Nor & Pearson, 2007)	Internet Banking in higher education sector	COM → ATT	Insignificant
(Amin et al., 2013)	Finance and Banking	COM → ATT	Insignificant
(Gallos et al., 2011)	HER in higher education sector	COM → ATT	Insignificant
(Fang & Shih, 2004)	Internet Banking	COM → ATT	Insignificant

On the contrary, number of past studies in literature proven that there is a significant and positive relationship between ATT and COM. Take for example, Ajjan and Hartshorne (2008) and Hartshorne and Ajjan (2009) in targeting respondents from the

educational sectors (students and academic staff) found that COM is a strong and positive antecedent of ATT in the adoption process of Web 2.0 either for the management to adopt the Web 2.0 technology or for the students to use it at the classrooms in the learning process. In another context, in the hotel sector using information technology, Huh et al. (2009) and M. Kim and Qu (2014) in their studies reported similar findings on the influence of COM on ATT to adopt technology either in using self-services kiosks or the use of information technology in hotels.

Moreover, Suki and Ramayah (2011) conducted a research paper on e-Government services. They used the TAM as a base for their research, targeting 200 respondents of employees (i.e. employees who work in Bayan Baru, Bayan Lepas, Sg. Dua, and Universiti Sains Malaysia staff). Their results reveal that COM found to be a highly significant predictor of ATT towards e-Government services with positive direction and meeting the theoretical expectations.

In addition, in a comparative study of adopters in developed country (i.e., Australia) and non-adopters in developing country (i.e., Indonesia) on studying citizens' acceptance of SMS-based e-Government services, the study was validated using 586 non-adopters in three cities in Indonesia and was compared with data of 80 adopters from Australia. The study reveals that COM is the strongest factor towards the ATT and shows a positive and significant relationship with the ATT for both adopters and non-adopters (Susanto & Goodwin, 2013).

Furthermore, in another study by Hung, Chang, and Yu (2006) to determine the factors of the acceptance of online tax filing and payment system in Taiwan as a e-Government services targeting 1,099 useable respondents, the study shows that COM

is one of the critical factors of the ATT, for both adopters and non-adopters. Also, it has a positively significant relationship with the ATT to accept the online tax services provided by the Taiwan government as part of e-Government services. Summary is provided in Table 3.5 of the positive relationship between COM and ATT.

Away from that, COM is used with multi-item Likert scale that were adapted from measurements with assured reliability and validity in previous published works (H. F. Lin, 2007; Taylor & Todd, 1995). Besides, to assure their appropriateness and suitability to the current study, the pre-test and pilot tests stages were conducted to attain strong and concrete measurements. These items were anchored with 5-point Likert scale ranging from “Strongly disagree” to “Strongly agree”, see section Research Instrument Measures on Chapter Four for details.

Table 3.5  
*The Significant Positive Relationship between COM and ATT*

Source	Area	Relationship	Result
(Suki & Ramayah, 2011)	e-Government services	COM → ATT	Significant (positive)
(Ajjan & Hartshorne, 2008; Hartshorne & Ajjan, 2009)	Technology of web 2.0 in educational sector	COM → ATT	Significant (positive)
(Susanto & Goodwin, 2013)	SMS in e-Government Services	COM → ATT	Significant (positive)
(Hung et al., 2006)	Tax filling and payment in e-Government	COM → ATT	Significant (positive)
(Huh et al., 2009; M. Kim & Qu, 2014)	Information technology in hotel sector	COM → ATT	Significant (positive)

Based on previous, the general perception of the user on innovation, such as SaaS applications, is more likely to be used, accepted, or adopted if they are compatible with the other technologies that the user has already used or experienced. It is more likely that this technology is adopted if they are consistent and fit with the user’s former

experience or existed technologies. In the foregoing paragraphs, the relationship between COM and ATT was comprehensively delineated and inconclusive results are found in the past literature. Therefore, this construct is included in the suggested framework of the current study.

### **3.6.1.3 Perceived Ease of Use (PEU)**

The perceived ease of use, or the complexity as referred to in DOI, which means the same but in the opposite direction as noted by Taylor and Todd (1995), is defined as the degree to which the innovative technology is perceived to be easily and readily understandable (Roger, 1983). Another definition can be said to be, “the degree to which a person believes that using a particular system would be free of effort.” (Davis, 1989, p. 320) and he added, “This follows from the definition of "ease": "freedom from difficulty or great effort”. In other words, Davis is pointing out to the feeling of being free from worries, difficulties, or effort to achieve the perceived performance when using the innovative system. More precisely, the more easily the technology or innovation perceived by the individual, the more likely that this technology influence the ATT, intention to use, and, in turn, accept or adopt the innovative system.

According to the above definition of perceived ease of use and based on the above literature, the study defines perceived ease of use as the degree in which the SaaS services’ usage, acceptance, or adoption is believed to be easy and free from worries, difficulties, or effort to achieve the perceived performance by the higher education institutes’ individuals (i.e., students and academic staff) and is readily understandable.

Further, the PEU latent construct towards ATT has gained theoretical support such as in TAM and DOI (i.e., Davis (1989) and Rogers (1983), respectively) and empirical

support in literature (Hartshorne & Ajjan, 2009; Huh et al., 2009; Hung et al., 2006, 2012; Susanto & Goodwin, 2013; P.-L. To et al., 2008) in which results revealed positive and significant relationship with ATT. Alternatively, it is found in the literature that PEU has a negative and insignificant relationship with ATT (Suki & Ramayah, 2011), whereas insignificant positive relationship in the DTPB model by Taylor and Todd (1995) and in the model of Huh et al. (2009). Also, Nor and Pearson (2007) found insignificant and positive relationship between the two.

To explain more, in the educational context, Taylor and Todd (1995) reported that PEU in their model is found to have an insignificant positive relationship with ATT in the DTPB model while having a positive and significant result in the TAM model of the same study. Likewise, in hotel context using information technology, the results reveal that PEU has an insignificant positive relationship with ATT (Huh et al., 2009) in DTPB model. On the contrary, it was found that to have a positive and significant relationship in TAM model of the same comparative study of three other models (i.e., DTPB, TAM and TRA).

Moreover, Suki and Ramayah (2011) in their research on e-Government services targeting 200 respondents of employees (i.e. employees who work in Bayan Baru, Bayan Lepas, Sg. Dua, and Universiti Sains Malaysia staff), found that PEU has a positive but insignificant relationship with ATT in their model using TAM as a base for their research. Also, Nor and Pearson (2007) studied empirically trust with other factors from DOI on Internet Banking acceptance by 1164 students in four public universities in Malaysia. The findings shed the light on the significant and positive roles of the anticipated factors and PEU found to be insignificant positive factor in

predicting the ATT. Table 3.6 summarizes the aforementioned discussion on the insignificant relationships between ATT and PEU.

Table 3.6

*The Insignificant Relationship between PEU and ATT*

Source	Area	Relationship	Result
(Taylor & Todd, 1995)	Technology educational sector	in PEU → ATT	Insignificant (positive)
(Suki & Ramayah, 2011)	e-Government Services	PEU → ATT	Insignificant (negative)
(Nor & Pearson, 2007)	Internet Banking educational sector	at PEU → ATT	Insignificant (positive)
(Huh et al., 2009)	Information technology in hotel sector	PEU → ATT	Insignificant (positive)

In contrast to the aforementioned studies, Ajjan and Hartshorne (2008) and Hartshorne and Ajjan (2009) in conducting studies in HE sector using respondents of students and academic staff when investigating Web 2.0 adoption found that there is a positive and significant relationship between ATT and PEU for both categories in adopting Web 2.0 in the teaching process. Similarly, in the banking sector, M.-C. Lee (2009) used an integrated model that contains constructs from three different models, the perceived risk theory, the technology acceptance model (TAM), and TPB model to explain the intention on using online bank services by customers (368 qualified responses in private bank) in Taiwan. The results revealed that PEU has a positive and significant relationship with ATT.

Also, in another context, in the hotel sector using information technology, M. Kim and Qu (2014) reported similar finding on the influence of PEU on ATT to adopt technology in hotels. Furthermore, in taxing sector of e-Government services to accept online payment and filing by Taiwan respondents (i.e., 1,099 respondents), the study

revealed that PEU is having a positive and significant relationship with ATT to accept online tax services in Taiwan Hung et al. (2006).

Moreover, in the medical field context using information technology, Hung et al. (2012) conducted a study in Taiwan on 224 physicians using Medline system. Their findings revealed that the relationship between ATT and PEU is positively significant. Likewise, Gallos et al. (2011) conducted a study on undergraduate students to investigate and measure the perception of using HER system and future ATT to use it. The relationship between the ATT and PEU is found to be positive and significant.

In another context, a study conducted to investigate factors influencing adoption of instant messaging at organizations targeting 313 employees, the results showed that the relationship between ATT and PEU is significantly positive (P.-L. To et al., 2008). Furthermore, a comparative study on adopters (in Australia) and non-adopters (in Indonesia) on accepting SMS-based e-Government services, Susanto and Goodwin (2013) found that the relationship is positive and significant between ATT and PEU.

In addition, Ayeh, Au, and Law (2013) used an online survey to find out the intention to use consumer-generated media by leisure travelers in the U.S. The study used new factors to extend the TAM model. The findings revealed a positive and significant relationship between ATT and PEU. The same results obtained in another study on the travelers' acceptance of consumer-generated media using TAM and source credibility theory (Ayeh, 2015).

Furthermore, PEU is used with multi-item Likert scale that were adapted from measurements with assured reliability and validity in previous published works (H. F. Lin, 2007; Ramayah, Rouibah, Gopi, & Rangel, 2009; Taylor & Todd, 1995;



Venkatesh & Davis, 2000). Besides, to assure their suitability to the current study, the pre-test and pilot test stages were conducted to attain strong and concrete measurements before the actual survey was conducted. These items were anchored with 5-point Likert scale ranging from “Strongly disagree” to “Strongly agree”, see section Research Instrument Measures on Chapter Four for details. Further, Table 3.7 summarizes the prior literature review.

Table 3.7

*The Significant Positive Relationship between PEU and ATT*

Source	Area	Relationship	Result
(M.-C. Lee, 2009)	Online Banking sector	PEU → ATT	Significant (positive)
(Hung et al., 2012)	Information technology in medicine	PEU → ATT	Significant (positive)
(Ajjan & Hartshorne, 2008; Hartshorne & Ajjan, 2009)	Technology of web 2.0 in educational sector	PEU → ATT	Significant (positive)
(Susanto & Goodwin, 2013)	SMS in e-Government services	PEU → ATT	Significant (positive)
(Hung et al., 2006)	Tax filling and payment in e-Government	PEU → ATT	Significant (positive)
(Huh et al., 2009; M. Kim & Qu, 2014)	Information technology in hotel sector	PEU → ATT	Significant (positive)
(Gallos et al., 2011)	HER in higher education sector	PEU → ATT	Significant (positive)
(Gallos et al., 2011)	HER in higher education sector	PEU → ATT	Significant (positive)
(Ayeh et al., 2013)	Information technology in tourism	PEU → ATT	Significant (positive)

Table 3.7 continued

(P.-L. To et al., 2008)	Instant messaging in organizations	PEU → ATT	Significant (positive)
(Ayeh, 2015)	Travelling decision using web 2.0 consumer generated media applications	PEU → ATT	Significant (positive)

In general, when an innovation is perceived to be easy, it is more likely to be widely used and accepted if they meet the demand of the prospective users. In other words, when the users of SaaS applications have the positive feeling of this technology and easiness of these applications to achieve the aimed outcome, they are more likely to adopt it in a wider scale compared with other methods that have difficult steps or procedures to follow to obtain the needed outcomes. Besides, in light with the foregoing paragraphs, the findings of the relationship between ATT and PEU comprehensively delineated and inconclusive results are found. Therefore, PEU is included in the model suggested of the current study to test its predictive power, its applicability, and relevance to the area of SaaS Cloud Computing.

### 3.6.1.4 Perceived Usefulness (PU)

The perceived usefulness has been found to have different definitions but with similar meanings as the degree in which the individual is expecting to achieve high performance to his/her job with the technology or innovation and is presumed to be better with the supersedes. For instance, Davis define it as, “the degree to which a person believes that using a particular system would enhance his or her job performance” and then he added, “This follows from the definition of the word useful: capable of being used advantageously" (Davis, 1989, p. 320).

Additionally, Rogers (1983) defines perceived usefulness (or relative advantage as it is called in DOI) as, “the degree to which an innovation is perceived as better than the idea it supersedes” (Rogers, 1983, p.15). That is, the higher the perceived usefulness of a technology, the higher possibility, the faster, and the more likely to have influence on the ATT, intention to use, and, in turn, the actual use, acceptance, or adoption of technology or innovation. According to the past literature’s definitions, the study defines PU as the degree in which the SaaS Cloud Computing services’ usage, acceptance, or adoption are perceived to be better to use, access, understood faster, and to reliably access as compared with the conventional methods, (e.g., storing/ uploading/ sharing different data in local hard drive or inside local server), to enhance performance and achieve the perceived advantages.

Moreover, the theoretical support of PU is proven widely as in the two theories of DOI and DTPB (Rogers, 1983; Taylor & Todd, 1995), in addition to the empirical support of the positive and significant relationship in different contexts and various fields in literature (Ajjan & Hartshorne, 2008; Ayeh et al., 2013; Giovanis et al., 2012; Hartshorne & Ajjan, 2009; Hung et al., 2006; M. Kim & Qu, 2014; Lai & Hitchcock, 2017; Mohammadi, 2014). On the contrary to the previous literature, one study found to have different results of the relationship between ATT and PU as the one by P.-L. To et al. (2008).

In investigating the relationship between ATT and PU, Huh et al. (2009) and Taylor and Todd (1995) compared different models and found that ATT has a positive and significant relationship with PU in both models TAM and DTPB. Also, in taxing sector of e-Government services in Taiwan, a study to investigate the online filing and tax services acceptance by respondents, reveals that PU found to be a strong predictor of

ATT to accept such services (Hung et al., 2006). Besides, in the higher education sector using students and academic staff as respondents to investigate the adoption, acceptance, and usage of Web 2.0 in classrooms, Ajjan and Hartshorne (2008) and Hartshorne and Ajjan (2009) found that there is a strong positive and significant relationship between ATT and PU in using the Web 2.0.

In the context of Internet Banking, a study was performed to examine the factors influencing customers' intention to adopt Internet Banking services in Greece using integrative model from TAM and DOI with perceived risk. The respondents were selected based on having an account in the bank, familiarity with Internet usage, and not an Internet Banking user so far. The results revealed a positive and significant relationship between PU and ATT (Giovanis et al., 2012). Similarly, but in the medical field context using information technology, Hung et al. (2012) in their results reported a positive and significant relationship between PU and ATT among 224 physicians using Medline system in Taiwan.

Also, Ayeh et al. (2013) conducted a research on leisure traveler in the tourism sector in the U.S. to use consumer-generated media to plan their travel. The usable sample was of 535 obtained from online database research company and the model was an extension of TAM. The results revealed the significant and positive relationship between ATT and PU among other results. The same result revealed in another study conducted by Ayeh (2015) on the Travelers' acceptance of consumer-generated media using TAM and source credibility theory.

In line with the aforementioned studies in literature, different categories of travelers were investigated to use self-services kiosks provided in hotels and results reveal

similar findings of the positive and significant relationship between ATT and PU (M. Kim & Qu, 2014). On the contrary to the prior literature review, two studies found to have different trend and the results shows that PU has a positive but insignificant relationship with ATT in the e-Government context and IM as in (Suki & Ramayah, 2011; W. To, Chung, & Lai, 2013).

Furthermore, PU is used with multi-item Likert scale that were adapted from measurements with assured reliability and validity in previous published works. Besides, to assure their suitability to the current study, the pre-test and pilot test stages were conducted to attain strong and concrete measurements before the actual survey was conducted. These items were anchored with 5-point Likert scale ranging from “Strongly disagree” to “Strongly agree”, see section Research Instrument Measures on Chapter Four for details. Further, Table 3.8 summarizes the prior literature review.

Table 3.8

*The Relationship between PU and ATT*

Source	Area	Relationship	Result
(Taylor & Todd, 1995)	Technology in Educational sector	PEU → ATT	Significant (positive)
(Hung et al., 2012)	Information Technology in Medicine	PU → ATT	Significant (positive)
(Ajjan & Hartshorne, 2008; Hartshorne & Ajjan, 2009)	Technology of Web 2.0 in Educational sector	PU → ATT	Significant (positive)
(Hung et al., 2006)	Tax filling and Payment in e-Government	PU → ATT	Significant (positive)
(Huh et al., 2009; M. Kim & Qu, 2014)	Information technology in hotel sector	PU → ATT	Significant (positive)

Table 3.8 continued

(Ayeh et al., 2013)	Information Technology in Tourism	PU → ATT	Significant (positive)
(Lai & Hitchcock, 2017)	Web 2.0 tool for learning	PU → ATT	Significant (positive)
(Ayeh, 2015)	Travelling decision using Web 2.0 Consumer Generated Media applications	PEU → ATT	Significant (positive)
(P.-L. To et al., 2008)	Instant Messaging in Organizations	PU → ATT	Insignificant (positive)
(Suki & Ramayah, 2011)	e-Government Services	PU → ATT	Insignificant (positive)

For a prospective user, it is a common sense that if the innovation is useful and would achieve the expected outcome in terms of performance, accessibility, usability, or superiority over the conventional methods of storage, exchange data, or accessibility of files, it is more likely to be used, accepted as a reliable method, and therefore adopted entirely in their personal use. Moreover, trying to shed the light on different studies and prior research in different fields and context in the literature, the foregoing paragraphs show mixed results on the relationship between ATT and PU in which they were comprehensively delineated and investigated. Additionally, different models and theories were investigated in different fields of study either with single theory, integrated theoretical models, or extended ones. These inconclusive findings trigger an area of research to find out if the results hold on the context of the study.

### 3.6.1.5 Trialability (TRI)

Trialability is very important in terms of using innovative technology and definitions lay on the short time usage until the individual feels comfortable and gets benefits. For

instance, Rogers defines trialability as, “the degree to which an innovation may be experimented with on a limited basis “(Rogers, 1983, p.231). Rogers (1983) adds further, the new ideas that can be divided into installment plan are more likely to be adopted faster than the one that is not dividable. Additionally, when innovation is triable, it is likely to have more certainty for the adopters, or acceptor of innovative technology, as stated by Rogers (1983). Similarly, Kassim, Ramayah, and Kurnia (2012) opined that trying an innovation or new ideas is a way to discover it, build one’s own perception about it, and is a means to dispel uncertainty about the innovation.

Moreover, TRI in the social context is positively related to usage, acceptance, or adoption and earlier adopters perceive it more important than later adopters as they, the early adopters or innovators, did not have any precedent to follow (Roger, 1983). Based on the previous literature definitions, the study adapts the definition of TRI as the degree in which the SaaS Cloud Computing services is tested prior to actual permanent usage, acceptance, or adoption for a limited time.

In mobile banking setting, Dash, Bhusan, and Samal (2014) in a recent study attempting to explain customers’ attitude towards mobile banking adoption in India, conducted a research paper by integrating DOI attributes with mimetic force and ATT, and used a sample of 400 respondents. The results revealed that TRI is one of the strongest predictors of the ATT and has a direct positive and significant relationship with ATT.

Additionally, Nor and Pearson (2007) in an empirical study in the HE sectors setting investigated the factors influencing the adoption and acceptance of Internet banking by using the attributes of DOI. The respondents were from public universities in

Malaysia with number of 1164 useable sample. TRI found to be playing a significant role with ATT, among other variables, and the results demonstrated a positive and significant relationship between ATT and TRI.

On the contrary, and in medical field, Park and Chen (2007) investigated the perception to adopt smart phones by physicians, doctors, and nurses in USA working in a local hospital network. The number of useable samples was 133, and attributes of DOI, SE, and TAM model was the base of the framework. The results reported were not significant and negative direction of the relationship between TRI and ATT. Likewise, Gallos et al. (2011) found that TRI is a negative and nonsignificant predictor of ATT in a study conducted using undergraduate students at the university of Athens to investigate the perception of using HER system and future ATT to use it. They refer these findings as the students are less experienced with the use of the actual system.

Away from that, TRI is used with multi-item Likert scale that were adapted from measurements with assured reliability and validity in previous published works (Moore & Benbasat, 1991; Y. Park & Chen, 2007). Besides, to assure their appropriateness to the current study, the pre-test and pilot test stages were conducted to validate the measurements before the actual survey was conducted. These items were anchored with 5-point Likert scale ranging from “Strongly disagree” to “Strongly agree”, see section Research Instrument Measures on Chapter Four for details. Lastly, Table 3.9 depicts the relationship between TRI and ATT as a summary of the above literature review.

Table 3.9

*The Relationship between TRI and ATT*

Source	Area	Relationship	Result
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(Hong-hong & Mei-hua, 2010)	Telecommunication	TRI → ATT	Significant (positive)
(Dash et al., 2014)	Mobile Banking	TRI → ATT	Significant (positive)
(Nor & Pearson, 2007)	Internet Banking at educational sector	TRI → ATT	Significant (positive)
(Y. Park & Chen, 2007)	Technology usage in medical context	TRI → ATT	Insignificant (positive)
(Gallos et al., 2011)	HER in higher education sector	TRI → ATT	Insignificant (positive)

In another aspect, TRI has been found in the literature to be one of the most important factors in adopting and using new technologies in different contexts such as: cloud computing services (Alshamaila, Papagiannidis, & Li, 2013), E-learning (Hsbollah & Idris, 2009), Mobile Banking (Khraim, Shoubaki, & Khraim, 2011), Internet Banking (Nor & Pearson, 2007), Human Resources information system (Kassim et al., 2012), and adopting high technological brands (A. R. Ismail, 2012). However, these various studies are focused on taking TRI as an influencer of adoption, acceptance, use of technology, and having direct relationship with ADP and not as an antecedent of ATT as suggested by the model of DTPB.

Furthermore, the results reveal a positive and significant relationship between TRI and ADP. Take for example, in the educational sector, a study conducted at the Universiti Utara Malaysia using undergraduate students in the marketing department to test the impact of innovation attributes, social influence, and perceived risk on technology brand adoption specifically on iPhone adoption. TRI was reported to have influence and as a key factor of intention, and as a result, has a significant effect on the final ADP of this brand (A. R. Ismail, 2012).

Additionally, Kassim et al. (2012) conducted a study in the field of Human Resource Information System in Malaysia to find out the antecedents of using it. The study used the HR executives and HR professionals as respondents who are familiar with IT products as part of their work. Reported results show that TRI is having a positive significant relationship with the use of the system.

In an exploratory study on identifying factors of adopting the mobile banking in three banks in Jordan, Khraim et al. (2011) conducted a study with 301 useable respondents. Their results shed the light on the important factors that affects significantly and positively the relationship between ADP banking services and using the mobile phones. Results revealed that TRI is one of these key factors.

Besides, in E-learning context, Hsbollah and Idris (2009) studied the perception of adopting E-learning as a means of teaching using lecturer as a usable sample at university Utara Malaysia. Evidence has been found to confirm that TRI is one key factor and has a positive and significant relationship with ADP decision of the E-learning. In cloud computing context, a study (i.e., 15 small-to-medium sized enterprises of service providers in Northern England) on cloud computing acceptance and adoption using Technology, Organizational, and Environment framework found that TRI is one of the identified important factors that has a significant role on ADP of the Cloud services (Alshamaila et al., 2013).

On the contrary, in literature review a study found to have an insignificant relationship between the ADP and TRI. To further explain, in a paper to investigate the influence of perceived e-commerce security on adopting Internet banking in Malaysia and the role of ATT, SN, and PBC towards the adoption was conducted and then compared

with the case of Singapore. A sample of 310 respondents (i.e., customers) from both countries were used. One of the findings of this study is that TRI was not found to be an insignificant influencer of ADP of Internet Banking in both countries (Dauda, Santhapparaj, Asirvatham, & Raman, 2007). Table 3.10 summarizes the results.

Table 3.10

*The Relationship between TRI and ADP*

Source	Area	Relationship	Result
(Alshamaila et al., 2013)	Cloud computing	TRI → ADP	Significant (positive)
(Khraim et al., 2011)	Internet banking	TRI → ADP	Significant (positive)
(Hsbollah & Idris, 2009)	E-learning in higher education sector	TRI → ADP	Significant (positive)
(Kassim et al., 2012)	Information technology in hr	TRI → ADP	Significant (positive)
(A. R. Ismail, 2012)	Technology brands adoption	TRI → ADP	Significant (positive)
(Dauda et al., 2007)	Internet banking	TRI → ADP	Insignificant (positive)

Reviewing the literature, TRI appears to be more effective in the early stages or the use or adoption of any innovation. That is, the more experience the adopter gain on innovation, the more likely that the innovation will be used especially in the early stages of the adoption process (Agarwal & Prasad, 1997). In other words, the uncertainties will be eliminated when the trails are applicable for users of innovation (Kassim et al., 2012). From the above paragraphs and the exclusive and deep literature review on TRI with its relationship with ATT and ADP, the current study investigates TRI with its relationship with ATT as there are scarcity of empirical studies in the literature, to the best of our knowledge, that focus on studying the relationship between

TRI with ATT to AUSaaS cloud computing in the context of the current study in Malaysian HE. Hence, this study is aiming to fill this gap in literature and study this respective relationship.

### **3.6.2 Subjective Norms (SN)**

Subjective norms are studied in literature thoroughly and has been given a special attention in the academia. There are different definitions that are found in the literature review. For example, it is defined as, "the perception that the significant referent desire the individual to perform a behavior or not" (Taylor & Todd, 1995, p. 149). In line with this definition, subjective norms is defined as, "specific individuals expect one to perform or not to perform the behavior combined with one's motivation to comply with these specific individuals" (Bagozzi, 1992, p. 180).

Ajzen (1985), additionally, adds that performing any behavior is based on the evaluation of the person to be positive and when he/she believes that important others urging him/her to perform it. In sum, the more perception the individual has that important others think that he/she has to be engaged in specific behavior, the more motivation the individual would have to comply with others' belief in performing that behavior or act. In the context of this study, the DTPB and its peer TPB suggest that individuals in HE are more willing to accept SaaS Cloud Computing services if they: have a positive ATT towards SaaS services, follow the important others that have positive perception of it, and have the knowledge and trialability option to use it, while having good image to use it.

According to the literature review's different definitions and explanation of the importance of subjective norms, the study adapts the definition of SN as the extent in

which the SaaS Cloud Computing services' users, in HE, expect, desire, and urge others to use/accept or not to use/accept SaaS Cloud Computing services combined with motivation that those others would comply with them. The following illustration, Figure 3.7, depicts the SN latent construct with its antecedents in the current study.

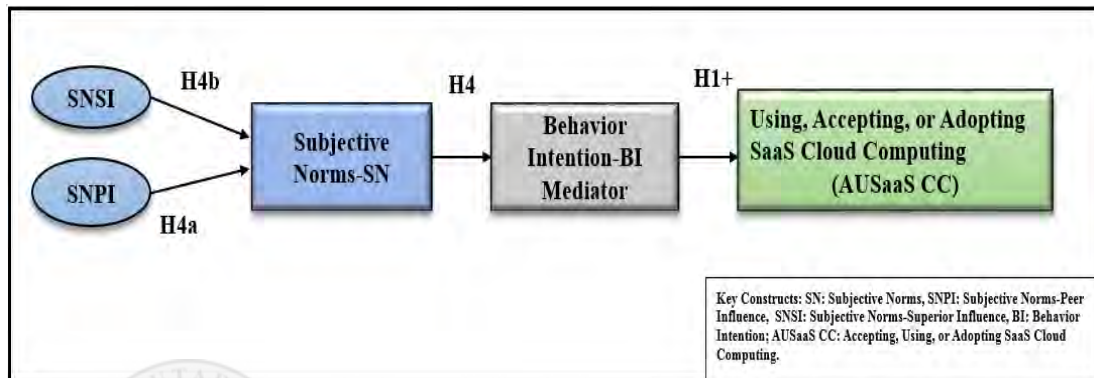


Figure 3.7. Subjective Norms (SN) latent construct with its antecedents

Furthermore, the subjective norms is theoretically supported to be one of the major antecedents of BI to use a technology or innovation (Ajzen, 1991; Ajzen & Fishbein, 1977; Taylor & Todd, 1995) and gain empirical support widely in the literature in the significant and positive relationship between SN and BI (Al-Gahtani, Hubona, & Wang, 2007; Ekufu, 2012; Hartshorne & Ajjan, 2009; Hung et al., 2012; Jain et al., 2017; Lian, 2015; Mishra et al., 2014; P.-L. To et al., 2008). On the other hand, other findings were found in the in depth-reviewing of the literature to have different results; that is, having no significant relationship between SN and BI (Ajjan & Hartshorne, 2008; Alalwan et al., 2017; Hartshorne & Ajjan, 2009; Md Husin & Ab Rahman, 2016; Picazo-Vela, Chou, Melcher, & Pearson, 2010; Shiau & Chau, 2016; Thoradeniya et al., 2015; H. C. Yang & Zhou, 2011; W. Zhang & Gutierrez, 2007).

To explain, Al-Gahtani et al. (2007) used a model based on UTAUT with modifications to study the outcome, antecedents, mediators, and moderators of the use of computers. They recruited a number of 1190 of useable knowledge workers who are able to use computers with different programs from different industries (i.e., banking, manufacturing, merchandising, and petroleum) in four different provinces in Saudi Arabia. They made a comparison between the Western culture represented by the North American society and the Saudi society using the theory of cultural dimensions. The results reveal a direct positive and significant relationship between SN and BI to use computers. In line with the above study, Hartshorne and Ajjan (2009) conducted a study on students' perception to adopt Web 2.0 in classrooms and its benefits at one large university in the U.S. The results' findings reveal that SN is an antecedents and influencers of BI of the students to use Web 2.0 in classrooms.

Additionally, in the field of technology usage of Instant Messaging in HE setting, a study revealed that SN has a direct positive and significant relationship with BI to use IM in organizations (P.-L. To et al., 2008). Furthermore, in another context, Hung et al. (2012) investigated the usage of Medline System in Taiwan utilizing 224 physicians in a medical field. Their findings are in accordance with the above studies that report the direct positive and significant relationship between SN and BI.

Likewise, Ekufu (2012) in his study on cloud computing context, investigated the factors influencing the adoption decision by the organizations. He used and integrated model of TAM and TPB and utilized 105 respondents of IT managers and decision makers in the U.S. working in different organizations. Findings showed that the financial industry sector is having a higher rate of adoption of cloud computing with a significant and positive relationship between SN and BI. In accordance to the above

study, Mishra et al. (2014) in an aim to find out the intention of IT professionals to use Green IT practices, conducted a study based on the core factors of TPB and the context was the public and private sectors of organizations. The findings showed a positive and significant relationship between SN and BIs of those IT professionals to adopt Green practices.

Similarly, in a recent study by Lian (2015) in the context of cloud computing e-Government services usage in Taiwan, the study tested the significant factors in the adoption of e-Government using integrated model of UTAUT2. The reported findings show a positive and significant relationship between SN and BI. Thoradeniya et al. (2015), also, investigated different relationships of TPB in the sustainability reporting in Sri Lanka and found that manager's SN positively and significantly associated with intention.

On the contrary, number of studies showed conflicting findings in the relationship between BI and SN. For instance, Ajjan and Hartshorne (2008) studied the adoption decision to adopt Web 2.0 technologies and assessed the faculty's awareness of its benefits in class rooms with a model based of TPB. They reported that SN did not have significant relationship with BI to adopt Web 2.0 technologies. Therefore, the perception of the academic staff is having no significant relationship with their BI to use this technology in pedagogical classrooms at the university in which this view is contradicting with the students' perceptions.

Moreover, W. Zhang and Gutierrez (2007) conducted a study on 24 different agencies that provide homeless assistance for clients in the United States using Homeless Management Information System. They employed DTPB theory as a lens for the study.

The results showed, however, that SN latent construct has insignificant results on BI of the user acceptance of IT services in the social services organization. In the same vein, the findings of Picazo-Vela et al. (2010) showed similar results of the insignificant relationship between SN and BI.

Additionally, Yang and Zhou (2011) in their study at a university college utilizing 440 usable responses of students to find out if American young consumers' virtual marketing intent influences their virtual marketing behavior. The findings revealed the contradictory results of having insignificant relationship between BI and SN. Additionally, in a literature review article, S. Yousafzai (2012) declared that Shih and Fang (2006) in their study in comparing three theories to understand Internet Banking behavior, concluded that SN did not achieve significance in the relationship with behavior.

Furthermore, SN is used with multi-item Likert scale that were adapted from measurements with assured reliability and validity (Mohammadi, 2015; Taylor & Todd, 1995). Furthermore, to assure their suitability to the current study, the pre-test and pilot test stages were conducted to validate the instrument before the actual survey was conducted. These items were anchored with 5-point Likert scale ranging from "Strongly disagree" to "Strongly agree", see section Research Instrument Measures on Chapter Four for details. Further, Table 3.11 summarizes the prior literature review.



Table 3.11

*The Relationship between SN and BI*

Source	Area	Relationship	Result
(Al-Gahtani et al., 2007)	Using computers in different industries	SN → BI	Significant (positive)
(Hartshorne & Ajjan, 2009)	Web 2.0 technology in higher education context	SN → BI	Significant (positive)
(Mishra et al., 2014)	Green IT acceptance in the business context	SN → BI	Significant (positive)
(Lian, 2015)	Cloud computing and e-Government services adoption	SN → BI	Significant (positive)
(P.-L. To et al., 2008)	Instant messaging in organizations	SN → BI	Significant (positive)
(W. Zhang & Gutierrez, 2007)	Acceptance of IT usage in the social services agencies	SN → BI	Insignificant (positive)
(Ajjan & Hartshorne, 2008)	Web 2.0 technology in higher education context	SN → BI	Insignificant (positive)
(Picazo-Vela et al., 2010)	Online shopping in higher education context	SN → BI	Insignificant (positive)
(Picazo-Vela et al., 2010)	Online shopping in higher education context	SN → BI	Insignificant (positive)
(H. C. Yang & Zhou, 2011)	Marketing in higher education context	SN → BI	Insignificant (positive)

Table 3.11 continued

(Shiau & Chau, 2016)	Cloud computing in education (classrooms)	SN → BI	Insignificant (positive)
(Md Husin & Ab Rahman, 2016)	Islamic insurance	SN → BI	Insignificant (positive)
(Jain et al., 2017)	Luxury and good buying behavior	SN → BI	Significant (positive)

To summarize, SN is the subjective social pressure that exists among people in a cohesive group in which arguably would lead to use, accept, or adopt SaaS services due to colleague advice, or institutional policy that urges to use these services, or superior judgment that influence the perception of others to use, accept, or adopt these innovative services provided from SaaS services. In addition, the foregoing paragraphs showed that there are mixed results that implies inconclusive results of the relationship between BI of the individuals and their SN. The findings were tested in different contexts that use the technology. These mixed results suggest the inclusion of SN in the model of the study to see its relevance to the SaaS Cloud Computing acceptance proposed framework. Therefore, this latent construct is part of the investigation of the dominant factors influencing AUSaaS.

### 3.6.2.1 Peer and Superiors (SNPI and SNSI)

Taylor and Todd (1995) recommend the decomposition of the three main constructs, namely: the attitudinal, the normative, and the behavioral control constructs. Here, the SN construct, or the normative beliefs, has been decomposed, according to Taylor and Todd (1995), to get better understanding of the antecedents of the ATT, uncover the specific factors that influence the use or adoption of a system or innovative technology,

and offers better explanation and prediction. Here, the normative belief is decomposed into different referent groups (i.e., peers and superiors). The authors argue that if one monolithic construct used in the presence of different views or opinions of the referent groups, this would possibly cancel the effect of these referents. Based on this argument, SN construct is decomposed into lower level beliefs, namely: peer influence and superior influence. Additionally, it can be said that the peers and superiors influence on others in the social circle can lead to the actual use of this technology.

In reviewing the effect of peers influential role with SN in literature, it is revealed that there are many studies supporting this significant positive influence of peers and superiors (Hartshorne & Ajjan, 2009; Huh et al., 2009; Hung et al., 2012; Rana, Dwivedi, & Williams, 2013; P.-L. To et al., 2008). On the other hand, other studies have revealed insignificant relationship between peers and superiors with SN; that is for the peers significant and for the superiors insignificant relationship with SN as found by W. Zhang and Gutierrez (2007)W. Zhang and Gutierrez (2007).

For instance, the studies conducted by Hartshorne and Ajjan (2009) and Ajjan and Hartshorne (2008) in HE employed students with different levels and academic staff to probe the student's perception on using and adopting Web 2.0 in classrooms. In addition, the perception of the academic staff in the pedagogical benefits of this tool is assessed. They found that peers and superiors are antecedents of SN and have a positive significant relationship between them and SN.

In the same sequence, but in hotel context using information technology, a study conducted by Huh et al. (2009) to find out the best predictor to explain BI to use hotel information system (HIS) using three models namely: DTPB, TAM, and TRA. peer

and superior influence constructs were found to have a significant and positive relationship with SN. Similarly, but in the context of medical field using information technology, Hung et al. (2012) used one construct to represent the peers and superiors using the construct of interpersonal influence as a replacement. Their findings reveal that the relationship between interpersonal construct (i.e., peers and superiors) is positively significant with SN.

Furthermore, in a previous work to probe the motivational factors to protect privacy in electronic medical records, the study employed DTPB as a framework of the study (Ma, Kuo, & Alexander, 2016). The results revealed that SNSI and SNPI accomplished a significant and positive role towards the innovation.

On the other hand, W. Zhang and Gutierrez (2007) had different results in the relationship between peers and superiors with SN. Their findings showed that peers have positive and significant relationship with SN, while superiors do not show significance in the relationship with SN. Likewise, the findings of P.-L. To et al. (2008) reveal that peers construct has significant and positive relationship with SN in their study to investigate the dominant factors of instant messaging in organizations. However, this significant relationship did not appear with the superior construct, rather it is found that the superiors construct has insignificant relationship with SN.

Away from that, SNSI and SNPI were measured with multi-item Likert scale that were adapted from previous works with assured reliability and validity (Taylor & Todd, 1995). Furthermore, to assure their suitability to the current study, the pre-test and pilot test stages were conducted to validate the instrument before the actual survey was conducted. These items were anchored with 5-point Likert scale ranging from

“Strongly disagree” to “Strongly agree”, see section Research Instrument Measures on Chapter Four for details. Lastly, Table 3.12 summarizes the relationship between SN with its antecedents of peer and superior constructs.

Table 3.12

*SNPI and SNSI Relationship With SN*

Source	Area	Relationship	Result
(Huh et al., 2009)	Information technology in hotel sector	SNPI and SNSI → SN	Significant (positive)
(Ajjan & Hartshorne, 2008; Hartshorne & Ajjan, 2009)	Technology of Web 2.0 in Higher Education sector	SNPI and SNSI → SN	Significant (positive)
(Hung et al., 2012)	Information Technology in Medicine	SNPI and SNSI → SN	Significant (positive)
(W. Zhang & Gutierrez, 2007)	Acceptance of IT usage in the Social Services agencies	SNPI → SN SNSI → SN	Significant (positive) Insignificant (positive)
(Rana et al., 2013)	e-Government	SNSI → SN	Significant (positive)
(P.-L. To et al., 2008)	Instant Messaging in Organizations	SNPI → SN SNSI → SN	Significant (positive) Insignificant (positive)
(Ma et al., 2016)	In medical sector using Technology	SNPI and SNSI → SN	Significant (positive)

While reviewing the previous works, it is common to see that SN is an important construct that has been investigated on a large scale in different disciplines of Information Technology research. On the other hand, some studies took the effect of social influence as one construct of subjective norms, others decomposed SN into two influencing constructs of peers and superiors.

In the current research, however, following the guidelines of Taylor and Todd (1995) is considered because the nature of the study include two distinct groups of students and academic staff, where they are arguably presumed to have different views in terms

of the use, acceptance, or adoption of SaaS services. That is, when different groups do exist, their perceptions will cancel each other's, and different views are considered to probe the perception of these groups.

Additionally, the foregoing paragraphs show that there are inconclusive results of the relationship between superiors and peers influence on SN latent variable. The findings were tested in different contexts that use innovative technology; therefore, and based on the former arguments, these findings suggest the inclusion of SN in the model of the study with its antecedents of peers and superior influences constructs to test its relevance to the SaaS Cloud Computing acceptance, usage, and adoption proposed framework.

### **3.6.3 Perceived Behavior Control (PBC)**

As mentioned earlier, the intention to use any technology is driven and predicted by the ATT, SN, and PBC as stated in TPB and DTPB. Perceived behavior control can be said to be, “the perceived ease or difficulty of performing the behavior and it is assumed to reflect past experience as well as anticipated impediments and obstacles.” (Ajzen, 1991, p.188). For the purpose of this research, PBC can be referred to the perceived ease or difficulty of performing different tasks using SaaS Cloud Computing services and it is assumed to reflect past experience of the individuals to use technology skills they possess, in addition to the anticipated obstacles to perform such tasks with SaaS services. The following illustration, Figure 3.8, depicts Perceived Behavior Control and its antecedents in the current study.

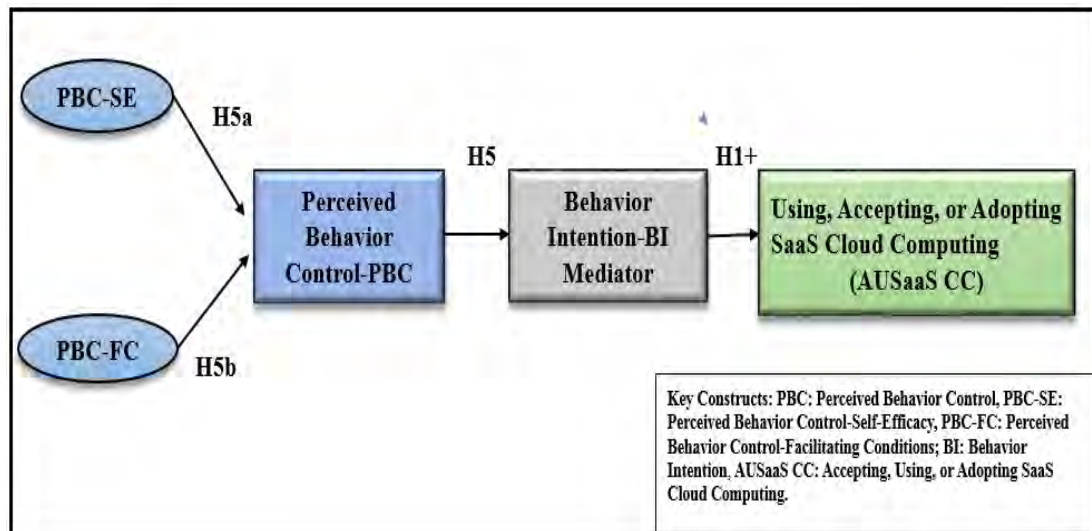


Figure 3.8. Antecedents of Perceived Behavior Control (PBC)

Additionally, Ajzen adds that the more favorable attitude and SN with greater PBC, the more likely that individual's intention to perform a specific behavior (Ajzen, 1991). PBC latent construct received theoretical support (Ajzen, 1985; Taylor & Todd, 1995) as explained earlier, in addition to empirical support in literature (Ajjan & Hartshorne, 2008; Huh et al., 2009; Hung et al., 2012; Susanto & Goodwin, 2013; Thoradeniya et al., 2015; P.-L. To et al., 2008) in which a significant and positive directional relationship of PBC with BI is found. However, other studies in literature reveal different findings of the insignificant relationship between PBC and BI (Jain et al., 2017; Picazo-Vela et al., 2010; H. C. Yang & Zhou, 2011).

To further explain, for instant, the relationship between PBC and BI reported to be significant and in a positive direction in a study conducted by P.-L. To et al. (2008) to examine the instant messaging in organizations. Similar findings found in a comparative study of three models (DTPB, TAM, and TRA) in the hotel context using information technology in Korea (Huh et al., 2009).

Additionally, Ajjan and Hartshorne (2008) and Hartshorne and Ajjan (2009) in HE on context found a significant and positive relationship between PBC and BI to use Web 2.0 technology in classrooms. Furthermore, in the medical context, a study by Hung et al. (2012) examined the usage of Medline System in Taiwan revealed that PBC is a salient predictor of BI and it presents a significant positive relationship with BI.

Besides, an empirical study by Nasri and Charfeddine (2012) investigated the salient factors influencing Internet banking in Tunisia and utilizing TPB and TAM models. These factors are security and privacy, SE, government support, technology support PU, PEU, ATT, SN, PBC, and BI. The findings revealed that PBC is having a significant positive relationship with the customer's intention to use Internet banking. Moreover, the comparative study of Susanto and Goodwin (2013) on the adopters and non-adopters of the citizens' acceptance of SMS-based e-Government services revealed that PBC is a salient predictor of BI and this result is in accordance with the above findings. Interestingly, in a recent study by Thoradeniya et al. (2015) investigated different relationships of TPB in the sustainability reporting in Sri Lanka found that manager's PBC has a positive and significant association with intention.

On the other hand, the findings of Picazo-Vela et al. (2010) in HE context showed different results on the relationship between PBC and intention. The researchers used students at a university level to investigate salient factors of the individuals' intention to use online shopping services based on TPB and personality framework. Inconsistent findings with previous studies were revealed in that PBC has no significant impact on intention to provide an online review, but the direction is positive.



In the same area of research of HE sector, Yang and Zhou (2011) used in their study students in an aim to find out if American young consumers' virtual marketing intent influences their virtual marketing behavior. A contradictory result revealed, as the previous paragraph, and the intention found to have a positive but insignificant relationship with PBC. Also, Jain et al. (2017) studied the Indian luxury market to investigate the purchasing behavior for luxury fashion goods utilizing TPB and employing 257 respondents. They found that PBC was having insignificant relationship with BI.

Away from that, PBC was measured with multi-item Likert scale that were adapted from previous works with assured reliability and validity (Fang & Shih, 2004; Taylor & Todd, 1995). Also, to assure their suitability to the current study, the pre-test and pilot test stages were conducted to validate the instrument before the actual survey was conducted. These items were anchored with 5-point Likert scale ranging from “Strongly disagree” to “Strongly agree”, see section Research Instrument Measures on Chapter Four for details. Lastly, Table 3.13 summarizes the relationship between SN with its antecedents of peer and superior constructs.

Table 3.13  
*The Relationship between PBC and BI*

Source	Area	Relationship	Result
(Taylor & Todd, 1995)	Technology Educational sector	in PBC → BI	Significant (positive)
(P.-L. To et al., 2008)	Instant Messaging Organizations	in PBC → BI	Significant (positive)
(Ajjan & Hartshorne, 2008)	Web 2.0 technology Higher Education context	in PBC → BI	Significant (positive)

Table 3.13 continued

(Huh et al., 2009)	Information technology in hotel sector	PBC → BI	Significant (positive)
(Hartshorne & Ajjan, 2009)	Technology of Web 2.0 in Higher Education sector	PBC → BI	Significant (positive)
(Hung et al., 2012)	Information Technology in Medicine	PBC → BI	Significant (positive)
(Nasri & Charfeddine, 2012)	Internet Banking	PBC → BI	Significant (positive)
(Susanto & Goodwin, 2013)	SMS in e-Government Services	PBC → BI	Significant (positive)
(Thoradeniya et al., 2015)	Accounting Auditing sector	and PBC → BI	Significant (positive)
(Picazo-Vela et al., 2010)	Online Shopping in Higher Education context	PBC → BI	Insignificant (positive)
(Yang & Zhou, 2011)	Marketing in Higher Education context	PBC → BI	Insignificant (positive)
(Jain et al., 2017)	Luxury and good buying behavior	PBC → BI	Insignificant (positive)

PCB is assumed to have an impact on BI if the availability of technological resources (e.g., internet connection) or the facilitating conditions (e.g., money or time to obtain the service and use it) do exist. In addition, the capabilities of the user are another factor that defines PBC. Besides, as indicated in the previous works, when the facilities by means of internet connectivity and related devices in addition of the ease of the services provided by the SaaS providers and being under control (or experience,

knowledge and skills) of the user, it believed to give more opportunities for users to influence their intention or the use, acceptance, or adoption of innovation such as SaaS technology.

Moreover, majority of past literature's review shows the importance of the latent variable of PBC in the predictive power of BI and that it is one of the salient factors affecting and influencing the acceptance, adoption, and usage of technology. However, other studies did not find significance in the relationship between these two latent variables, although in the positive direction of the relationship. Accordingly, and based on the literature review with confounding results, this triggers the need to further investigate this relationship in the area of SaaS Cloud Computing.

#### **3.6.3.1 Facilitating Conditions and Self-efficacy (PBCFC and PBCSE)**

As mentioned earlier, Taylor and Todd (1995) recommended the decomposition of the ATT, subjective norms, and behavior control in the DTPB. Here, the behavior control construct, or the behavior beliefs, has been decomposed, according to the following reasons namely as delineated by Taylor and Todd (1995): to get better understanding of the antecedents of the ATT, uncover the specific factors that influence the use or adoption of a system, and offer better explanation and prediction. The behavior belief is determined by internal notion of self-efficacy and the external resources constrains or the facilitating conditions as discussed in TPB (Ajzen, 1985, 1991). The first construct is the self-efficacy that is related to perceived ability where the higher levels of it, leads to higher levels of BI as argued by Taylor and Todd (1995).

Moreover, and based on the social cognitive theory (Bandura, 1986), the higher the self-efficacy ones possess in doing a certain action, the more likely to perceive difficult

tasks encountered as something to be challenged and controlled rather than to be evaded (Bandura, 2012; Ozturk, Bilgihan, Nusair, & Okumus, 2016). Ozturk et al. (2016), further explained self-efficacy related to Technology as the belief ones possess of having sufficient capabilities or skills and aptitude to perform a certain related task. Additionally, Ewe, Yap, and Lee (2015) contend the crucial importance to adopt mobile banking complementary services is in providing impression of the easiness and compatibility of the services provided to promoting these services.

On the other hand, the second construct is the facilitating condition, which is divided into two dimensions, namely: One related to resources such as time and money - Facilitating Conditions Resources- and the second is technology related issues - Facilitating Condition Technology- that might constrain the usage of innovative technology as explained by Taylor and Todd (1995). In DTPB it is argued that the less money and time available with more compatibility issues or constrains, the less likely the intention and actual use is expected to be. Additionally, it can be said that having a higher level of self-efficacy by the individual, with having available resources as time and money, combined by high technical compatibility, the use of the intention and actual use of SaaS Cloud Computing is more likely to occur.

In reviewing the literature, the empirical support for both constructs is evident. Many studies report a directional significant and positive relationship between facilitating conditions and the latent variable of PBC (Huh et al., 2009; M. Kim & Qu, 2014; Susanto & Goodwin, 2013; Taylor & Todd, 1995; P.-L. To et al., 2008, 2008); while others found insignificant relationship with intention (Ajjan & Hartshorne, 2008; Hung et al., 2012). Also, other empirical studies found insignificant relationship between facilitating conditions and intention (Ajjan & Hartshorne, 2008; Hung et al., 2012). On

the other hand, a study found indicating significant relationship of technology facilitating conditions, but insignificant relationship of resources facilitating conditions as in a study conducted by Hartshorne and Ajjan (2009).

In terms of self-efficacy, the relationship between self-efficacy and PBC has been empirically studied and results showed a direct and significant positive relationship (Ajjan & Hartshorne, 2008; Hartshorne & Ajjan, 2009; M. Kim & Qu, 2014; Susanto & Goodwin, 2013; Taylor & Todd, 1995; P.-L. To et al., 2008). The following paragraphs delineate these studies.

Taylor and Todd (1995) in their comprehensive study to improve the predictive power of DTPB and comparing it with other models (TAM and TRA) found that self-efficacy proven to be predicting PBC and showed a positive and significant attitude with it. Additionally, in a study conducted by P.-L. To et al. (2008), Self-efficacy (PBCSE) and facilitating conditions (PBCFC) both emerged as a significant predictor of PBC and showed positive relationship with it.

In line with the above results, Huh et al. (2009) used three different models to find out the predictive power of three models (DTPB, TAM, and TRA). Their results revealed that PBCSE and PBCFC both emerge as a predictor of PBC latent construct and showed a directional positive and significant relationship with it in DTPB model. Furthermore, in a comparative study conducted by Susanto and Goodwin (2013) of adopters and non-adopters of the citizens' acceptance of SMS-based e-Government services, the reported results showed directional positive and significant relationship between the two structures of the control behavior (self-efficacy and facilitating conditions) with the latent construct PBC.

On the contrary, in the context of medical sector using information technology, Hung et al. (2012) examined the usage of Medline System in Taiwan, and their findings appeared to be in accordance with the above studies that reports the direct positive and significant relationship between PBCSE and PBC, while PBCFC did not emerge to be a predictor of PBC. Moreover, Ajjan and Hartshorne (2008) studied the intention to use Web 2.0 in classrooms, and they found that PBCFC (namely: facilitating conditions- technology and resources) did not emerge as a predictor of PBC latent construct. Further, in the same context of using Web 2.0 but with different respondents of students, Hartshorne and Ajjan (2009) found that facilitating conditions of technology did not show any significant influence on the perception of control behavior toward the intention to use Web 2.0, while on the same time the facilitating conditions of resources and self-efficacy showed a positive and significant relationship with it.

Furthermore, PBCSE and PBCFC measurements are used with multi-item Likert scale that were adapted from measurements with assured reliability and validity in previous published works (Ajjan & Hartshorne, 2008; Zolait, 2014) and (H. F. Lin, 2007; Taylor & Todd, 1995; Zolait, 2014), respectively. To assure the appropriateness of the measurements used in the current study, the pre-test and pilot test stages were conducted to validate the measurements before the actual survey was conducted. These items were anchored with 5-point Likert scale ranging from “Strongly disagree” to “Strongly agree”, see section Research Instrument Measures on Chapter Four for details. Finally, the following Table 3.14 shows summary of the above literature review.

Table 3.14

*The Relationship between PBCSE and PBCFC With PBC*

Source	Area	Relationship	Result
(Taylor & Todd, 1995)	Technology in educational sector	PBCSE and PBCFC → PBC	Significant (positive)
(P.-L. To et al., 2008)	Instant messaging in organizations	PBCSE and PBCFC → PBC	Significant (positive)
(Huh et al., 2009)	Information technology in hotel sector	PBCSE and PBCFC → PBC	Significant (positive)
(Ma et al., 2016)	Medical informatics and decision making	PBCSE and PBCFC → PBC	Significant (positive)
(Susanto & Goodwin, 2013)	SMS in e-Government Services	PBCSE and PBCFC → PBC	Significant (negative)
(Hung et al., 2012)	Information technology in medicine	PBCSE → PBC PBCFC → PBC	Significant (positive) Insignificant (positive)
(Hartshorne & Ajjan, 2009)	Technology of web 2.0 in higher education sector	PBCSE → PBC PBCFCR → PBC PBCFCT → PBC	Significant (positive) Significant (positive) Insignificant (positive)
(Ajjan & Hartshorne, 2008)	Web 2.0 technology in higher education context	PBCSE → PBC PBCFCR → PBC PBCFCT → PBC	Significant (positive) Insignificant (positive) Insignificant (positive)

The literature affirms the vital role of the availability/lack of substantial resources combined by the self-ability (i.e. having or lacking it) to conduct certain behavior. In that sense, the individual possessing these elements, is more inclined to have a better control on the behavior under consideration. Therefore, when the user of SaaS services has no difficulties in practicing or using the services, combined by the availability of the connectivity to the cloud (i.e., by means of computer/smart device, internet

connectivity, money to buy these services or accessibility devices, and time to use), it is more likely to use, accept, and adopt SaaS innovative services and applications. Furthermore, the in-depth review of the past literature shows that there are conflicting results that needs further investigation to include the two constructs of PBCSE and PBCFC and their relationships with PBC in the area of SaaS Cloud Computing.

### 3.7 User Security Predisposition (USecP)

The following subsections describe two latent constructs (i.e., Trust, and Credibility) that are proposed to be included in a composite second-order latent construct of USecP in the framework of this study. Also, the following illustration, Figure 3.9, depicts these two latent constructs and their relationship (i.e., in the composite form) with BI as postulated in the current study.

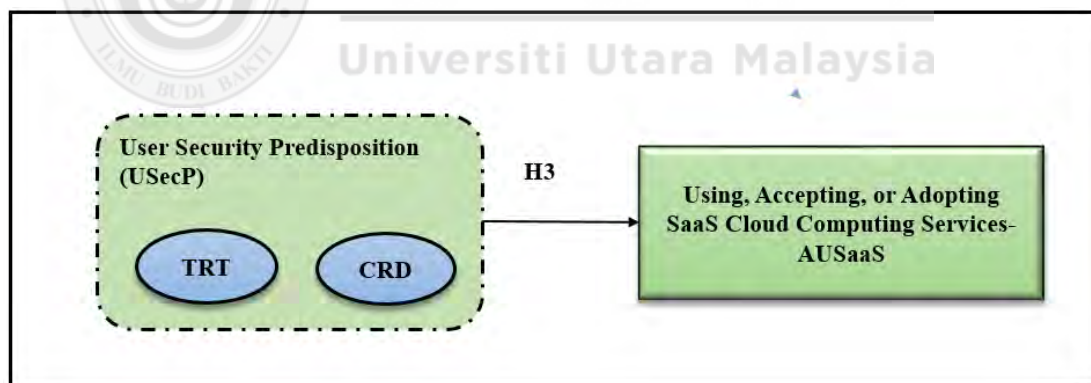


Figure 3.9. Relationship between BI and User Predisposing and Security Concerns (USecP)

#### 3.7.1 Trust (TRT)

Trust is found to be crucial element in the area of IS/IT and its services especially when the situation come to transact very important information over presumed unsecure medium. Many definitions were found in literature that define and explain



trust. For example, trust is defined as, “the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party. This definition of trust is applicable to a relationship with another identifiable party who is perceived to act and react with volition toward the trustor“ (Mayer, Davis, & Schoorman, 1995, p. 712). The aforementioned authors further added that there is a kind of vulnerability and taking risk of something valuable that needs to place trust on the trustee. Another definition of trust is found in literature as, “the subjective probability with which consumers believe that a particular transaction will occur in a manner consistent with their confident expectations” (Chellappa & Pavlou, 2002, p. 360).

In the context of this study and based on the above explanations and definitions, the study adapt the definition of perceived trust as the degree in which the user of SaaS Cloud Computing services (trustor), in higher education, is willing to be vulnerable to the actions of the SaaS Cloud Computing services’ provider (trustee) based on his/her confident and expectation that it will perform a particular action important to him/her (trustor) from SaaS Cloud Computing services provider (trustee), irrespective of the ability to monitor or control the trustee.

Prior empirical studies investigating the role of TRT on the adoption, acceptance, and intention to adopt a technology or services, revealed mixed findings. For instance, a positive effect of TRT on BI was found in literature in different contexts with significant relationship (Lian, 2015; Lu et al., 2011; Siang, 2012; S. Y. Yousafzai et al., 2010), while others found no significant relationship between TRT and BI (Burda & Teuteberg, 2014; Chemingui & Lallouna, 2013; Koenig-lewis et al., 2009; Luo, Li,

Zhang, & Shim, 2010). Also, few studies focused on the direct relationship between TRT and ADP of services, behavior, or actual use of technology, namely: Yee-Loong Chong et al. (2010), Hanafizadeh et al. (2014), and Engwanda (2014). These studies resulted positive and significant role of TRT on ADP.

To further explain, S. Yousafzai (2012) in an effort to assess the technology value and critical factors affecting this value for users (435 useable ones using the Internet banking) to adopt Internet banking, conducted a comparison of three models of TRA, TPB, and TAM. The study extended TAM model with TRT construct and the results revealed that the predictive power of the extended TAM model increased and that TRT proven to have significant and positive relationship with BI. Therefore, TRT is a predictive element of the actual behavior as TRT affects BI and BI is the main driver of ADP of innovative technologies.

Additionally, Lu et al. (2011) investigated the acceptance factors of customers of mobile payment services using 374 valid respondents based on the trust transfer theory and valance framework. Their findings show that TRT has a positive and significant relationship with BI to use the mobile payment services; therefore, we could assume that TRT is an influencer of the actual behavior.

Moreover, Siang (2012) in his study in the area of cloud computing to evaluate the perception on the adoption of electronic Cloud based medical record system, used UTAUT framework with special attention of the added construct of TRT and its role on BI to adopt the system. The results revealed that TRT is a significant factor affecting BI in medical record in healthcare industry in Malaysia and has a significant value in this relationship. This infers to the important role of TRT in shaping the intention to

adopt a system, and is therefore, a predictor of adopting a system. Likewise, in cloud computing context, Lian (2015) in his effort to probe the factors influencing the adoption of e-Government Cloud based services, found a positive and significant role of TRT on BI to adopt e-Government Cloud based services among other factors.

In-depth literature review demonstrates other findings regarding the relationship between TRT and BI. For instance, in an effort to investigate the barriers of mobile banking adoption in Germany, Koenig-lewis et al. (2009) used model based on constructs from DOI and TAM with other variables integrated. The findings revealed a positive but insignificant relationship of TRT on BI and that it does not provide any direct influence on intention. In the same vein, a study of initial adoption of wireless Internet and its usage on mobile banking utilizing undergraduate respondents was conducted by Luo et al. (2010). The study used a multi-dimension form of risk and trust constructs. The study yielded that TRT is not a significant and direct influencer of the BI, although exerts positive correlation.

Furthermore, the resistance and motivation of customer intention to use mobile financial services in Tunisia was investigated by Chemingui and Lallouna (2013). The study goes in accord with the above studies of not having a significant relationship between TRT and BI. Finally, an empirical study on the adoption of SaaS Cloud Computing archive services was conducted by Burda and Teuteberg (2014) using students and staff at two German universities. The findings correspond with the aforementioned studies in that TRT has insignificant effect on BI to adopt archiving services.

On the other hand, studies on the direct relationship between TRT and ADP were investigated, and few studies found to shed light on this relationship. For instance, Yee-Loong Chong et al. (2010) in their aim to find out the main factors influencing online banking in Malaysia, found TRT positively and significantly related with the adoption of online banking.

Also, Hanafizadeh et al. (2014) conducted a study investigating mobile banking in Iran found that TRT is one of the factors that have positive and significant relationship with adopting mobile banking. Additionally, Engwanda (2014) used extended model of TAM to examine the relationships towards adopting m-banking in the United States, the results yielded that TRT showed a positive and significant relationship.

Away from that, TRT is used as a one component of USecP, and not a standalone construct, and therefore a multi-item Likert scale was adapted from measurements that assured their reliability and validity in previous published works (Bélanger & Carter, 2008; Koenig-lewis et al., 2009), in addition to the pre-test and pilot tests stages that were followed to have a strong and concrete measurements. These items were anchored with 5-point Likert scale ranging from “Strongly disagree” to “Strongly agree”, see section Research Instrument Measures on Chapter Four. Further, Table 3.15 summarizes the prior literature review.

Table 3.15

*The Relationship between Trust and Behavior Intention*

Source	Area	Relationship	Result
(Koenig-lewis et al., 2009)	Mobile banking	TRT → BI	Insignificant (positive)
(Luo et al., 2010)	Wireless internet and mobile banking	TRT → BI	Insignificant (positive)

Table 3.15 continued

(Chemingui & Lallouna, 2013)	Mobile financial services	TRT → BI	Insignificant (positive)
(Burda & Teuteberg, 2014)	Cloud computing in higher education	TRT → BI	Insignificant (positive)
(Yee-Loong Chong et al. (2010)	On-line banking	TRT → ADP	Significant (positive)
(Hanafizadeh et al., 2014)	m-Banking	TRT → ADP	Significant (positive)
(Engwanda, 2014)	m-Banking	TRT → ADP	Significant (positive)
(Lian, 2015)	Cloud computing using e-Government services	TRT → BI	Significant (positive)
(Siang, 2012)	Cloud Computing Services in Medical context	TRT → BI	Significant (positive)
(Lu et al., 2011)	Mobile payment services	TRT → BI	Significant (positive)
(S. Y. Yousafzai et al., 2010)	Internet Banking	TRT → BI	Significant (positive)

Drawing upon the previous literature in-depth review, the findings show inconclusive results of the relationship between TRT and BI in different contexts and models. However, transferring these findings to the context of the current study, the researcher asserts the applicability of including TRT in the framework. Furthermore, based on the literature of cloud computing, it is proven that security concerns are other facets of cloud computing services pertaining the two aspects of trust and credibility.

To explain further, Burda and Teuteberg (2014) demonstrated that there is consensus among scholars in different disciplines that trust is an effective element in enabling relationships that suffers from uncertainty situations. Consistent with extant literature in information systems that investigated the trust in online services explained above, the current study is concerned about trust (that is in the current study included it as one element of individual's security predisposition construct USecP) in terms of what is

expected rather than what is actually feared, which is in line with former work conceptualization of Burda and Teuteberg (2014). Besides, the trust construct here probes the legal, technological, transactional, and connection aspects of using, accepting, or adopting SaaS services and applications on the personal use level.

Moreover, Burda and Teuteberg (2014) articulated that when the user accepts the vulnerabilities underlying the usage of cloud storage, i.e. based on their beliefs to meet their expectations, competence, and integrity, it is more likely that these users would overcome the concerns, fear, and hesitance to use cloud technology services. Also, Lassoued and Hobbs (2015) assert that being satisfied with specific retailer can evolve to make the consumer confident with that brand or retailer. In the same way, when the user is content with the applications or services that (s)he uses on daily bases (e.g., WhatsApp, twitter, Facebook, e-mail/storage/multimedia, or other SaaS Cloud Computing services), this creates a feeling of trust that may evolve into confidence of SaaS Cloud Computing providers that eventually reflects into an action to use, accept and adopt SaaS Cloud Computing services.

Transferring these findings to the context of this study, whereby security concerns reside, the researcher believes that if the trustor (the user of SaaS technology) do not put in place trust on the provider (the trustee) of SaaS services and agree on their service contract (i.e., as a user of the offered services on the personal level), it is not possible for him/her to use or benefit from their services offered. In light with these views and based on the previous works on different information system disciplines that affirm the role of positive and direct effect of trust on intention/adoption, the study includes trust as one component of USecP construct that affect the final outcome of the study.

### 3.7.2 Credibility (CRD)

Perceived credibility is defined in literature to reflect individual's personal belief and judgment and positive feeling of security and privacy. One definition of credibility is expressed as, "the extent to which the retailer believes that the vendor has the required expertise to perform the job effectively and reliably" (Ganesan, 1994, p. 3). Another clearer definition of credibility is given as the, "users' perception of protection of their transaction details and personal data against unauthorized access" (Aderonke & Charles, 2010, p. 6). The other definition in line with the previous definitions is given by Koenig-lewis et al. (2009) that defines credibility based on Y.-S. Y. Wang et al. (2003) as, "the degree to which a potential user believes that the service will be free of security and privacy threats" (p.415).

For the purpose of this research and based on the literature review, the study adapts the definition of perceived credibility as the individual's perception of the SaaS provider's expertise in protecting their transaction, systems, or information- when using different services (e.g., using public e-mails, storing/ sharing/ accessing/ downloading files, images, and data) of the provider- safeguarding the personal data against unauthorized access or divulge of personal information (either from the SaaS Cloud Computing service provider or any third party that violates the access privileges of the individual), and believing that the services provided are free of security and privacy threats.

In literature, CRD has been identified with different views. Some authors perceive credibility as a component of trust or risk (McKnight, Choudhury, & Kacmar, 2002; Pavlou, 2003). On the other hand, others regarded credibility as a distinct concept that has its own components (Al-Gahtani, 2011; Liao & Cheung, 2003; Y. Wang et al.,

2003). To explain more, credibility is regarded as a composition of two components namely: security and privacy (Aderonke & Charles, 2010; Y. S. Wang, 2003; Y. Wang et al., 2003). Security refers to “the protection of information or systems from unsanctioned intrusions or outflows” (Y. Wang et al., 2003, p. 508), while privacy refers to “the protection of various types of data that are collected (with or without knowledge of the users) during the user’s (online) interaction (with the electronic tax-filing system)” (Y. Wang et al., 2003, p. 509).

Further, Amin (2008) and Y. Wang et al. (2003) among other researchers assert that CRD influences BI of the user to adopt online services and has a positive relationship with BI. In past literature, it is found that CRD is a strong predictor of BI especially in online banking that needs considerable feeling of security while transacting sensitive data and at the same time the user of these services has to have enough feeling of not violating his privacy.

In the same vein, when the user has the feeling of not having a security when performing any transaction over the Internet to the SaaS providers such as: sending/receiving e-mail, storing or editing files, and uploading images and important personal data, this would cause an obstacle to use the SaaS services provided. The lack of or inadequate security is considered one of the hindrance of the development of online services as indicated in literature (Aderonke & Charles, 2010). Additionally, CRD has been proven in different studies to have a positive and significant relationship with BI (Amin, 2008; Ariff et al., 2012; Dasgupta et al., 2011; Hanafizadeh et al., 2014; Luarn & Lin, 2005; X. Wang & Yang, 2010).



To further explore these relationship, for instance, in the area of marketing, X. Wang and Yang (2010) conducted their study with focus on the brand credibility of consumers' intention to purchase automobile in China. Results suggested that CRD has a direct and significant relationship with intention to purchase, in which this intention leads to the actual behavior of customers to purchase automobile in China. In addition, Dasgupta et al. (2011) recruited students at a Business School in India to investigate the determinants of the intention to use mobile banking. Their findings correspond with the above aforementioned studies in that CRD exerts direct and significant positive relationship with BI to use mobile banking. Furthermore, Ariff et al. (2012) in their effort to find out the determinants of Internet banking among young users in Malaysia. The findings showed that CRD exerts direct and significant positive relationship with BI and that CRD is a stronger predictor of BI more than PEU and PU.

On the other hand, reviewing previous works on the CRD, few studies found to pay more attention on the direct relationship between CRD and the actual behavior (ADP), unlike the previous studies to focus on the CRD and BI relationship. These studies found positive and significant relationships between the two (Engwanda, 2014; Fan, Miao, Fang, & Lin, 2013; Hanafizadeh et al., 2014). For instance, Hanafizadeh et al. (2014) conducted a study investigating mobile banking in Iran and found that TRT is one of the factors that have positive and significant relationship with adopting mobile banking in Iran.

Besides, Fan et al. (2013) studied the online purchase decision that depends on the electronic word-of-mouth (e-WOM) empirically to find out the role of CRD. The results revealed that CRD is positively and significantly correlated with the adoption of e-

WOM. Additionally, Engwanda (2014) examined the relationships towards adopting m-banking. The results revealed that CRD and COM were the dominant influencers of adopting m-banking in the United States with statistically positive and significant relationship with adoption of m-banking. In-depth literature review shows other results concerning the relationship between CRD and BI. In fact one study found by Koenig-lewis et al. (2009) in that CRD did not have any significant relationship with intention.

Away from that, CRD is used as a one component of USecP, and not as a standalone construct, and therefore a multi-item Likert scale was adapted from measurements that assured their reliability and validity in previous published works (Amin, 2008; Y. Wang et al., 2003), in addition to the pre-test and pilot tests stages that were followed to have a strong and concrete measurements. These items were anchored with 5-point Likert scale ranging from “Strongly disagree” to “Strongly agree”, see section Research Instrument Measures on Chapter Four. Further, Table 3.16 summarizes the prior literature review.

Table 3.16

*The Relationship between Credibility and Behavior Intention*

Source	Area	Relationship	Result
(Koenig-lewis et al., 2009)	Mobile Banking	CRD → BI	Insignificant (positive)
(Ariff et al., 2012)	Internet Banking in higher education context	CRD → BI	Significant (positive)
(Dasgupta et al., 2011)	Mobile Banking in higher education context	CRD → BI	Significant (positive)
(X. Wang & Yang, 2010)	Marketing	CRD → BI	Significant (positive)
(Amin, 2008)	Banking sector using mobile phone credit card in banking sector	CRD → BI	Significant (positive)
(Fan et al., 2013)	Online purchase using e-WOM	CRD → ADP	Significant (positive)

Table 3.16 continued

(Hanafizadeh et al., 2014)	M-Banking	CRD → ADP	Significant (positive)
(Engwanda, 2014)	M-Banking	CRD → ADP	Significant (positive)
(Y. Wang et al., 2003)	Internet Banking	CRD → BI	Significant (positive)

Based on the extensive literature review of the topic of CRD, it is vital to focus on this construct especially on the online services and applications that cross unsecure medium such as the Internet. The same applies to SaaS services and applications, where transactions are Internet-based, and security and privacy are of much concern of the users. Besides, if there is a lack of CRD as perceived from the user, a higher possibility of not using, accepting or adopting SaaS Cloud Computing is expected, and therefore, hindering the users from benefiting from this innovative technology. To conclude, CRD is included as a dimension of the second order composite construct of USecP to study its effect on the usage, acceptance, or adoption of SaaS Cloud Computing services.

After explicated literature review on TRT and CRD, the researcher opines that when the user has a positive feeling of security while performing any transaction with the SaaS provider, this would facilitate the use, acceptance, or adoption of these services. The user also has to have confidence in that during transactions of the data collected do not violate his/her privacy. So, trusting the providers' measures (i.e., technological, legal, or transactional procedures) combined with the sense of security in the systems or transaction of data and not violating the privacy of the data collected during the transaction with the provider must be in place in order to achieve positive USecP on SaaS services provider. Therefore, the two constructs are perceived to shed more light on the user security perception on SaaS providers.

### 3.8 Moderating Effect of Educational Level (ED) on Accepting, Using, or Adopting SaaS Cloud Computing Services

Moderation effect has been studied in various IS system discipline and marketing to identify and quantify its effect on complex phenomena that are subject to contingencies Helm et al. (2010). The moderator can increase or decrease an effect of an antecedent on the dependent variable  $e$  and even change the direction of this relationship (Aguinis, Edwards, & Bradley, 2017). Figure 3.10 illustrates the basic concept where the relationship between exogenous construct and the endogenous construct is influenced by the moderator  $M$ , in addition to the interaction terms of the moderator and the independent variable.

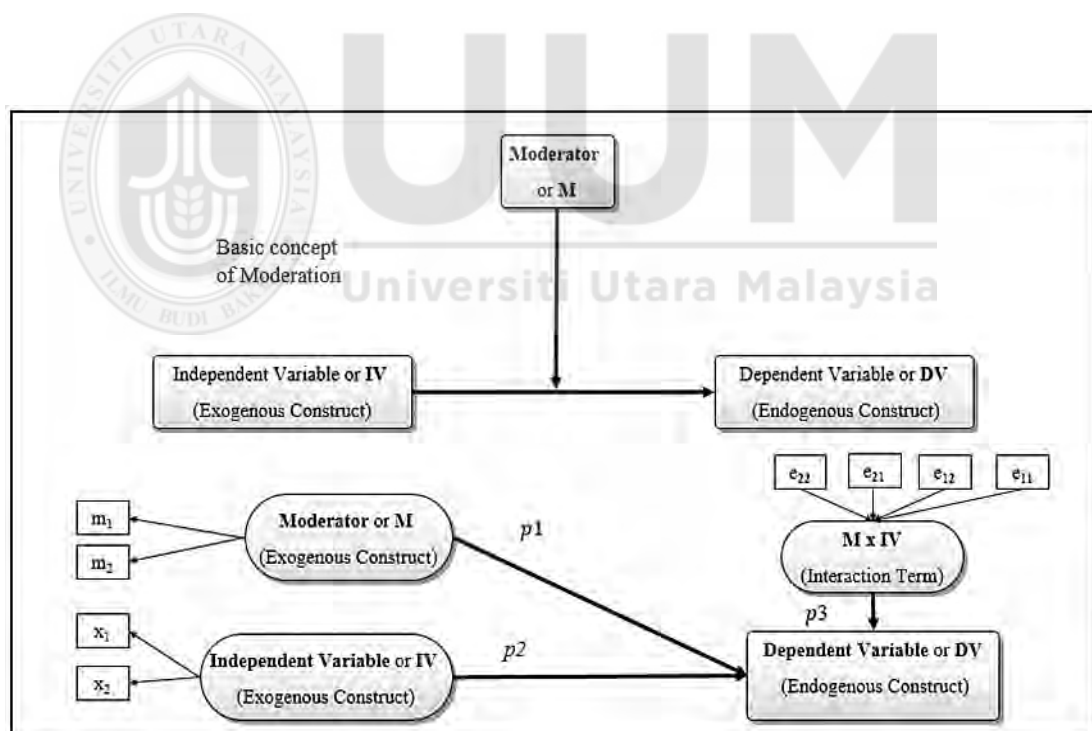


Figure 3.10. The moderation concepts

The moderator can be continuous (e.g., firm resources) or categorical (e.g. educational level), where it can influence the nature of the causal relationships in a model postulated. Basically, there are three main procedures followed in testing this effect,

namely: product indicator approach, orthogonalizing approach, or two stage approach. In the product indicator approach, the product of the moderator and the exogenous constructs' items are calculated to produce the interaction term. This approach applicable only on reflective constructs. Also, it has some drawbacks in terms of collinearity in the model path that is solved by standardizing the items of the moderator before creating the interaction term to reduce the collinearity and facilitate the interpretation of the moderation effect.

The second approach, however, is an extension of the product indicator approach to fully eliminate the collinearity issues (not just reducing it as the former approach) and another advantage is the path coefficients estimation in the model with or without the interaction terms are identical (Hair et al., 2017). This method holds only on models with reflective indicators and where the purpose of the analysis is to minimize the estimation bias or maximize the prediction of the moderation effect (Hair et al., 2017).

Besides, in this approach the residual  $e$  is the main interest as can be seen in Figure 3.10. For the purpose of the current research, the nature of construct is reflective; therefore, it is more appropriate to use in the analysis to accomplish the reduction of the estimation bias and maximizing the prediction power of the moderating effect as recommended by Hair et al. (2017)

The last approach, i.e. Two-stage approach is used when either the moderator or the exogenous construct is informative in nature. On stage 1, the latent variable scores (LVS) are obtained and used on stage 2 to create a single-item measure to measure the interaction term. The Two-stage approach is recommended to be used when the objective is to yield high significant effect of the moderator in formative constructs of

the moderator and/or endogenous construct (Hair et al., 2017). Consequently, this approach cannot be used as the moderator (the educational level) and the exogenous constructs (i.e., BI and USecP) that are moderated in the path towards AUSaaS are not formative in nature, rather they are reflective.

Away from the technicality issues of the moderator, it is worthwhile to probe the previous works on the role of educational level (ED) in using, accepting, and adopting technologies or the actual behavior. Demographic factors have been widely used in literature to understand its influence on the usage and adoption of IT and its diffusion in non-western nations (E. W. Baker, Al-Gahtani, & Hubona, 2007). E. W. Baker et al. (2007) noted that the demographic factors such as age, gender, and level of education affect the usage, acceptance, and adoption of technologies in developed countries.

In principle, Anderson and Cunningham (1972), who is considered to be salient and the pioneers of researchers in studying green consumers, infer to the role of demographic factors such as: occupation, income, education, and age in the differences of the degree of social consciousness. Therefore, the researcher spots the light on the role of education in literature with focus of its importance, role, and its moderating effect. For example, K. Wu et al. (2017) reported that the higher educational level the individuals possess, the more likely they seek better protection for their files and the easier switching intention is generated for the adoption. This means the education is a significant factor in the intention and decision taken (the actual behavior) by individuals to enhance their productivity and utilization of innovative technology such as SaaS Cloud Computing services. To further explain, Agag and El-Masry (2016) identified education as one of the influential factors on intention and highlighted its

importance on consumer behavior intention. On the other hand, they found that education has a significant impact on the intention although with weak effect.

Besides, Meftah, Gharleghi, and Samadi (2015) highlighted the role of education in promoting e-Government services and urging users (i.e., citizens and employees) to adopt its e-Services through educational training programs. In same view, Jansen and Leukfeldt (2015) spot the light on the importance of ED in Information System studies and its crucial influence on the respondents to conduct complicated actions (e.g., using innovative new technologies) and create positive perceptions towards new innovative technologies compared with those with lower level of education. They explained further, the higher level of education, the more skills and knowledge the respondents possess to cope with new innovations. Their empirical findings correspond with this view and PhD holders show higher rate in the adoption behavior.

Additionally, Joglekar (2014) further explained that when education level varies, this leads to various cultural perspectives that the consumer possesses and thus makes him/her less/more likely to conform and be open to global ideas. Similarly, E. W. Baker et al. (2007) emphasize the importance of education as a crucial factor in accepting new technologies in organizations' behavior. The author further explains that the highly educated individuals are benefited from the training, have greater exposure to technology that made them better users of technology, become professionals in the usage, and consequently adopters of new technology regardless of job-related knowledge or opportunities.

Likewise, Lleras-Muney and Lichtenberg (2002) asserts the role of education in selecting the new medical technology. More specifically, in their study on the role of

education on the usage of new medical technologies, they concluded that educated figures are better learner from their experiences in the usage and purchase of drugs, that lead them to use recent and reliable ones than those who are not or less educated.

Also, it is widely accepted that the higher education the individual possesses, the higher level of understanding (s)he has (Abdullah & Rahman, 2007). On the other hand, Gottschalk and Kirn (2013) argue that demographic factors (i.e., age, gender, and education) are more likely to influence the adoption of cloud computing services in higher education institutes. However, their findings contradict their hypotheses pertaining the use of cloud computing. In light with the extended literature review presented above and the confounding views, the researcher articulate to empirically test the educational factor and its moderating effect on the outcome of the current study.

Finally, in this study the educational level (ED) is measured by five level ordinal scale that conforms to the typical levels of education in Malaysia. These levels are adopted from Ismail (2014) that includes the following educational levels as illustrated in the following Table 3.17.

Table 3.17

*Educational Level Measurement Items*

<b>Code</b>	<b>Educational Level</b>	<b>Source</b>
ED1	Certificate	M. H. S. Ismail (2014)
ED2	Diploma	
ED3	Bachelor	
ED4	Master	
ED5	PhD	



### **3.9 Group Differences between Student and Lecturers Groups on Accepting, Using, or Adopting SaaS Cloud Computing Services**

It is widely known that individuals as well as organizations have differences in their perceptions and behaviors and assuming homogeneity could lead to wrongly interpret these behaviors or perceptions (Matthews, Sarstedt, Hair, & Ringle, 2016). These differences' identification and assessment create better understanding about the phenomenon under investigation. To further explain, Rogers (1983) argues that different students and different academic staff have different ED level. In other words, the perception would vary in accepting the technology and using it in their daily life.

Rogers (1983), additionally, infers the importance of using teachers on the educational sector as respondents when studying diffusion in developing countries. He demonstrates that the U.S. Department of Education sponsorship is relying on the educational sector of teachers or lecturers and on researchers in PhD levels to evaluate different diffusion programs. Moreover, academic staff are more technology savvy and are source of diffusing the innovation to different generations that eventually leave to real life field and practice the technology in their work and in different aspects of life.

Similarly, Mac Callum, Jeffrey, and Kinshuk (2014) highlighted the importance of the inclusion of students and educators in studying the educational technology adoption. They imply that students are likely to have different perception and different technological literacy than educators. These group difference can be beneficial in this research to understand the usage, acceptance, or adoption of SaaS services from different angles of perceptions and behaviors toward the outcome of the study.

In another context, Hernandez and Mazzon (2007) in their study in Internet banking in Brazil recruited 600 respondents to compare three different groups characteristics (i.e., 150 neither Internet nor Internet banking users, 150 Internet users but Internet banking users, 300 Internet banking users). They found that the actual adoption and acceptance of Internet banking, which is innovative technology-based service, is influenced by characteristics of individuals, while BI is not affected by these characteristics. They, also, asserted that individual characteristics are important to be included and tested in their model as proven in literature to have influence on the adoption process (Hernandez & Mazzon, 2007). In light with these recommendations, the study considers the group difference analysis to explore the differences between the students and lecturer's groups, if exists, to have better conclusion of the perceptions of individuals at university pertaining the salient factors under study.

In contrast, Peng, Zhao, and Zhu (2016) found that occupation did not have any effect on the intention to use Mobile Instant Messaging application (MIM). In the same token, Laukkanen and Pasanen (2008) conducted a study in Finland to differentiate different groups of users and found occupation did not show any significant differences among the two groups of respondents in using mobile and other online banking services. This, therefore, may raise a flag to investigate the role of demographics such as occupation in the current study as there are confounding findings on the role of occupation in the use of innovative technologies such as adopting SaaS Cloud Computing.

Relying on the previous works and recommendations, it is evident that the previous literature review corroborates the belief that the differences between groups yields different perceptions on the usage, acceptance, or adoption of innovative technologies.

Therefore, the need to probe the differences of the two main groups of respondents in the current study, namely: the students and academic staff, is warranted pertaining different relationships postulated in the model.

### **3.10 Definition of Variables**

The following Table 3.18 defines the latent constructs used in this study.



Table 3.18

*Definition of Latent Constructs*

<b>Latent Construct</b>	<b>Definition</b>
Acceptance and Usage of SaaS Cloud Computing	Is the use behavior (adoption, acceptance, or usage) referring to the application, usage, acceptance, or adoption of the personal level of SaaS Cloud Computing services by individuals in higher education academic studies.
Behavior Intention (BI)	The degree in which the individual- student and academic staff- using, accepting, or adopting the personal level of SaaS Cloud Computing services has formulated conscious plans to use or not use these services in the future that were provided by SaaS provider.
Attitude (ATT)	The degree of favourability or unfavorability felt by the individual in higher education in relation to the usage, acceptance, or adoption of SaaS Cloud Computing in the personal level of the services provided.
Compatibility (COM)	The extent to which the SaaS Cloud Computing services fit or perceived to be consistent with the services that the individual, in higher education, use in a computer in his/her university or privately. OR: The extent in which the SaaS Cloud Computing services' usage, acceptance, or adoption fit or perceived to be consistent with the existing technological services, past experiences, and needs where the individual can use in a computer or smart device in his/her university or privately.
Perceived Ease of Use (PEU)	The degree in which the SaaS Cloud Computing services' usage, acceptance, or adoption are free from worries, difficulties, or effort to achieve the perceived performance.
Perceived Usefulness (PU)	The degree in which the SaaS Cloud Computing services' usage, acceptance, or adoption are perceived to be better to use, access, understand faster, and be reliable to be accessed as compared with the conventional methods of storing/ uploading/ sharing different data in local hard drive or inside local server.
Trialability (TRI)	The degree in which the SaaS Cloud Computing services on the personal level are tested prior to the actual usage, acceptance, or adoption for a limited time.
Trust (TRT)	The degree in which the user of SaaS Cloud Computing services (trustor) is willing to be vulnerable to the actions of the SaaS services' provider (trustee) based on his/her confident and expectation that it will perform a particular action important to him/her (trustor) of Cloud services, irrespective of the ability to monitor or control the SaaS Cloud Computing services' provider (i.e. taking risk and be vulnerable to the trustee).

Table 3.18 continued

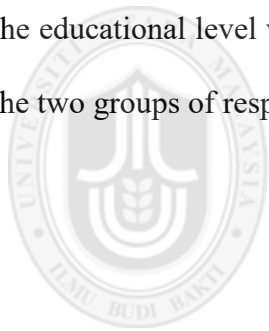
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Perceived Credibility (CRD)	The individual's perception of the SaaS provider's expertise in protecting their transaction, systems, or information- when using different service- (e.g., using public e-mails, storing/sharing/accessing/downloading files, images, and data)-safeguarding the personal data against unauthorized access or divulge of personal information (either from the SaaS service provider or any third party that violates the access privileges of the individual), and believing that the services provided are free of security and privacy threats.
Subjective Norms (SN)	The extent in which the SaaS Cloud Computing services' users expect others to use/accept/adopt or not to use/accept/adopt SaaS services combined with the motivation that those others would comply with them.
Perceived Behavior Control (PBC)	The perceived ease or difficulty in performing different tasks using SaaS Cloud Computing services (in the personal level) and it is assumed to reflect past experience, of the individuals to use technology skills, in addition to the anticipated obstacles to perform such tasks with SaaS Cloud services.
Educational Level (ED)	Refers to the differences of the academic attainment among individuals in the higher education, students and academic staff, and the current already certificate achieved or expected that moderates the the relationship between AUSaaS and BI and USecP.

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### 3.11 Summary

In this chapter, different aspects were explained and delineated. Firstly, related theories were explained in different subsections given special focus on the primary and the supporting theories with the rationale behind the selection of DTPB and DOI to utilize them as lenses to investigate the different relationships. Secondly, the outcome of the study with the related antecedents were reviewed based on literature previous works. In addition, the definition and the relationship between BI and AUSaaS is explained; followed by explanation of the concept of mediation. The subsequent sections delineated the antecedents of BI, followed by the related works of USecP and its relationship with AUSaaS. Next, the moderation concepts and the moderating effect of the educational level were explained and illustrated. Finally, the group differences of the two groups of respondents and their importance in literature were highlighted.



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## **CHAPTER FOUR**

### **RESEARCH METHODOLOGY**

#### **4.1 Introduction**

This chapter describes the methodology used in the current study, the procedures followed in terms of data collection, data analysis, the sampling procedures, the developments of hypotheses and the questionnaire survey instrument, the pilot study and its related issues.

#### **4.2 Conceptual Framework**

Having conducted an in-depth literature review on defining the important study variables relevant to the study, gaining more insight of the area of research of this current study, and articulating the issues, gaps, and problem of the study, the need to develop the research conceptual framework is also very important in conducting and finding out solutions of the research problem. Further, the conceptual framework is essential to show different relationships among the variables and indicates the different hypotheses that are postulated.

Additionally, sequel to the discussions in the literature review in the previous chapter, conceptual framework is developed to include the relationships of different beliefs, i.e. attitudinal, subjective, and control beliefs on the intention. Moreover, the exogenous latent constructs of User Security Predisposition (USecP), the moderating effect of ED, and the mediation effect of BI are postulated. Additionally, the difference between the main two groups of the study are part of the postulated hypotheses.

The postulated framework is adapted from DTPB (Taylor & Todd, 1995) model, integrated with DOI (Roger, (1983) theory, and extended by the inclusion of variable USecP that has much concern in literature that affect the adoption and acceptance of SaaS Cloud Computing (i.e., trust, credibility). Besides, this study, however, combined the two constructs of facilitating condition resources and facilitating conditions technology of the original model of DTPB with one single construct of facilitating conditions which was adapted from the literature measurements.

It is worth mentioning that this postulated conceptual framework is targeting students in HE institutes as well as academic staff (i.e., lecturers) as recommended by Roger's (1983) book for their importance in conducting studies in HE institutes. Figure 4.1 depicts the conceptual framework of the current study.

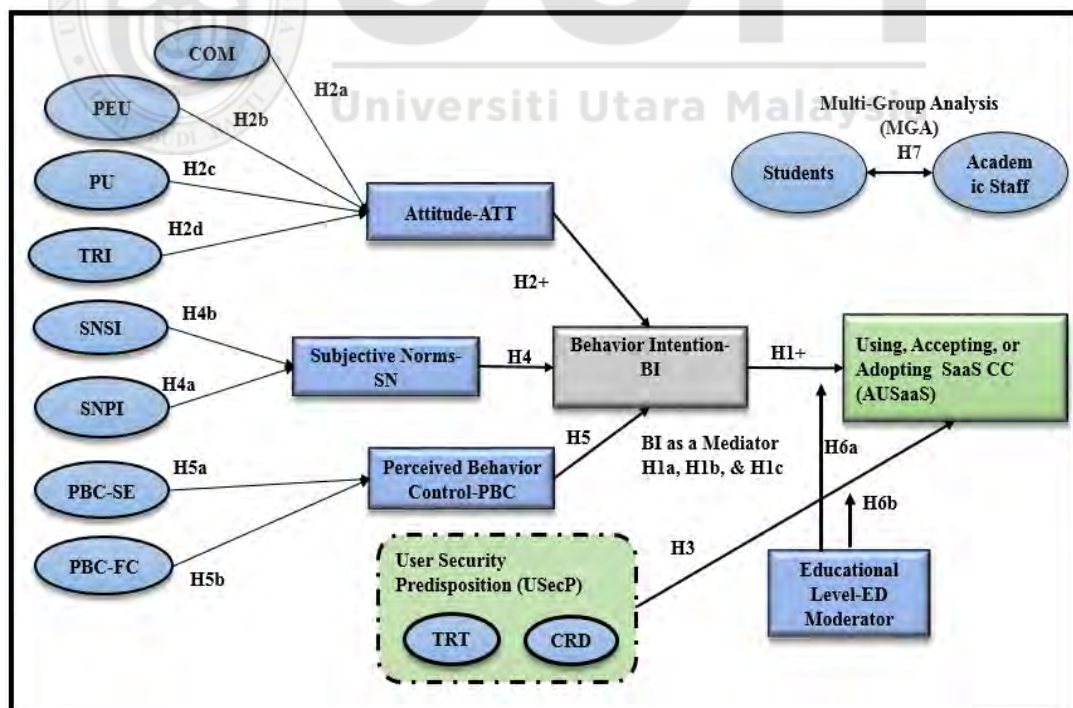


Figure 4.1. Conceptual framework of the study



### **4.3 Hypotheses Development**

In the Decomposed Theory of Planned Behavior (DTPB), the actual behavior is determined directly by Behavior Intention (BI). The Behavior Intention, in turn, is determined jointly by three factors, namely: Attitude (ATT), Subjective Norms (SN), and Perceived Behavior Control (PBC). Each of these antecedents, lastly mentioned, are generated by number of beliefs and evaluations that are explained in the following subsections. Additionally, other composite latent constructs (TRT and CRD) are added to the proposed model as dimensions of the High Order Construct (HOC) of User Security Predisposition (USecP).

Besides, educational level (ED) is evaluated as a moderator in the relationships between BI and USecP with AUSaaS. Moreover, the difference between the two groups of the respondents (i.e., students and academic lecturers) in their perception in the relationships postulated are examined. Lastly, the mediating effect of BI is investigated against the relationship between the driver constructs of BI and AUSaaS.

#### **4.3.1 Acceptance or Usage of SaaS Cloud Computing Dependent Construct (AUSaaS)**

In literature, the adoption is defined in terms of implementation, usage, utilization, and actual behavior or use (Al-jabri & Sohail, 2012). In the same sequence, Rogers (1983) affirms that the Usage or Adoption behavior toward technology is a process that has many phases that need to extend over time and under the individual's will to perform or not to perform it. Further he defined it as, "a decision to make full use of an innovation as the best course of action available" (Rogers, 1983, p.172). In the theory of reasoned action (TRA), the behavior is defined as, "a function of salient

information, or beliefs, relevant to the behavior” (Ajzen & Madden, 1986, p. 455). Additionally, TRA theory categorize it into two types (i.e., behavior beliefs that influence attitudes, and normative beliefs that constitutes the determinants of subjective norms).

On the other hand, the theory of DTPB adds other constructs (i.e., the control behavior that constitutes the underlying determinants of self-efficacy, perceived behavior controls of resources and technology) (Taylor & Todd, 1995). In the context of this study, the use behavior, acceptance, or adoption, is referring to the application, acceptance, or usage of SaaS Cloud Computing services by individuals in HE academic studies. Moreover, the actual behavior (i.e., usage, usage, or adoption of technology) is believed to be an outcome of BI and proven to be supported theoretically, namely by: DTPB (Taylor & Todd, 1995), UTAUT (Venkatesh et al., 2003), TPB (Ajzen, 1991), and empirically in using and adopting technologies in various areas in past studies (Ajjan & Hartshorne, 2008; Al-Ghaith, 2016; Hartshorne & Ajjan, 2009; Pinheiro et al., 2014; Sonthiprasat, 2014; Velázquez, 2014; H. C. Yang & Zhou, 2011; S. Yousafzai, 2012).

#### **4.3.2 Behavior Intention (BI) as a Predictor and Mediator**

Behavior intention is the driver of the actual behavior and is the way that people respond to any task. This view is supported by many studies in literature and the major theories included it as a mediator toward the actual behavior, namely: The theory of TRA (Fishbein & Ajzen, 1975), TPB (Ajzen, 1991), and DTPB (Taylor & Todd, 1995). In addition, Fishbein and Ajzen (1975) pointed out that the intention is essential and necessary precursor to perform a specific behavior.

Additionally, adding intention to models brings an effect on increasing the predictive power of models such as in TRA and TAM compared by less prediction power when excluded or not included in other models (Fishbein & Ajzen, 1975). Therefore, in previous literature many studies has included it in their models and it is found to be a significant determinant of behavior in diverse models (Ajjan & Hartshorne, 2008; Alalwan et al., 2017; Arpaci et al., 2015; Hartshorne & Ajjan, 2009; Pinheiro et al., 2014; Sonthiprasat, 2014; Taylor & Todd, 1995; Thoradeniya et al., 2015; Velázquez, 2014; H. C. Yang & Zhou, 2011; S. Yousafzai, 2012). These studies find that BI is significantly and positively predicts the behavior in different settings and fields in academic research. In the context of the current study, the researcher assumes that when there is a strong intention to perform the tasks assigned to or done voluntarily by the user of various types the SaaS applications or services, these intentions are more likely to boost the feelings and triggers the future plans of those users to use, accepts, or adopt (i.e., do the actual behavior). Consequently, by referring to Section 3.5.1 and based on the discussion presented in the above paragraphs, the study postulates the following hypothesis:

H1. Behavior Intention (BI) has a direct and statistically significant positive relationship with the usage, acceptance, or usage of the personal level of SaaS Cloud Computing services (AUSaaS).

#### **4.3.2.1 Mediating Effect of BI**

When a third latent construct is between two latent constructs, it is said that the mediating effect is created to intervene between these two latent constructs (Albarq & Alsughayir, 2013). It is worthwhile to know that mediator is different than the moderator in that the predictor is mostly an antecedent of the mediator and the

mediator changes the roles from effect to causes in the mediator-predictor relationship (Chiu, Bool, & Chiu, 2017). In the current study, the latent constructs ATT, SN, and PBC are investigated of being mediated by the BI as depicted in the study conceptual framework.

In principle, the literature lent support and emphasized the important mediating role of BI in the relationship between the actual behavior (or adoption, usage, acceptance) and ATT, SN, and PBC (Ajzen & Madden, 1986; Fishbein & Ajzen, 1975). Moreover, other studies pointed out to the mediating effect of intention on the relationship between ATT, SN, and PBC with AB (Albarq & Alsughayir, 2013; T.-Q. Peng, Zhu, Tong, & Jiang, 2012). However, based on the extensive literature review, the researcher found that there is a paucity of research in evaluating the mediating effect of BI on the actual behavior in academia and this notion is supported by Mafabi et al. (2017) study on the mediating effect of BI in the theory of planned behavior TPB.

To conclude, the discussion on Section 3.5.3 combined by the explanation presented above, and the paucity of studies on the mediating role of BI, the researcher argues to text and explore this mediating role of BI in the study with the following hypotheses:

H1a. BI has a mediating influence on the relationship between ATT and AUSaaS.

H1b. BI has a mediating influence on the relationship between SN and AUSaaS.

H1c. BI has a mediating influence on the relationship between PBC and AUSaaS.

#### 4.3.2.2 Mediating Assessment Procedure

The current study proposes a mediating effect of BI between the three behavior attributes (ATT, SN, PCB) with the dependent variable AUSaaS. In principle, there are three procedures followed in literature to assess the mediation effect of a variable, namely: the traditional procedures of Baron and Kenny (1986) and Sobel (1982) test, and the recent procedure of Preacher and Hayes (2004, 2008) that is called bootstrapping the indirect effect. These approaches explained intensively on Chapter Three.

Based on the extensive review- delineated in Chapter Three- on the three different procedures followed in literature combined by the limitations of Baron and Kenny (1986) and Sobel (1982) test methods, the researcher articulate to adopt the recent method of bootstrapping that is highly recommended by many scholar in the academia (Hair et al., 2014, 2017; Hayes & Preacher, 2014; Preacher & Hayes, 2008; X. Zhao et al., 2010) and proven its effectiveness in SEM studies in different fields.

On the other hand, the recent trend in literature is to ignore the significance of the direct effect of the relationship between the IV and the DV (X. Zhao et al., 2010). That is, the primary focus is on the indirect effect, then the attention is turned to the direct effect to explain the mediation effect if falls on the following definitions:

- Direct-only nonmediation (direct effect is significant and indirect effect is not),
- No-effect nonmediation (both the direct and indirect effect are not significant),
- The Indirect-only mediation or the full mediation (indirect effect is significant and the direct is not), and finally,

- The partial mediation with two categories, namely: complementary mediation (the direct effect and indirect effect are significant and with the same direction) and the competitive mediation (both direct and indirect are significant but with different directions). Figure 4.2 and Figure 4.3 visualize the previous paragraphs.

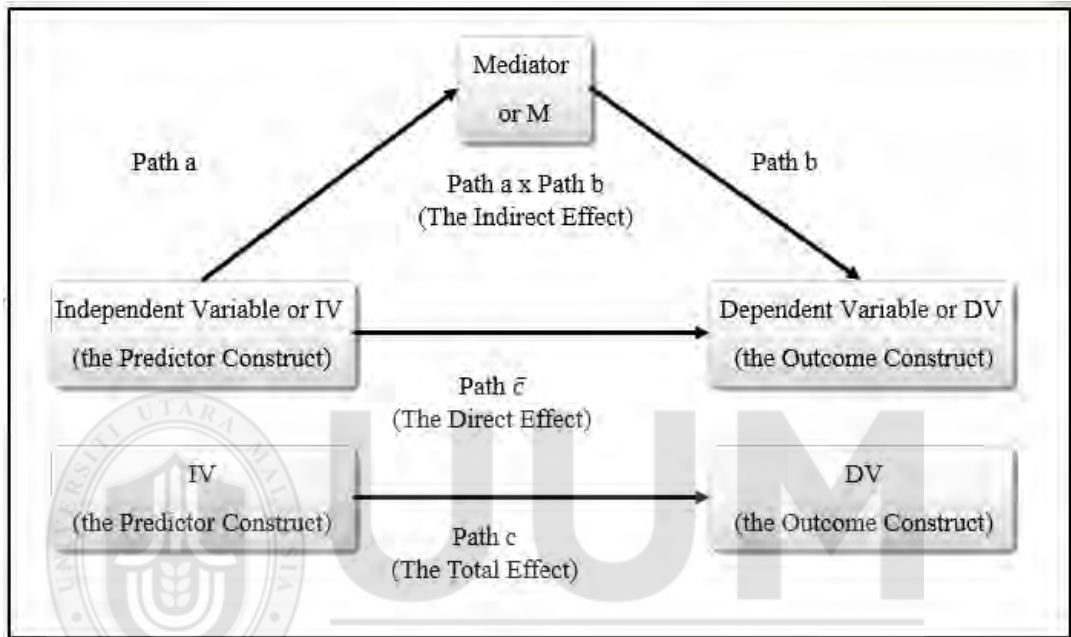


Figure 4.2. The indirect effect's new trend assessment

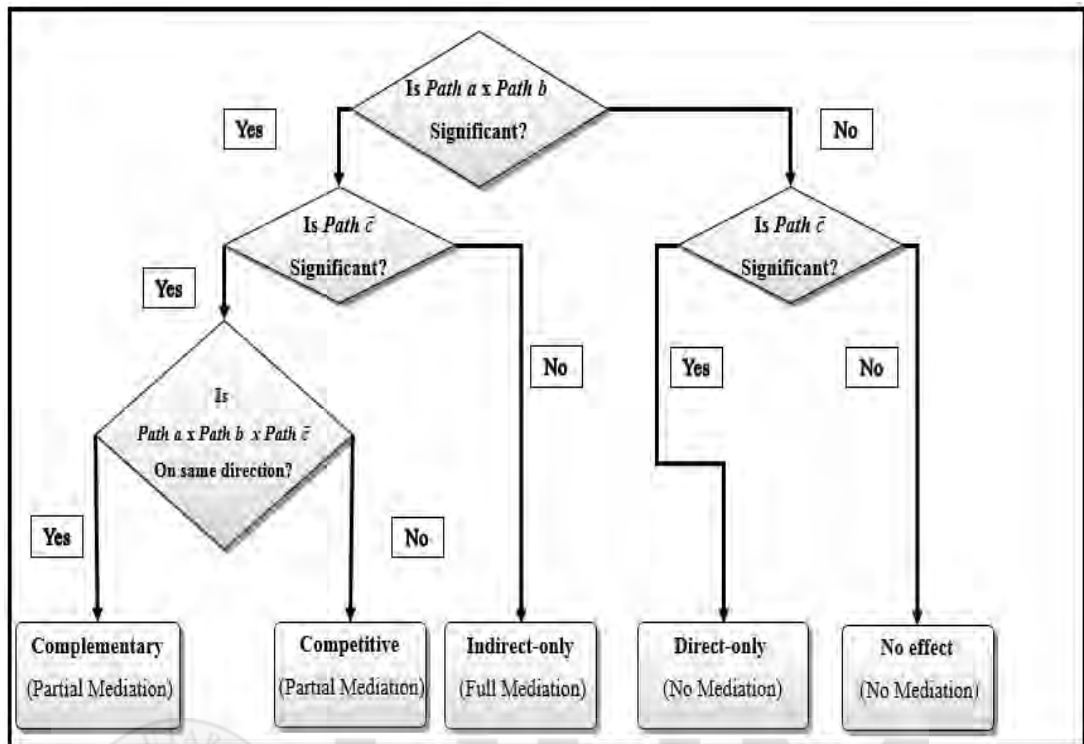


Figure 4.3. Assessment of mediation effect

In the current study, the path coefficient or the standardized  $\beta$  for the direct and indirect effects are calculated by SmartPLS program. Therefore, after running the bootstrapping procedure in SmartPLS program, the indirect effects of ATT, SN, and PBC are obtained with their values and significance level is evaluated. As a next step of evaluation process, the direct effect is further considered to explain whether the mediation effect of BI do exist or not, as well as the level of mediation is evaluated based on the guidelines explained above and visualized in Figure 4.3

#### 4.3.3 Attitude (ATT) Influence on BI

Attitude is one of the main antecedents of BI and is as result a salient belief that a person has either as an evaluation or appraisal of a behavior in question (Ajzen, 1991). In the context of SaaS Cloud Computing online services, the 24-hour access to

applications, storage, and tools with convenience of the location and usage of variety of devices to access SaaS Cloud Computing services make it advantageous compared with other conventional methods.

The traditional methods such as using computers at office hours, accessing data using USB devices that may malfunction easily, or use of limited sharing capabilities of files, data, or multimedia at university premises can be a source of disturbance to conduct certain tasks at specific times. These facilities provided by SaaS online services make it of excellent choice for academics and students at HE institutes. Therefore, these tangible benefits of SaaS online services will affect the attitude of an individual and thus influence his/her intention to perform the behavior in question.

Further, the relationship between ATT and BI have been studied in literature and gained support from different theories (e.g., TAM, TRA, TPB, and DTPB). Previous work theoretically (Ajzen, 1991; Fishbein & Ajzen, 1975; Taylor & Todd, 1995) and empirically (Ajjan & Hartshorne, 2008; Hartshorne & Ajjan, 2009; Huh et al., 2009; Hung et al., 2012; M. Kim & Qu, 2014; Shiau & Chau, 2016; P.-L. To et al., 2008) lend support for the positive and significant relationship between ATT and BI and that ATT is an important antecedent of BI. By referring to the discussion on Section .6.1 and based on the above paragraphs on the topic, the current study postulates the following hypothesis:

H2. ATT has a direct positive and statistically significant relationship with BI in using, accepting, or adopting SaaS services on the personal level.



#### **4.3.4 Antecedents of ATT**

Taylor and Todd (1995) recommend the decomposition of attitudinal behavior – among others- to have a better understanding of the antecedents of the attitude, uncover the specific factors that influence the acceptance of an innovative technology, in addition to have better prediction power of the model. Based on this, ATT is decomposed into lower level beliefs, namely: COM (compatibility), PEU (perceived ease of use), PU (perceived usefulness), and TRI (trialability).

##### **4.3.4.1 Compatibility (COM) Influence on ATT**

According to Rogers (1983), the more compatibility and accordance of the technology that the user can obtain, the more likely this technology is used, accepted, or adopted. Additionally, Rogers (1983) argues if an idea is not compatible with a well-known, common, or highly accepted values and norms, it will not be accepted rapidly as the one compatible in any social science. Also, the greater the compatibility the user obtains from a technology, the higher the adoption rate does occur (Ozturk et al., 2016). According to the above justification stated by Rogers', this construct is included into the postulated model of the current study.

Theoretically, COM is supported in many theories as it influences ATT. For instance, DTPB and DOI give significant support of COM as an antecedent of ATT (Rogers, 1983; Taylor & Todd, 1995). Empirically, many studies in different contexts in literature supported COM as an antecedent of ATT, and found a positive and significant relationship with ATT (Ajjan & Hartshorne, 2008; Burcu İnci, 2017; Hartshorne & Ajjan, 2009; Huh et al., 2009; M. Kim & Qu, 2014; Susanto & Goodwin, 2013; P.-L. To et al., 2008; Tung, Chang, & Chou, 2008; Tweel, 2012). However,

other studies found insignificant relationship between COM and ATT (Amin et al., 2013; Fang & Shih, 2004; Gallos et al., 2011; Nor & Pearson, 2007; Taylor & Todd, 1995). Moreover, Taylor and Todd (1995) recommend further investigations on COM to better understand IT usage behavior.

In the context of the study, the user of SaaS Cloud Computing services uses the online services provided by SaaS Cloud Computing providers when they are compatible with his/her work. Additionally, when this happens, he/she will continue to use it as long as they are compatible with practices he/she already knows. Moreover, according to the above inconclusive results of the relationship between COM and ATT combined by the discussion presented on Section 3.6.1.2, in addition to the argumentation of previous researchers on this topic, the study includes this construct to be examined against ATT to find out its relevance to SaaS Cloud Computing area of research in the HE institutes. Consequently, the following hypothesis is postulated:

H2a. COM has a statistically significant relationship with ATT toward using, accepting, or adopting SaaS services on the personal level.

#### **4.3.4.2 Perceived Ease of Use (PEU) Influence on ATT**

Davis stated that ease of use is the feeling of being free from worries, difficulties, or effort to achieve the perceived performance when using the innovative system (Davis, 1989). In other words, the easier the technology perceived by the individual, the more likely that this technology influences the attitude to use, accept, or adopt the innovative system. In recent years, many services were shifted to the Internet to be processed or stored because of its easiness. For example, the trend nowadays is to use e-mail that is accessible from anywhere, anytime, and from any device. In addition, many SaaS

services such as social network sites or applications (e.g., Facebook, WhatsApp or Google & Microsoft services, etc.) are using SaaS Cloud Computing services to accomplish this goal of ease of use and produce this easy trend to the public.

There are number of theories supported PEU such as TAM, DOI, and DTPB (Davis, 1989; Rogers, 1983; Taylor & Todd, 1995) and this latent construct is studied by different scholars to find out its relationship with ATT. For example, results reveal positive and significant relationship between PEU and ATT (Ajjan & Hartshorne, 2008; Ayeh et al., 2013; Gallos et al., 2011; Hartshorne & Ajjan, 2009; Huh et al., 2009; M. Kim & Qu, 2014; Susanto & Goodwin, 2013; P.-L. To et al., 2008). In contrast, other researchers' findings exhibit that PEU has a negative and insignificant relationship with ATT (Suki & Ramayah, 2011), whereas others' findings showed insignificant positive relationship with ATT (Huh et al., 2009; Nor & Pearson, 2007; Taylor & Todd, 1995).

In light with the past literature discussed earlier in Section 3.6.1.1 and the foregoing justification, there are contradicting and inconclusive findings when the relationship is tested in different fields and contexts, with different models and theories (either as extending, integrating, or comparing them). Therefore, this construct is included in the posited model of the current study to test its predictability power on ATT to use, accept, or adopt SaaS services. Hence, the hypothesis is postulated as follows:

H2b. PEU has a statistically significant relationship with ATT toward using, accepting, or adopting SaaS services on the personal level.

#### **4.3.4.3 Perceived Usefulness (PU) Influence on ATT**

Perceived usefulness of any innovative technology such as SaaS Cloud Computing services, would lead to higher and faster possibility to be used, accepted, and adopted. In other words, when the technology is useful and presumed to be better than its supersedes, it will be perceived as useful (Davis, 1989; Rogers, 1983) and, therefore, it has an influence on the attitude.

Moreover, the theoretical support of the relationship of PU with ATT is found in literature on a large scale (Davis, 1989; Rogers, 1983; Taylor & Todd, 1995), in addition to the empirical support in different contexts of the positive and significant relationship between PU and AB (Ajjan & Hartshorne, 2008; Burcu İnci, 2017; Giovanis et al., 2012; Hartshorne & Ajjan, 2009; Huh et al., 2009; Hung et al., 2006; M. Kim & Qu, 2014; Taylor & Todd, 1995).

On the contrary, other two studies have different trend toward this relationship. One study by PU has P.-L. To et al. (2008) showed that a positive but insignificant relationship between PU and ATT in the e-Government context and Instant Messaging. Consequently, the mixed results combined by the discussion presented on Section 3.6.1.3 suggest investigating the relationship in the context of SaaS Cloud Computing. Therefore, the current study postulates the following hypothesis:

H2c. PU has a statistically significant relationship with ATT toward using, accepting, or adopting SaaS services on the personal level.

#### **4.3.4.4 Trialability (TRI) Influence on ATT**

Roger (1983) suggests that dividing new idea's plan into smaller ones makes it more likely to be used, accepted, or adopted. That is, when there is a new technology such as SaaS Cloud Computing online services (e.g., storing data on Dropbox, Google Drive or Microsoft OneDrive) that is triable for a limited time, it gives more certainty to the user to accept or adopt it faster than others (Roger, 1983). Additionally, TRI in the social context is positively related to earlier adopters, who perceive it more important than later adopters because they did not have any precedent to follow (Roger, 1983). Therefore, TRI is very important when talking about using innovative technology.

This latent construct was tested in many models and contexts in literature. For instance, in Cloud Computing services area of research (Alshamaila et al., 2013), E-learning (Hsbollah & Idris, 2009), Mobile Banking (Khraim et al., 2011), Human Resources information system (Kassim et al., 2012), and adopting high technological brands (A. R. Ismail, 2012). However, these various research papers studied the relationship between TRI and ADP (i.e., acceptance, usage, or adoption of technology) and not as an antecedent of ATT. Additionally, this relationship is found to have positive and significant influence of TRI on ADP. On the contrary, there are many research papers found in literature studying the relationship between TRI and ATT but with mixed results. Some found significant and positive relationship with ATT (Dash et al., 2014; Hong-hong & Mei-hua, 2010; Nor & Pearson, 2007); while others found an insignificant but positive relationship (Gallos et al., 2011; Y. Park & Chen, 2007).

Based on the foregoing explanation and the exclusive and in-depth literature review combined by the discussion on Section 3.6.1.4, the researcher finds the importance of investigating the influence of TRI on ATT in SaaS Cloud Computing area to find its

relevance, predictability power on ATT, and its influence on the model proposed. This study is aiming to fill this gap in literature and add to the body of knowledge on this relationship in the area of SaaS Cloud Computing. Therefore, the following hypothesis is postulated:

H2d. TRI has a statistically significant relationship with ATT toward using, accepting, or adopting SaaS services on the personal level.

#### **4.3.5 Subjective Norms (SN) Influence on BI**

Subjective norm is regarded as an important component for many theories and models such as TRA (Ajzen & Fishbein, 1977), TPB (Ajzen, 1985), and DTPB (Taylor & Todd, 1995). It consists of the influence on the individual to comply with the expectations of the social circle especially when performing a behavior that could lead to reward or punishment by referent groups or individuals (Fishbein & Ajzen, 1975).

In addition, past literature provide empirical support for the significant and positive relationship between SN and BI (Al-Gahtani et al., 2007; Ekufu, 2012; Hartshorne & Ajjan, 2009; Hung et al., 2012; Jain et al., 2017; Lian, 2015; Mishra et al., 2014). However, other results were found to have insignificant relationship between SN and BI (Ajjan & Hartshorne, 2008; Alalwan et al., 2017; Hartshorne & Ajjan, 2009; Picazo-Vela et al., 2010; H. C. Yang & Zhou, 2011; W. Zhang & Gutierrez, 2007). Consequently, based on the discussion presented on Section 3.6.2 and the foregoing paragraphs, combined by the mixed results suggest the inclusion of SN in the proposed model to investigate its relevance to the acceptance of SaaS Cloud Computing services. Hence, the present study postulates the following hypothesis:

H4. SN is expected to have a statistically significant relationship with BI toward using, accepting, or adopting SaaS Cloud Computing services on the personal level.

#### **4.3.5.1 Peer and Superiors (SNPI and SNSI) Influence on SN**

Taylor and Todd (1995) recommend the decomposition of the normative belief construct. Here, the subjective norms construct, or the normative beliefs, is decomposed into different referent groups (i.e., peers and superiors). Taylor and Todd (1995) argue that if one monolithic construct used in the presence of different opinions of the referent groups, this would possibly cancel the effect of these referents. Based on these arguments, SN is decomposed into lower level beliefs, namely: peer influence and superior influence.

Additionally, it can be inferred that the peers and superiors effect have influence on others in the social circle, which can lead to use or adopt the innovation. Transferring this to the current stud, it can be argued that the actual use, acceptance, or adoption of SaaS services by means of the pressure of the social community is inevitable. Take for example, if a student/lecturer at the university is using Dropbox (a SaaS online service) to store and share his/her files and important data, this user, consequently, is utilizing innovative technology that makes him/her different than those who does not use it.

Moreover, he/she may urge other students/lecturers in his/her social circle to use this technology as it is more reliable than using traditional USB storage device, in which it renders unusable frequently in many occasions. This influence, by means of encouraging, makes others use SaaS Cloud Computing services accordingly. Other examples of SaaS applications can have the same argumentation in encouraging others to use innovative applications provided by SaaS online services.

The same influence can be considered for lecturers, who can access lectures' presentations and different pedagogical resources and at the same time share it with students and receive their comments whenever the lecturer deems it necessary. In other words, this lecturer, who is using SaaS services, can influence others by means of encouragement to accomplish different tasks through the usage of such services (e.g., using different programming tools provided by SaaS Cloud Computing services). On the other hand, the lecturers or supervisor are imparting technology to students and encourage them to use SaaS services in their assignments and projects as they (i.e., the lecturers) are the source of technology, whom students learn from them different skills and gain variety of technological information.

In reviewing the literature, many studies support the significant and positive relationship of peers (Hartshorne & Ajjan, 2009; Hung et al., 2012; Ma et al., 2016; P.-L. To et al., 2008) and superiors (Hartshorne & Ajjan, 2009; Huh et al., 2009; Hung et al., 2012; Ma et al., 2016; Rana et al., 2013; P.-L. To et al., 2008) with SN. Moreover, the discussion on Sections 3.6.2.1 and 3.6.2.2 combined by the explanation above gives enough justification on the inclusion of these constructs on the model postulated. Therefore, the following two hypotheses are proposed:

H4a. SNPI is expected to have a statistically significant relationship with SN.

H4b. SNSI is expected to have a statistically significant relationship with SN.

#### **4.3.6 Perceived Behavior Control (PBC) Influence on BI**

Ajzen (1985, 1991) indicated that the more favorable attitude and subjective norm with greater perceived behavior control, the more likely that individual's intention to



perform a specific behavior is expected to be achieved (Ajzen, 1991). PBC latent construct received theoretical support from different theories and models in literature such as: TPB and DTPB (Ajzen, 1985, 1991; Taylor & Todd, 1995).

Empirically, some researchers found that PBC has significant and positive relationship with BI (Ajjan & Hartshorne, 2008; Huh et al., 2009; Lai & Hitchcock, 2017; Susanto & Goodwin, 2013; P.-L. To et al., 2008). Conversely, other studies revealed different results, which shows insignificant relationship (Jain et al., 2017; Picazo-Vela et al., 2010; H. C. Yang & Zhou, 2011). As can be seen from this quick review of the literature and combined with the discussion on Section 3.6.3, contradictory results between BI and PBC suggest the inclusion and investigation of this latent construct with its antecedents in the model proposed. Therefore, the following hypotheses is suggested:

H5. PBC is expected to have a statistically significant relationship with BI.

#### **4.3.6.1 Self-efficacy (PBCSE) and Facilitating Conditions (PBCFC) Influence on PBC**

PBC construct is decomposed, according to the recommendation by Taylor and Todd (1995), into the internal notion (i.e., self-efficacy) and external resources (i.e., facilitating conditions either resources or technology), which more details explained in Chapter 2. In reviewing the literature, the empirical support for both constructs, PBCFC and PBCSE, are evident. Some research studies reported a directional significant and positive relationship between PBC and PBCFC latent variable (Huh et al., 2009; M. Kim & Qu, 2014; Susanto & Goodwin, 2013; Taylor & Todd, 1995; P.-

L. To et al., 2008); while others found insignificant relationship with PBC (Ajjan & Hartshorne, 2008; Hung et al., 2012).

Additionally, one study indicates a significant relationship of technology facilitating conditions, but insignificant relationship of resources facilitating conditions as found in a study conducted by Hartshorne and Ajjan (2009). Further, the researcher infers that PBCFC such as Internet connectivity (e.g., Wi-Fi, modem cable device, etc.), smart devices and computers, in addition to time and money (i.e., to cover purchase of accessibility devices, subscription, or computers/smart devices) are important elements to study adoption or acceptance of innovative technology, which SaaS Cloud Computing services is regarded so.

Therefore, the better the PBCFC and availability of low rate access services, time, and money, the more likely the individuals be able to use, accept, or adopt SaaS Cloud Computing service. On the other hand, Self-efficacy (PBCSE) is the capability of a person to use computer or technological device to complete a certain task (Compeau & Higgins, 1995; Ramayah et al., 2014). In that sense, the higher self-efficacy the person possesses, the stronger the belief to conduct certain behavior is under control, and therefore, the more possibilities in using, accepting, or adopting new innovations (such as SaaS applications and services) with challenge and confidence.

In the context of the current study, individuals in HE institutes when having high computer self-efficacy, the perception that they will be able to use SaaS Cloud Computing online services (e.g., upload/download, share, process, and edit files/data/media content, etc.) will be under their control. Besides, literature shows a direct and significant positive relationship between PBCSE and PBC (Ajjan &

Hartshorne, 2008; Hartshorne & Ajjan, 2009; Huh et al., 2009; Hung et al., 2012; M. Kim & Qu, 2014; Rana, Dwivedi, & Williams, 2015; P.-L. To et al., 2008).

Additionally, it is worth mentioning that these two dimensions of PBC are important for the acceptance of SaaS Cloud Computing technology. Firstly, PBCSE is the individual's judgment of his/her capabilities to use SaaS Cloud Computing applications and services. Secondly, PBCFC reflect the available resources needed to access SaaS services. In other words, the technological facilities such as: accessibility equipment to SaaS Cloud (e.g., Laptops, Smartphones, Tablets, Internet equipment, etc.) and the resources in terms of time and money, are the facilitating conditions to encourage the intention of individuals and facilitate the acceptance of SaaS services. Accordingly, this study focuses on assessing the facilitating conditions of SaaS Cloud Computing in terms of Internet equipment, time, and money as suggested by Taylor and Todd (1995).

In sum, based on the above paragraphs, the discussion on Section 3.6.3.1, and combined by the confounding results trigger the need for empirical investigation of the two constructs in the context of the current study. Therefore, the above antecedents are posited with hypotheses:

H5a. PBCSE is expected to have a statistically significant relationship with BI toward using, accepting, or adopting SaaS Cloud Computing services.

H5b. PBCFC (i.e., resources and technology) are expected to have a statistically significant relationship with BI toward using, accepting, or adopting SaaS Cloud Computing services.

#### **4.3.7 User Security Predisposition (USecP) Influence on BI**

The current study suggests a parsimonious one second-order composite latent construct that consists of two latent variables found to be of real concern in literature of Cloud Computing, namely: Trust, and Credibility. Trust is the feeling that the individual has towards SaaS Cloud Computing provider. That is, when the user is having security concerns, he/she will hesitate to use, accept, or adopt innovative new technology unless a basic trust is hold on the provider of SaaS services or the trustee.

Moreover, the CRD is the security and privacy positive feeling that the individual has when using SaaS services. In sum, the individual, who is using or intending to use new innovative technology, should overcome his/her concerns and take the initiative to use, accepts, and adopt SaaS applications. These concerns are basically lay on the security issues surrounding the transactions between the SaaS services provider and the user of these services. Another concern would be the privacy of the user and keeping data away from intruders as well as the violation of privacy from the provider itself.

In addition, although there is a security concern, the user of SaaS online services should have at least a basic kind of trust that will motivate him/her to accept and use the services provided. If, for any reason, the trust is not taking place and no positive feeling of being secure and having privacy issues, the advantage of not using variety of SaaS services would be of great loss. Additionally, T.-Q. Peng et al. (2012) assert that BI is an important mediator between the AB and other psychological factors. Hence, it can be argued that USecP latent variable can be an influencer of using or adopting SaaS Cloud Computing.

The following subsection explains briefly the relationship between those sub-dimensions to use, accept, or adopt SaaS Cloud Computing in previous literature. This multi-dimension construct refers to the extent in which individual is led by the degree of his/her level of trust and the positive feeling of security and privacy (i.e., credibility) on the SaaS Cloud provider to act based on these beliefs and, consequently, to use, accept, or adopt SaaS Cloud Computing services on the personal level.

#### **4.3.7.1 Dimensions of User Security Predisposition (USecP)**

The following subsections explain the two dimensions of USecP relationships and demonstrate the literature review.

#### **4.3.7.2 Trust (TRT)**

Trust is found to be a crucial element in the area of IS/IT and its services especially when the situation comes to transact very important information over presumed unsecure medium. Many definitions were found in literature that define and explain trust. For example, trust is defined as willingness of the trustor, the SaaS Cloud Computing user, to be vulnerable to the trustee, the SaaS Cloud Computing provider, in order to perform certain tasks regardless of the level of knowledge that the trustor has on the trustee (Mayer et al., 1995). “This definition of trust is applicable to a relationship with another identifiable party who is perceived to act/react with volition toward the trustor” (Mayer et al., 1995, p. 712)

Based on these definitions, we could say that on daily transactions of information over untrusted medium, the Internet, the trustor has to place a trust on the other party, the trustee, in order to gain its services provided by the latter with perceived vulnerability

from the trustor to perform such actions (Mayer et al., 1995). These transactions occur with confidence expectations of the trustor (Chellappa & Pavlou, 2002).

In the same vein, the SaaS Cloud Computing user is transacting the data back and forth to the provider's Cloud storage space on the internet and processing engines. These transactions are happening on untrusted medium, the Internet. In addition, the data is processed and stored in the Cloud in which the SaaS Cloud Computing provider has almost the full control over it. Meaning that some of the control issues over the user's own data are not fully assured by the user of SaaS Cloud Computing services if they are safe enough from outside intruders or the provider itself, refer to Section 3.7.1 on Chapter 3 of the literature review for details on this regard. However, if the user does not have at least a basic trust on the provider's security measures, many of the services will not be attainable by the trustor, the user of Cloud services. Therefore, there should be a trust between the SaaS Cloud Computing provider and the user to enable exchangeable twofold benefits.

Additionally, Lassoued and Hobbs (2015) assert that being satisfied with specific retailer of any product can evolve to make the consumer confident with that brand or retailer. In the same way, when the respondent is content with the applications or services that (s)he uses on daily bases (e.g., WhatsApp, twitter, Facebook, e-mail/storage/multimedia SaaS Cloud Computing services), this creates a feeling of trust that may evolve into confidence of SaaS services providers and eventually reflects into an action to accept and adopt SaaS services and applications. Transferring these findings to the context of this study, it is believed that TRT in SaaS Cloud Computing service provider will help the embrace of the services, utilities, and applications when

the concerns or uncertainties are eliminated from the user (i.e., trustor) and thus, driving the user to use, accept, or adopt SaaS services.

Moreover, past empirical studies investigating the role of TRT on BI to adopt, accept, or use a technology or services, revealed inconsistent findings. For example, a positive significant effect of TRT on BI was found in literature in different contexts (Alalwan et al., 2017; Lian, 2015; Lu et al., 2011; Siang, 2012; S. Y. Yousafzai et al., 2010), while others found no significant relationship between TRT and BI (Burda & Teuteberg, 2014; Chemingui & Lallouna, 2013; Koenig-lewis et al., 2009; Luo et al., 2010, p. 2017; Q. Zhao, Chen, Wang, & Chen, 2017).

Beside, few studies focused on the direct relationship between TRT and ADP of services, behavior, or actual use of technology, namely: Yee-Loong Chong et al. (2010), Hanafizadeh et al. (2014), and Engwanda (2014). Their results shed light on the positive and significant role of TRT on ADP. Interestingly, a most recent study on the adoption of Cloud Computing affirmed that TRT has a significant effect and is one of the most important factors in adopting Cloud Computing (Priyadarshinee, Raut, Jha, & Gardas, 2017). Based on the foregoing explanation and the discussion in Section 3.7.1, the researcher articulates to include TRT as a dimension of USecP.

#### **4.3.7.3 Credibility (CRD)**

Credibility is the positive personal belief of security and privacy. This positive belief leads to user satisfaction that the security and privacy are free from threats during transaction process against unauthorized access (Aderonke & Charles, 2010; Ganesan, 1994; Koenig-lewis et al., 2009; Y. Wang et al., 2003). In the context of the study, CRD is assumed by the user of SaaS services while the user transacting files and

process applications on the SaaS Cloud. This positive feeling makes the user more comfortable to use the services offered by the SaaS providers and motivates him/her to continue using the services offered.

In principle, many of the free SaaS applications offered to users ask the user for his/her approval and permission to accept terms and conditions imposed by the provider. If the user does not accept these terms and conditions, he/she is no longer eligible to use its services. Consequently, the user has to feel free from threats and worries on violating his/her privacy and security in using the applications or storage of the SaaS provider.

Additionally, in former works, it is found that CRD is a strong predictor of BI. The lack of or inadequate security is considered one strong inhibitor of the development of online services (Aderonke & Charles, 2010). In that sense, CRD has been proven in different studies to have a positive and significant relationship with BI (Amin, 2008; Ariff et al., 2012; Dasgupta et al., 2011; Hanafizadeh et al., 2014; Luarn & Lin, 2005; S. W. Wang et al., 2017; X. Wang & Yang, 2010; Y. Wang et al., 2003). Additionally, few studies focused on the direct relationship between CRD and ADP, and found positive and significant relationships between the two (Engwanda, 2014; Fan et al., 2013; Hanafizadeh et al., 2014).

However, one study found by Koenig-lewis et al. (2009) indicated insignificant relationship between the two constructs. In general, majority of studies place a positive significant relationship between CRD and BI/ADP to use innovative technologies. Hence, its positive relationship with AUSaaS is presumed in this current study under the composite second-order latent construct of USecP. In this regard, SaaS services'



providers should provision security and privacy to the end user in order to use their services. If there is a lack of CRD, a higher possibility of not using, accepting, or adopting SaaS services, and, therefore, hindering the users from the acceptance of SaaS Cloud Computing innovative technology. For the above reasons combined with the discussion on Section 3.7.2, the researcher finds CRD as one essential dimension of the parsimonious multi-dimension second-order construct USecP.

Following this line of reasoning and based on past literature review of the two subsections of trust and credibility, the study incorporates these two constructs and composed them in one second-order latent variable (i.e., USecP) in the proposed model to investigate its relevance and role on AUSaaS cloud computing. Additionally, USecP has, to the best of researcher knowledge, not been covered in literature comprehensively on the micro level at higher education sector and there is scarcity of empirical studies on investigating its role on accepting and using SaaS services. Therefore, the study argues that the inclusion of such construct is valuable on this area of research and is estimated to shed light on its significance in the relationship proposed. Hence, the following is postulated:

H3. USecP is expected to have a statistically significant influence on AUSaaS.

#### **4.3.8 Educational Level (ED) Moderting Effect and Group Differences Testing**

In past literature, it was revealed that the differences in ED level affect using or adopting an innovative technology. That is to say, different participants with different ED level have different perceptions and understanding of technology and, therefore, affect the level of acceptance of innovative technology (M. H. S. Ismail, 2014). Furthermore, it is widely accepted that the higher education the individual possesses,

the higher level of understanding (s)he possess (Abdullah & Rahman, 2007). In the same view, Jansen and Leukfeldt (2015) spot the light on the importance of ED level in Information System studies and its crucial influence on the respondents to use innovative new technologies and create positive perceptions towards new IT compared with those with lower level of education.

Besides, several studies identified ED as fostering the intention and the adoption process of an innovative technology or certain behavior. This proposition is found in different fields in Information System/Technology works (Agag & El-Masry, 2016; Jansen & Leukfeldt, 2015; Joglekar, 2014; Meftah et al., 2015; K. Wu et al., 2017). On the other hand, other works of X. Peng et al. (2016) and Laukkanen and Pasanen (2008) did not find significant role of occupation (OC) and education (ED) on BI to use innovative technologies. This, therefore, may raise a flag to investigate ED role as moderators in the current study as there are confounding findings on the role of education in the use of innovative technologies such as adopting SaaS Cloud Computing.

Away from that, the students and lecturers (or academic staff) are selected in this study to be the unit of sampling for a number of reasons. Firstly, Rogers (1983) highlighted the importance of the HE sector represented by Universities to be used in research for the following reasons: Universities teach students, conduct research to help solving problems, and are as an extension service to diffuse innovations that are based on research of these Universities to help potential adopters in the respective field. Secondly, different students and different academic staff have different levels of education. Therefore, their perception would vary in accepting the technology.

Similarly, Mac Callum et al. (2014) highlighted the importance of the inclusion of students as well as educators in studying the educational technology adoption. They imply that students are likely to have different perception and different technological literacy than educators; thus, they recommend the inclusion of both groups in studying technology adoption and investigates the differences between the groups. Moreover, the academic staff are more technology savvy and are source of diffusing the innovation to different generations. Therefore, this warrants to find out if there is any differentiation between the student group and the lecturer group in the adoption process of SaaS Cloud Computing.

More importantly, Schloderer, Sarstedt, and Ringle (2014) noted that the moderators have a crucial role in increasing our understanding on group-specific differences especially in the cause-effect complex relationship. They indicated that there may be different effects of different groups of the respondents in the relationships that may bias the final result on the aggregate level. Moreover, Sarstedt, Henseler, and Ringle (2011) emphasized the importance of investigating the heterogeneity of the population under study or it may lead to inaccurate managerial conclusion. For these reasons, a growing call for capturing these observed and unobserved heterogeneity is warranted (Becker, Rai, Ringle, & Völckner, 2013; Schloderer et al., 2014).

Following prior research on extending the model, the study comes to the point of raising the questions: To what extent does ED qualifications of individuals in Malaysian HE sectors influence SaaS Cloud Computing acceptance, usage, and adoption of services? And is there any difference between the perception of students and the academic staff in the relationships of the model estimated, (i.e. the role of

occupation)? Pertaining to these questions, this research posits the following hypotheses and investigates these primary questions:

H6a. There is a statistically significant moderating effect of Educational Level (ED) on the relationship between BI and AUSaaS.

H6b There is a statistically significant moderating effect of Educational Level (ED) on the relationship between USecP and AUSaaS.

H7. It is expected to have a statistically significant difference between the two groups (i.e., students and academic staff) in HE sectors on the relationships towards accepting, using, or adopting SaaS Cloud Computing services

#### **4.3.8.1 Moderating Effect Assessment Procedure**

To assess the moderating effect, there are three components, the exogenous variable, the moderator, and the interaction term as explained previously. In the phase of the measurement model evaluation, the first two components are evaluated in terms of internal consistency reliability, convergent validity, and discriminant validity. However, this procedure does not hold for the interaction term, which is a multiplication of the moderator and the exogenous variable items.

The interaction term is an auxiliary measurement that uses the interrelationships between the mediator and the exogenous variable (Hair et al., 2017). The reason behind that is the interaction term product violates the discriminant validity as they have a high correlation as a result of the its calculation process. For these reasons Hair et al. (2017) recommend the evaluation of the  $f^2$  size of the interaction term to assess the moderation effect. The values of the effect size  $f^2$  are in general very small pertaining

the interaction term and Kenny (2016) suggests for the small, medium, and large effect sizes 0.005, 0.010, and 0.025, respectively.

In general, the procedure to assess the moderating effect is by bootstrapping the model that includes the moderator to evaluate the significance level of the interaction effect, following that  $f^2$  size is evaluated based on the criteria abovementioned for the evaluation of the effect size of the moderator on the endogenous construct- this value obtained by running the PLS path algorithm. Further analysis to ease the interpretation of the moderating effect is to use the simple slope plot, where it compares the moderating effect with each increase/decrease of one standard deviation unit of the moderating effect with the mean value of the main effect between the exogenous and endogenous constructs. Figure 4.4 Illustrates the concept of moderation.

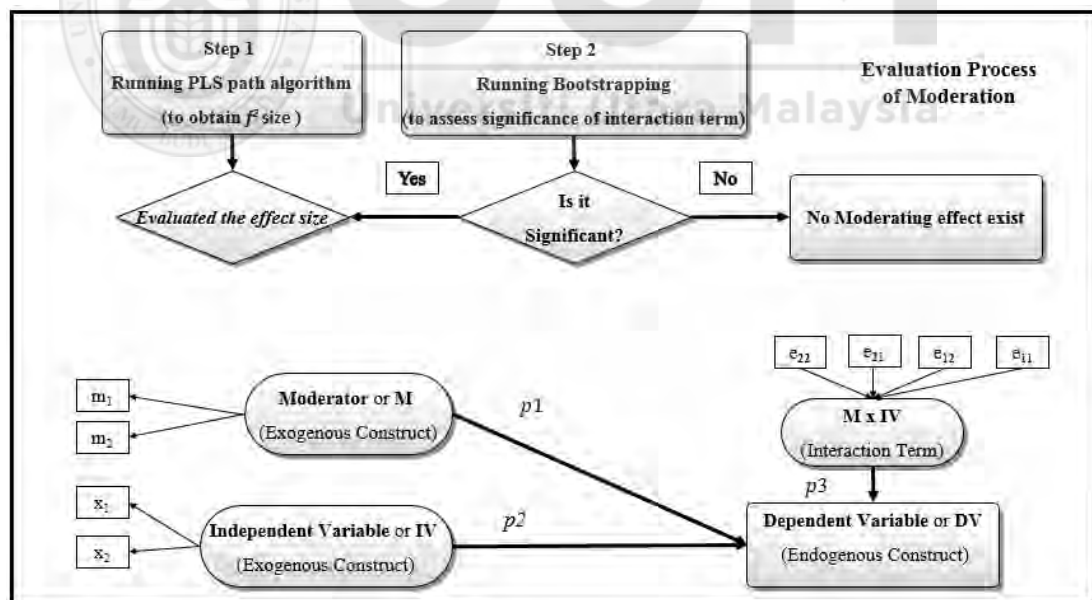


Figure 4.4. Moderating effect evaluation process

## **4.4 Research Design**

This section has three subsections, namely, scale of questionnaire, questionnaire structure, and research instrument measurements.

### **4.4.1 Measurements' Scale**

In this study, questionnaire was administered to the individuals in HE represented by students and lecturers in Malaysian Universities. Furthermore, as stated earlier, all items adapted in the questionnaires were answered using a Likert-type scales that are widely used in quantitative behavior research and found to be very useful and suitable in factor analysis tests (Hinkin, 1998). The responses of items, in Likert-type scale, representing a particular concept or variables are summed for each respondent. The scale is regarded as interval type scale that differences between any two points of the scale remain the same.

In principle, the Likert-scale initially developed with 5-point scale (Likert, 1932), i.e., strongly disagree, disagree, neither agree or disagree, agree, and agree strongly. In quantitative survey research; however, other scales such as 7 and 9 point scales were used. Sekaran (2003) asserts that using scales of (5, 7, and 9) that has neutral point in the middle, makes it a balanced rating. Additionally, Lissitz and Green (1975) state that the Cronbach's alpha that measures the reliability is found to increase up to 5-point Likert scale, while decreasing with 7 and 9 point scales. Moreover, the authors assert that it is not recommended to double the options in items as it does not increase reliability, rather increasing number of items.

In literature the recommendation of 5 point Likert scale is highly supported (Lissitz & Green, 1975). Moreover, Frary (1996) recommends keeping away from higher level

of scoring such as 7 or 9 Liker scale to avoid negative responses of respondents that will exert their efforts, consumes their time, and may annoy or confuse them in finding the right choice. For these reasons, the 5-point Likert scale is used in this study.

In the context of the study, the Likert-type scale is used from section two the survey instrument and forward and is anchored with “Strongly Disagree” with “1” value to “Strongly Agree” with value of “5”, while in the middle is “Neutral” option. Other items in the demographic section Age and ED have also 5-point measurements, while Gender has two levels and Ethnicity has four levels. The occupation is only ranged with two levels that reflects the respondents’ categories: students and lecturers.

#### **4.4.2 Questionnaire Structure**

A covering letter started the questionnaire with an introduction of the topic, the purpose of the research, asking for the respondents’ consent, and details of the author. The questionnaire is made up of seven sections. First section is probing the demographics and consisting of eight questions. General questions are presented, followed by information on the SaaS Cloud Computing software that is used on the personal level on daily bases.

The first section consists of items related to the AUSaaS Cloud Computing (outcome of the study) with four items, as well as the second section of BI (four items). Second Section consists of one main part related to ATT (consists of 4 items), followed by its antecedent with four sub-sections, namely: COM (4 items), PEU (4 items), PU (4 items), and finally TRI (4 items).

Next Section three, User Security Predisposition (USecP) with two sub-sections, namely: TRT (4 items), CRD (4 items). After that Section 4, which is related to SN (4 items) and consists of two other sub-sections, namely: Peer Influence (4 items) and Superior Influence (4 items). Section 6 is concerned with PBC (4 items), and has two antecedents, namely: PBCSE (4 items), and PBCFC (4 items).

All these measures of the current study were validated and, therefore, adapted from different resources found in literature. They were selected according to the criterion of Cronbach's alpha ( $\alpha$ ) value and relevance to the study proposed. Table 4.1 illustrates the main latent constructs, antecedents and other latent constructs along with relevant number of indicators/items.

Table 4.1

*Summary of Variables, Dimensions and Total Number of Items*

Main Latent Constructs	Antecedents/Latent Constructs	No. of Items
Acceptance and Usage of SaaS Cloud Computing- AUSaaS		4
Behaviour Intention- BI		4
Attitude- ATT		4
	Perceived Ease of Use- PEU	4
	Perceived Usefulness- PU	4
	Compatibility- COM	4
	Trialability- TRI	4
User Security Predisposition -USecP		
	Trust- TRT	4
	Perceived Credibility (Security and Privacy)- CRD	4
Subjective Norms- SN		4
	Peer Influence- SNPI	4
	Superior Influence- SNSI	4
Perceived Behaviour Control- PBC		4
	Self-Efficacy- PBCSE	4
	Facilitating Condition- PBCFC	4
	Educational Level-ED	1
	Total items	61



#### 4.4.3 Research Instrument Measurements

The estimation of a multiple-item scale is measured by means of Cronbach alpha, which is the most commonly used estimate to represent internal consistency by computing the average of all possible reliabilities for a multiple-item scale as indicated by Zikmund, Babin, Carr, and Griffin (2010). Cronbach alpha ranges from 0, which means no consistency, to 1, which means complete consistency. Moreover, in literature there are different views of the acceptable values of Cronbach's  $\alpha$  to consider the reliability and internal consistency of a scale or measurements selected. For instance, values in the range of 0.70 are acceptable measurements, and those above 0.8 are considered as good measurements. However, the reliability of measurement is considered poor if the value of Cronbach's  $\alpha$  is less than 0.60 (Sekaran, 2003; Zikmund et al., 2010).

Other researchers have different views for the reliability and internal consistency of the scale. For example, the value of 0.93 is considered with high coefficient, 0.72 reliability coefficient (Cronbach's  $\alpha$ ) is satisfactory, and a value of 0.6 is acceptable for determining the internal consistency of the scale or measurement to be used (Creswell, 2012).

Interestingly, Zikmund et al. (2010) summarized the values of alpha as follows: the range of alpha values (0.80 to 0.95) are considered to have very good reliability, and range of (0.70 to 0.80) are considered to have good reliability, while a value in the range of (0.60 to 0.70) indicates fair reliability, while below 0.6, the scale has poor reliability. In sum, values of Cronbach alpha in the range of 0.70 or above is acceptable value that shows good reliability of the measurements.

In the context of this study, all the measurements adapted are in the range of 0.70 and above which is the acceptable value of Cronbach alpha that most researchers have consensus upon. Table 4.2 delineate the latent variables with their code, items, the sources of items adapted from, along with Cronbach's alpha values from source.



Table 4.2

*Constructs in The Conceptual Model*

<b>Operational Latent Variable/ No. Items</b>	<b>Survey Items</b>	<b>Sources and Cronbach alpha</b>
Adoption and Usage of SaaS Cloud Computing (AUSaaS)/ 4 items	<ol style="list-style-type: none"> <li>1. I prefer online SaaS Cloud Computing services (e.g., store my data on the web, watching Youtube movies, listening to online music, calling friends using Tango or imo, etc) than using conventional methods (e.g., using USB drive, watching movies on DVD, or normal telephone calls).</li> <li>2. I frequently use online SaaS Cloud Computing services for my work/academic studies (e.g., uploading my data/accessing e-mail, sharing files on Facebook, opening Pdf files online, watching Youtube, etc.).</li> <li>3. I believe that I could tell others the advantage of using SaaS Cloud Computing services in my academic study/work.</li> <li>4. I would have no difficulty explaining why SaaS Cloud Computing services may or may not be beneficial.</li> </ol>	(Ajjan & Hartshorne, 2008; Davis, 1989; H. F. Lin, 2007) 0.85-0.89
Behaviour Intention (BI)/ 4 items	<ol style="list-style-type: none"> <li>5. I Intend to continue using SaaS Cloud Computing online services in my work /academic studies.</li> <li>6. I will strongly recommend online services from SaaS Cloud Computing providers to others.</li> <li>7. I plan to continue using SaaS Cloud Computing services frequently this term and onward.</li> <li>8. Assuming that I have access to Internet, I intend to continue using SaaS Cloud Computing services.</li> </ol>	(Davis, 1989; Lin, 2007) 0.82- 0.97
Attitude (ATT)/ 4 items	<ol style="list-style-type: none"> <li>9. Using the SaaS Cloud Computing services is a good idea.</li> <li>10. Using SaaS Cloud Computing services is a wise idea.</li> <li>11. I like the idea of using the SaaS Cloud Computing services.</li> <li>12. Using SaaS Cloud Computing online services is beneneficail to my academic studiesa/work.</li> </ol>	(H. F. Lin, 2007; Taylor & Todd, 1995) and (Mohammadi, 2015) 0.83-0.94
Compatibility (COM)/ 4 items	<ol style="list-style-type: none"> <li>13. Using SaaS Cloud Computing services will fit well with the way I work and my lifestyle.</li> <li>14. Using SaaS Cloud Computing services fits well with my academic needs and values.</li> <li>15. SaaS Cloud Computing services and applications are compatible with my preferred work practices.</li> </ol>	(H. F. Lin, 2007; Taylor & Todd, 1995) 0.86

Table 4.2 continued

Perceived Ease of Use (PEU)/ 4 items	16. SaaS Cloud Computing services are compatible with our culture and values in protecting nature, decrease power consumption, reduce CO <sub>2</sub> .	
	17. It would be easy for me to become skilled at using online SaaS Cloud Computing services (e.g., access webmail, share files in WhatsApp or Facebook, open Pdf file online on web browser, etc.)	(H. F. Lin, 2007; Ramayah et al., 2009; Taylor & Todd, 1995; Venkatesh & Davis, 2000)
	18. Learning to use online SaaS Cloud Computing services is easy for me.	0.86-0.98
	19. I would find the online SaaS Cloud Computing services easy to use.	
Perceived usefulness (PU)/ 4 items	20. Using SaaS Cloud Computing online services is clear and understandable.	
	21. Using online SaaS Cloud Computing services would facilitate in achieving my duties in work/academic studies.	(Taylor & Todd, 1995; Venkatesh & Davis, 2000)
	22. Using online SaaS Cloud Computing services would provide access to useful academic information.	0.87-0.98
	23. Using online SaaS Cloud Computing services would save my time when working with electronic information (e.g., reading online, downloading articles).	
Triability (TRI)/4 items	24. Using SaaS Cloud Computing online services increases productivity by accessing my data anytime and anywhere.	
	25. Before deciding on whether or not to accept the various SaaS Cloud Computing applications, I would need to use it on a trial basis.	(Moore & Benbasat, 1991; Y. Park & Chen, 2007)
	26. Before deciding on whether or not to use or adopt any SaaS Cloud Computing applications (e.g., Dropbox), I would need to properly try it out.	0.71-0.85
	27. SaaS Cloud Computing online services were adequately available to me to test or try various applications.	
User Security Predisposition (USecP): This construct composed of two dimensions as follows: 1- Trust (TRT)/ 4 items	28. There are enough people in my university to help me try the various uses of SaaS Cloud Computing services (e.g. Google Drive).	
	29. I would trust SaaS Cloud Computing provider to offer secure transaction to access my data (e.g., access my e-mail, my files on Microsoft OneDrive).	(Bélanger & Carter, 2008; Koenig-lewis et al., 2009)
	30. I would trust SaaS Cloud Computing provider to provide me online services to help in conducting my work/academic studies on the web.	0.81
	31. I would trust my SaaS Cloud Computing provider to provide secure data connections using strong security codes to conduct my transactions over the Internet.	

Table 4.2 continued

	32. I feel confident that legal and technological aspects of SaaS Cloud Computing provider are adequate to protect my data.	
2- Perceived Credibility (CRD)/ 4 items	33. Using SaaS Cloud Computing applications & services would not disclose my personal information.	(Amin, 2008; Y. Wang et al., 2003)
	34. I would find SaaS Cloud Computing services secure in conducting my transactions and working with online applications provided from SaaS Cloud Computing providers.	0.79-0.95
	35. I trust in the ability of SaaS Cloud Computing services provider (e.g., Google) to protect my privacy.	
	36. SaaS Cloud Computing services are really secure to use in my work/academic research.	
Subjective Norms (SN)/ 4 items	37. People who influence my behavior would think that I should use SaaS Cloud Computing services.	(Mohammadi, 2015; Taylor & Todd, 1995)
	38. People who are important to me would think that I should use SaaS Cloud Computing services.	0.88-0.94
	39. People who are important to me would recommend using SaaS Cloud Computing online services.	
	40. People who are important to me would find using SaaS Cloud Computing online services beneficial and practical.	
1. SNPI- Peer Influence / 4 items	41. My friends would think that I should use the SaaS Cloud Computing services. My friends would think that I should use the SaaS Cloud Computing service.	(Taylor & Todd, 1995)
	42. I want to do what my classmates/colleagues think I should do.	0.80
	43. My classmates/ colleagues recommend that I should use SaaS Cloud Computing services.	
	44. Colleagues/Classmates who are important to me would think that I should use SaaS Cloud Computing services in my academic studies/work.	
2. SNSI- Superior Influence/ 4 items	45. I will have to use SaaS Cloud Computing services and applications because my professors/supervisors require it.	(Taylor & Todd, 1995)
	46. Generally speaking, I want to do what my professors/supervisors think I should do.	0.80
	47. My professors/supervisors would think that I should use SaaS Cloud Computing services and applications. I will have to use SaaS Cloud Computing services and applications because my professors/supervisors require it.	
	48. I would be able to use SaaS Cloud Computing services and applications.	

Table 4.2 continued

Perceived Behaviour Control (PBC) / 4 items	49. I would be able to use SaaS Cloud Computing services and applications. 50. Using SaaS Cloud Computing services (e.g., storing files on the web) is entirely within my control and capability. 51. I have the resources and the ability to use SaaS Cloud Computing services. 52. I have the knowledge to use SaaS Cloud Computing services.	(Fang & Shih, 2004; Taylor & Todd, 1995) 0.70-0.86
1.PBCSE- Self-Efficacy / 4 items	53. I would feel comfortable using SaaS Cloud Computing services. 54. I could easily use SaaS Cloud Computing services on my own. 55. I know enough to use SaaS Cloud Computing services. 56. It is important to me to use SaaS Cloud Computing services, even if there is no one around to show me how to use it.	(Ajjan & Hartshorne, 2008; Zolait, 2014) 0.82-0.95
2.PBCFC- Facilitating Conditions / 4 items	57. I have the Internet equipment (modems, ADSL, Wi-Fi accessibility etc.) required to use online SaaS Cloud Computing services. 58. I have the time to use online SaaS Cloud Computing services. 59. I have enough money to buy the hardware (e.g., Tablet, Smartphone, Laptop) to access and use online SaaS Cloud Computing applications and services. 60. It is important to be able to use SaaS Cloud Computing services when I need it.	(H. F. Lin, 2007; Taylor & Todd, 1995; Zolait, 2014) 0.70-0.80
Educational Level (ED) / 1 item	1. Certificate 2. Diploma 3. Bachelor 4. Master 5. PhD.	

## 4.5 Operational Definitions of Terms

The following Table 4.3 presents the operational definitions of the latent constructs used in this study and based on literature review.

Table 4.3

### *Latent Constructs and Their Definition from Literature*

Latent Construct Name	Definition
Acceptance and Usage of SaaS Cloud Computing (ADP):	“A decision to make full use of an innovation as the best course of action available“ (Rogers, 1983, p. 172). In the theory of reasoned action (TRA), the behavior is defined as, “a function of salient information, or beliefs, relevant to the behavior” (Ajzen & Madden, 1986, p. 455).
Behavior Intention (BI)	“The degree to which a person has formulated conscious plans to perform or not perform some specified future behavior.” (Warshaw & Davis, 1985, p. 214). And “the degree to which a student has formulated conscious plans to use or not use cloud services in the future “ (Arpaci et al., 2015, p. 94).
Attitude (ATT)	“The degree to which a person has a favorable or unfavorable evaluation of the behavior in question.” (Ajzen & Madden, 1986, p. 454). Also, (Bagozzi, 1992, p. 2) in line with the above defines attitude as, “expressing the degree of favorability/unfavorability felt by the person in relation to that act or object”.
Compatibility (COM)	Rogers gave more self-explained definition for Compatibility as, “the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters” (Rogers, 1983, p. 224).
Perceived Ease of Use (PEU)	“The degree to which a person believes that using a particular system would be free of effort.” (Davis, 1989, p. 320) and he added, “this follows from the definition of ease: freedom from difficulty or great effort”
Perceived usefulness (PU)	Rogers (1983) definition of PU (or relative advantage as it is called in DOI), as “the degree to which an innovation is perceived as better than the idea it supersedes”. Also another definition, “the degree to which a person believes that using a particular system would enhance his or her job performance.this follows from the definition of the word useful: capable of being used advantageously" (Davis, 1989, p. 320).
Trialability (TRI)	“The degree to which an innovation may be experimented on a limited basis“ (Rogers, 1983, p. 231).
Trust (TRT)	“The willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party. This definition of trust is applicable to a relationship with another identifiable party who is perceived to act and react with volition toward the trustor“ (Mayer et al., 1995, p. 712).

Table 4.3 continued

Also, “the subjective probability with which consumers believe that a particular transaction will occur in a manner consistent with their confident expectations” (Chellappa & Pavlou, 2002, p. 360).

Perceived Credibility (CRD)	“The degree in which a potential user believes that the service will be free of security and privacy threats” (Koenig-lewis et al., 2009, p. 415). Also, it is defined as, “users’ perception of protection of their transaction details and personal data against unauthorized access” (Aderonke & Charles, 2010, p. 6). And, “the extent to which the retailer believes that the vendor has the required expertise to perform the job effectively and reliably” (Ganesan, 1994, p. 3).
Subjective Norms (SN)	”The perception that the significant referent desire the individual to perform a behavior or not” (Taylor & Todd, 1995, p. 149). “Specific individuals expect one to perform or not to perform the behavior combined with one’s motivation to comply with these specific individuals” (Bagozzi, 1992, p. 180).
Perceived Behavior Control (PBC)	“The perceived ease or difficulty of performing the behavior and it is assumed to reflect past experience as well as anticipated impediments and obstacles”(Ajzen, 1991, p. 188)
Educational Level (ED)	Refers to the differences of the academic attainment among individuals in the higher education, students and academic staff, and the currently already certificate achieved and not expected.

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## 4.6 Popolation of Study and Sampling procedures

### 4.6.1 Targeted population or Sample Frame

Population is defined as, “the entire group of people, events, or things of interest that the researcher wishes to investigate” (Sekaran, 2003, p. 256). Another view is given by Creswell (2012, p. 142), who defines population as it, “is a group of individuals who have the same characteristic.” Starting from here, in the HE institutes the study is mainly focusing on individuals of the students and academic staff that make up the population of the HE institutes. The population might be small or large in research. In this study, the researcher aims to study the individuals in HE public institutes in Northern Malaysia, which is quite large and reach over one hundred thousand of targeted respondents.

In quantitative research, population is represented by the sampling frame or targeted population that is defined as, “a group of individuals (or a group of organizations) with



some common defining characteristic that the researcher can identify and Study” (Creswell, 2012, p. 142). Also, Sekaran (2003, p. 256) gave definition of the sample frame as, ”a listing of all the elements in the population from which the sample is drawn.”

To explain more, the higher education institutes comprises of public, private, and other institutes under the supervision of HE authority. The population is the individual (i.e. student and academic staff) of higher education institutes in Malaysia, whereas the scope of the current study is taking the sampling frame of the individual of public HE institutes in the Northern part of Malaysia that comprises of four districts. The study, however, focuses on the main campuses of the major public Universities (i.e., UUM, UniMAP, USM, and UPSI), which aligns with the scope of the study.

#### **4.6.2 Sample and Unit of Sampling**

In practice, it is not logical and rationale to select each member of the targeted population; therefore, the need for sample in the targeted population is crucial. The sample is defined as, “a subgroup of the target population that the researcher plans to study for generalizing about the target population” (Creswell, 2012, p. 142). A sample is a representative of the whole population under investigation and is a subset of the population. In other words, “It comprises some members selected from it (i.e., some not all elements of the population)” (Sekaran, 2003, p. 266). For these reasons, the researcher study the sample to draw conclusion that can be generalized to the whole population under investigation (Sekaran, 2003).

In the current study, the population is the individual of HE institutes (students and academic staff), this population comprises of universities of the public, private,

community colleges, and polytechnic., and the sample frame or targeted population is selected to be of the main campuses of the four main public universities in the Northern Malaysia. The population is divided into three clusters, namely: the south, the middle, and the north part of Malaysian Peninsula. One cluster is chosen to be investigated, i.e. the northern part of Malaysia, which consists of four districts. The sample considering four main campuses public Universities (i.e., UUM, UniMAP, USM, and UPSI).

It is noteworthy, these four Universities have different specialization in their field of study ranging from: Engineering, Business, Sciences, to Education (i.e., UUM, UniMAP, USM, and UPSI). These variety of fields of study in each University make the perceptions vary among different students and academic staff that have different backgrounds. Therefore, the selection fall on these main campuses to gain better insight of the individuals. Besides, the estimated population of those four Universities, is 103,268 (students enrolled and academic staff) according to a report from the HE official website (Ministry of Higher Education, 2015). Refer to Table 4.4 for details.

Table 4.4

*Statistics of Public Universities' Population in Northern Districts of Malaysian Peninsula*

University	District	Enrolled Student	Academic Staff	Total number
UUM	Kedah	30,837	1,492	32,329
USM	Pulau Pinang	29,065	1,956	31,021
UPSI	Perak	27,659	827	28,486
UniMAP	Perlis	10,415	1,017	11,432
Total		97,976	5,292	103,268

*Source:* (Ministry of Education Malaysia, 2015)

More importantly, the selection fall on North part of Malaysia for sampling is based on the notion that Malaysia is a multi-ethnic and multi-cultural country that can present many of the cultures in Asia (Thien, Thurasamy, & Abd Razak, 2014). More importantly, the culture values have an influence on how the people think and behave when it comes to the introduction of an innovative new technology such as SaaS Cloud Computing (Choi, Lee, Sajjad, & Lee, 2014).

Furthermore, Thien et al. (2014) demonstrated the three dominant ethnic groups in Malaysia that consists of Malay, Chinese, and Indians in which they have distinguished cultures, languages, beliefs, religions and values. This unique differences influence the perceptions of these groups and assure the importance of this variety of differences that are based on Hofstede's cultural values (Thien et al., 2014). This view is, also, in line with Cohen (2007) in which he pointed out the role of culture in influencing a specific behavior and commitment within the same country.

More importantly, Universities are the source of imparting the knowledge and technological skills for the community it resides in and are a microcosm that encompasses diversity of cultures and social groups (Sabi et al., 2016). Therefore, when studying the usage, acceptance, or adoption of SaaS Cloud Computing inside the Universities, we are actually studying the variety of the community sample that is representative of the society of the Malaysian context. Therefore, these reasons trigger the researcher to explore further in HE sectors and propose it as the context of research.

#### **4.6.3 Sampling Procedures**

Sampling is divided into two types, namely: probability sampling and non-probability sampling. The probability sampling is most rigorous way of sampling in quantitative

research as the sample is representative of the population under study and therefore can be generalized (Creswell, 2012). The generalization is the goal of positivists in conducting their research, so probability sampling lies on the heart of it. Besides, the probability sampling can be defined with four forms, namely: Simple Random Sampling, Systematic Sampling, Cluster Sampling, and Stratified Sampling (Creswell, 2012). The Simple Random Sampling is widely used in research and is a very strict form of the probability sampling in that each unit of sampling, “has an equal probability of being selected from the population” (Creswell, 2012, p. 143), is representative of population, and if any bias exists it would be equally distributed among respondents.

Systematic probability sampling, however, is defined as, “sampling design (that) involves drawing every  $n$ th element in the population starting with a randomly chosen element between 1 and  $n$ . “ (Sekaran, 2003, p. 271). This type of sampling is adopted in this research to sample the elements (subjects, respondents, or unit of analysis) in the final stage of the sampling process.

Furthermore, cluster sampling, on the other hand, is dividing the large population into groups with diverse characteristics within groups and common characteristics among these groups. The definition of cluster sampling is that, “Groups or chunks of elements that, ideally, would have heterogeneity among the members within each group are chosen for study in cluster sampling” (Sekaran, 2003, p. 274). In this study, the researcher assumes that heterogeneity resides in the different three parts of the Malaysian Peninsula based on the geographical location, and homogeneity among them as the respondents are from the HE sector. Moreover, the cluster sampling can

be either single stage (Sekaran, 2003) or multiple stage (Creswell, 2012; Sekaran, 2003).

In principle, in this current research, the researcher adopts the multi-stage probability sampling that is given by Sekaran (2003, p. 275) as in the following example, “if we were to do a national survey of the average monthly bank deposits, cluster sampling would first be used to select the urban, semi-urban, and rural geographical locations for study. At the next stage, particular areas in each of these locations would be chosen. At the third stage, banks within each area would be chosen”. The study uses this three-stage cluster sampling strategy in the higher level of sampling of the study, where Malaysian Peninsula is divided into three geographical locations (i.e., Northern, Middle, and Southern part) accordingly. The next step is selecting the Northern part of the Malaysian Peninsula for the study. After that, this cluster is divided into four smaller areas or clusters (districts or counties i.e., Kedah, Perlis, Penang, and Perak). Finally, the individuals at the four Public Universities selected in every cluster will be sampled. The estimated population in HE in the Northern Part of Malaysia, in the public sector, is quoted according to a report from the Ministry of Higher Education official website (Ministry of Higher Education, 2014). The following Table 4.5 depicts the districts with the selected Universities and estimated population.

Table 4.5

*Public Universities' Population in Northern Districts of Malaysian Peninsula*

University	District	Enrolled Student	Academic Staff	Total number	Percentage from total Population
UUM	Kedah	30,837	1,492	32,329	31.3%
USM	Pulau Pinang	29,065	1,956	31,021	30%
UPSI	Perak	27,659	827	28,486	27.6%
UniMAP	Perlis	10,415	1,017	11,432	11.1%
Total		97,976	5,292	103,268	100%

On the other hand, stratified sampling is a probability sampling in which the population is stratified or divided into chunks or strata (the single is one stratum) based on specific characteristic. Sekaran (2003, p. 256) asserts that stratified sampling is more efficient than the simple random sampling as, “each important segment of the population is better represented, and more valuable and differentiated information is obtained with respect to each group.” He also explains that it suits different scenarios to be used and the population can be stratified according to size of company or geographical area, gender, age or segments, even with different combinations of the aforementioned. In this study, the researcher follows this strategy where the four public Universities in Northern Malaysia cluster differing in terms of size and geographical area location.

Moreover, the stratified sampling can be proportionate (i.e., the stratum is a percentage of the total population; that is, to take this percentage from the sample size) or disproportionate (i.e., if the researcher finds that the proportion is not suitable to give the correct representation of the sample, he can retain the sample size but uses different proportions than product of the stratum size over the population) (Sekaran, 2003) .

In this study, the Universities have different number of respondents; that is to say, the size of population in each university differs from each other. Some have large numbers

of subjects that are aimed to be studied in this research such as UUM, while others have much less respondents such as UniMAP, refer to Table 4.5 for more details. Creswell (2012) notify that if there is imbalance on a characteristic of the sample, this method is suitable. Accordingly, the selection of proportionate stratified sampling is the second stage of sampling, after clustering phase, and is suitable in this study to give equal probability for each element to be equally having chance to be selected (Neuman, 2007). In principle, Neuman (2007) calls this procedure, “Probability Proportionate to Size” or PPS.

In addition of using the stratified sampling, Sekaran (2003) recommends to use systematic sampling (every  $n^{\text{th}}$  number of the respondents) or random sampling in the later stage of the stratifying sampling when testing the subjects or unit of analysis. Here, the systematic random sampling is proposed for the final sampling procedures in this study in which every  $n^{\text{th}}$  respondent, in each stratum (i.e., university), in the corresponding cluster (i.e., each district or county).

To summarize, and based on the foregoing argumentation, in this study population is divided into three geographical clusters and one cluster is chosen, Northern part of Malaysian Peninsula that has four districts (each is representing a cluster). The four main-campus public universities were chosen, i.e. one in each cluster. However, the number of individuals that are aimed to be investigated in each university differs from each other that made the researcher to propose the stratified probability sampling for the different sizes of Universities, based on the above recommendations and literature review. Using proportionate stratified sampling or (PPS) to represent each university, with percentage of the total population to have equal chance for each element to be selected in the final sampling process, is postulated in the current study. And finally,

the unit of analysis, (element, subject, or respondent), is sampled using systematic probability sampling. Thus, the study is aiming to use complex multistage cluster sampling, stratified proportionate sampling, and finally, on its last stage for testing respondents (i.e. individuals of students and lecturers) it uses systematic random sampling.

#### **4.6.4 Sample Size and Power Analysis**

In order to study a certain phenomenon in a population, it is important to take sample frame that has a sample size from that population that represent the characteristics of the entire population. The larger the sample size, the better to obtain good statistical results as there will be less sampling error (Creswell, 2012). Additionally, Creswell (2012) explains different aspects regarding the sample size as follows: Firstly, there can be cases in which the number of respondents are limited and available to the study. Secondly, the financial issues and physical access to participants, and the size of population affect the sample size. Lastly, the number of variables in the study is important factor in determining the sample size of the targeted group under study and the statistical procedure that you are going to follow in your analysis.

Also, there are tables that can be referred to find the sample sizes according to population. Another method is to use formulas (e.g., sampling error formula and power analysis formula) that facilitates the calculation of the sample size taking into account factors such as confidence in statistical test and sampling error (Creswell, 2012). For example, one formula stated by Creswell (2012) is the sampling error formula to determine the sample size based on the proportion of the sample that the sample will be divided among the questions (alpha values of .05 or .1), the sample error (i.e., the difference between the sample mean and population mean) that researcher can tolerate



(usually 4% or 6%), and the confidence interval (i.e., the upper and lower values that likely to contain actual population mean for example 95% evenly). On the other hand, Roscoe (1975), as cited in Sekaran (2003), suggested the following:

- Firstly, for most research the accepted sample size is between 30 to 500.
- Secondly, for sample size with subcategories, each category has to have at least 30 samples.
- Finally, in multivariate research, the sample size is recommended to be 10 times the number of constructs.

Nonetheless, and according to Krejcie and Morgan (1970), the relationship between the sample size and the population increases together until a certain level, then it starts to remain relatively constant more than 380 cases. Hence, it should be noted that as the population increases, the sample size increases at a diminishing rate and remains relatively constant at slightly more than 380 cases. Also, Krejcie and Morgan (1970) quote the formula from the research division of the National Education Association that aims to help in finding the sample size and produced a table based on Equation 4.1 as follows:

$$S = \frac{X^2 N P (1-P)}{d^2 N (N-1) + X^2 P (1-P)} \quad (4.1)$$

Where:  $X^2$  = value of chi-square for 1 degree of freedom at the desired confidence level ( $1.96 \times 1.96 = 3.841$ ),  $N$  = the population size,  $P$  = the population proportion (assumed to be .50 to give the maximum sample size), and  $d$  = the degree of accuracy expressed as a proportion (.05).

The total population in the context of this study is estimated to be (N = 103,268) respondents. By applying the equation above to get the required sample size, we find:

$$S = \frac{X^2 N P (1-P)}{d^2 N (N-1) + X^2 P (1-P)} = \frac{(3.841) * (103,268) * (0.5) * (1-.50)}{(.05)^2 (103,286) * (103,286-1) + (3.841) * (0.50) (1-.50)} = 0.003719.$$

The product of this equation is multiplied by the population N and that yields the sample size as follows: 103,286 x 0.003719 = 384, which denotes the sample size. The following table in Figure 4.5 delineate the population (N) and the corresponding sample size in which the previous result is easily obtained from the table without returning to the equation.

S	N	S	N	S	N	S	N	S	N
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	246
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	351
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	181	1200	291	6000	361
45	40	180	118	400	196	1300	297	7000	364
50	44	190	123	420	201	1400	302	8000	367
55	48	200	127	440	205	1500	306	9000	368
60	52	210	132	460	210	1600	310	10000	373
65	56	220	136	480	214	1700	313	15000	375
70	59	230	140	500	217	1800	317	20000	377
75	63	240	144	550	225	1900	320	30000	379
80	66	250	148	600	234	2000	322	40000	380
85	70	260	152	650	242	2200	327	50000	381
90	73	270	155	700	248	2400	331	75000	382
95	76	270	159	750	256	2600	335	100000	384

Figure 4.5. Population and sample size

Source: Krejcie and Morgan (1970)

From the above argumentation, the researcher assumes a sample size of 384 respondents as a minimum sample size of the study but takes into account collecting more responses (Pallant, 2011; Tabachnick & Fidell, 2013) as to ensure that the targeted sample size is fulfilled, to assure the achievement of the minimum response of the sample, and to better obtain good statistical results as there will be less sampling error (Creswell, 2012; Sekaran, 2003). Table 4.6 summarizes the above.

Table 4.6

*Statistics of Public Universities' Population in Northern Districts of Malaysian Peninsula*

University	District	Total number	Percentage from total Population	Sample size
UUM	Kedah	32,329	0.313	120
USM	Pulau Pinang	31,021	0.300	115
UPSI	Perak	28,486	0.276	106
UniMAP	Perlis	11,432	0.111	43
Total		103,268	100%	384

#### 4.6.5 Data Collection

Methods of collecting data with two main categories and each of which have sub-categories, can be identified as follows: Firstly, self-administered (Internet/intranet-mediated questionnaire, postal questionnaire, and delivery and collection questionnaires). Secondly, interviewer-administered (telephone questionnaire and structured questionnaire or face-to-face) (Saunders, Lewis, & Thornhill, 2009).

In principle, the decision to embrace the best method is rather difficult as each of which has its own pros and cons; however, there are some factors that are listed by Saunders et al. (2009) that should be considered: The characteristics of respondents, importance to reach specific respondent, their clear answers, size of sample, response rate, and finally types and number of questions to be collected.

On the other hand, the interviewer-administered and self-administered questionnaires can have better control in this regard and increase the reliability of data (Saunders et al., 2009). Additionally, Saunders et al. (2009) state that other reasons can affect the choice of questionnaire such as the available resources, namely: time to conduct and collect the data, financial issues, availability of assistance, and ease of entering data collected.

The following paragraphs describes briefly the pros and cons of some methods used in the academia that facilitated the work of the current research. Figure 4.6 shows the self-administered questionnaires methods that are explained briefly in the following paragraphs.

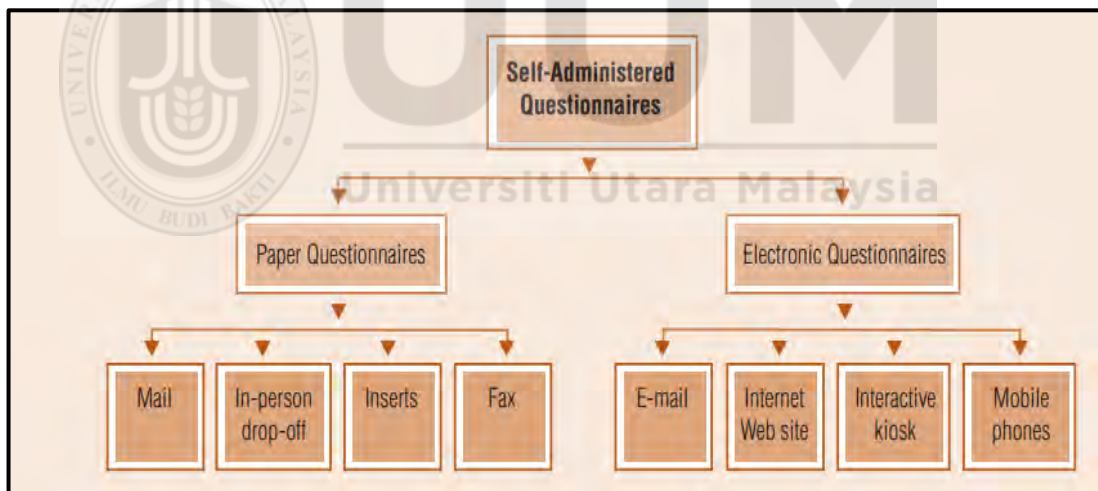


Figure 4.6. Self-administered questionnaire

Source: Zikmund et al. (2010)

On the other hand, Zikmund et al. (2010) have classified the self-administered questionnaire into two major categories, namely: The Paper Questionnaire (e.g., Mail, In-Person drop-off, Inserts, Fax) and the Electronic Questionnaires (e.g., E-mail, Internet Website, Interactive Kiosk, and Mobile phones), as depicted in Figure 4.6.

They state that the Self-administered questionnaires basically depend on the wording of questionnaire rather than the skills of the interviewer. The major focus on this study lies on the In-Person drop-off paper questionnaire, and Electronic questionnaires (i.e., E-mails, Internet Websites represented by Google Forum, and Mobile phones). In this regard, E-mail surveys have different advantages such as: distribution speed, lower cost than normal mail distribution- that uses paper and postal cost-, less time, and flexibility (Zikmund et al., 2010).

However, the disadvantages can be said as the security issues (such as lack of anonymity if the e-mails are under control of the managements of the organization), the possibility of deleting the emails if they are directed to many respondents, and finally the covering letter and the questionnaire can be annoying if they both are contained in the same e-mail with long questionnaire (Zikmund et al., 2010). Additionally, recommendation of the questionnaire are as follows: Covering letter should be short and the purpose of it and how the name of the respondent is obtained is mentioned, and finally, the questionnaire should be short. Moreover, the e-mail used has a covering letter with a link to a specific site (Zikmund et al., 2010).

An Internet survey is another method of self-administered questionnaire in which the questionnaire is displayed on a Website that enables answering by: selecting one/multiple options of the question (e.g., drop down menu, click on an option, tick on one or multiple option, etc.) or typing some information in a reserved space. The advantages of the internet survey can be said to include the following: large audience can be reached, cost effective with confidentiality, real time response and reporting, a prompt when one question is skipped, and less time compared with other self-administered methods (Zikmund et al., 2010). On the other hand, the disadvantage may

be faced when the respondents do not see any incentive or motivation to participate. This can be avoided by sending personal invitation to the respondents, with clear subject line and motivates the respondents to participate, proper design of the Webpage, and a kind reminder when necessary to increase response rate (Zikmund et al., 2010).

Moreover, using Mobile phone as a means of a survey is a new way that can give new horizons to self-administered questionnaires in which the questionnaire can be sent in a form of SMS (Short Message Service) or MMS (Multimedia Message Service) to reach respondents (Zikmund et al., 2010). In this method, the questionnaire is sent as a link of a Website or directly appears on the screen of the respondent in which they can answer directly using social networks such as Facebook or WhatsApp application on their mobile devices. This is a convenient way to be given to the respondents to answer when they access their social applications and submit the answers immediately.

Finally, the Self-administered drop off questionnaire is used when there are large number of questions needed to be answered and these questionnaires should be distributed by traveling to the location of the respondents and then to be collected afterwards, which may cause additional cost for travel and printing materials. Zikmund et al. (2010) state that it is possible to combine two or more of these methods to conduct the self-administered questionnaire. In this research, the researcher conducted the following:

Firstly, the Self-administered Electronic-questionnaire (i.e., using e-mail/mobile phones, WhatsApp application/Internet webpage survey/social networks such as Facebook Universities' groups) used to send the invitation to urge respondents to

participate, with a link to an Internet Google Website. Secondly, as a precaution, the drop-off method is used with hard-copy of the questionnaire. Besides, a motivation to participate combined with an explanation of the nature of the questionnaire in face-to-face manner is given. Additionally, a gift is offered in a lucky-draw.

In principle, Internet has the advantage to save cost, time, reduction of printing materials, and a fast way to send the questions through a link to smart devices or computers (Dillman & Smyth, 2007), while obtaining the responses electronically and easy to follow the responses online (e.g., Google forms). Further, the HE academic environment facilitated the access to Internet for students and academics; thus, the Internet is an invaluable source for conducting research (Couper, 2000). Most importantly, the researcher took into consideration the skills of the respondents to use the Internet and having the access to it.

Moreover, the drop-off survey is used if the number of responses is not reaching the expected results to conduct the research. This method has the advantage of flexibility to deliver the questionnaires to respondents by hand and achieving the face-to-face interaction; that is to say, urging the respondents to answer promptly, directly giving the questionnaires, and getting the answers on a short time in most cases (Cooper & Schindler, 2014). The advantage of drop-off is that the response rate is of 70% and its cost per completed questionnaire is 18-40% lesser than in normal mail surveys (Cooper & Schindler, 2014). In sum, the electronic version and the hard copy methods used to enrich the possibilities of gaining sufficient number of responses.

## **4.7 Data Analysis Technique**

Partial Least Squares Structural Equation Modeling (PLS-SEM) is a second-generation statistical method that emerged on the early 1990s. It is also known as Variance Based Modeling that has family of software such as: Smart PLS 2.0 M3, PLS GUI, and PLS GRAPH. Hair et al. (2014) delineated the features of PLS-SEM that are classified as follows: Data characteristics, Model Characteristics, Algorithm Properties, and model evaluation issues.

### **4.7.1 Data Characteristics**

Smart PLS 3.0 and 2.0 M3 can deal well with small sizes, adds more precision with large sizes, and has high level of statistical power (Hair et al., 2017). A more important thing to be focused upon, Smart PLS is a nonparametric method that has no issues related to data distribution and normality issues (Gupta et al., 2013; Yeh, Chuan-Chuan Lin, & Lu, 2011). Moreover, Smart PLS is robust against missing data. Additionally, it uses different scales ranging from metric, ordinal data, binary coded variables, and dummy variables (Hair et al., 2017).

### **4.7.2 Model Characteristics**

Firstly, Smart PLS can deal well with single item construct or multi-item construct in formative or reflective models. Secondly, it works effectively with complex models with many relationships, and reduces bias when having large number of indicators in constructs (Hair et al., 2014, 2017).



### 4.7.3 Algorithm Properties

One important advantage of Smart PLS is the maximization of  $R^2$  values. In that way, it minimizes the unexplained variance of the model. Further, it is efficient with large data sets and have a high level of statistical power (Hair et. al., 2017). Lastly, constructs' scores estimated as liner, used for prediction purposes, and can be an input for later analysis.

### 4.7.4 Model Evaluation

For the evaluation purposes of the measurement model, the reflective models are assessed for their validity and reliability with different criteria. Also, the formative models are assessed for their validity, indicators' weights, and collinearity. However, in the structural model there are different assessments: collinearity among constructs, significance of path coefficients,  $R^2$ , effect size  $f^2$ , predictive relevance  $Q^2$  and its effect size  $q^2$  (Hair et al., 2014, 2017). Moreover, other additional featured tests that can be obtained from the usage of Smart PLS 2.0 and 3.0 can be summarized as: Interaction (moderating and mediating effects), Multi-group analysis, Hierarchal component models, measurement model invariance, uncovering and treating unobserved heterogeneity, and finally important performance matrix analysis (Hair et al., 2014, 2017).

On the other hand, there are other path modeling techniques used in literature (e.g., AMOS; Analysis of Moment Structures) that are referred to as CB-SEM (Covariance Based-Structural Equation Model); however, the Smart PLS 3.0 software (i.e. PLS\_SEM) is used in the current study as the analytical tool for its features of user friendly interface and easy to use tools to create moderating effects for path model

with interaction effects (Temme, Kreis, & Hildebrandt, 2006, 2010) and well-suited in a complex theory based model, as is the case of the current study.

Furthermore, there are different features in SmartPLS, which are listed as follows: Firstly, it is independent of the operating system as it is a Java-based program, providing structural model by drawing the latent variables and then assign indicators (items) to them. Secondly, it has different outputs as: parameterized path model, HTML, Excel or Latex formats. Lastly, the special feature is the finite mixture routine (FIMIX) that its importance lay when unobserved heterogeneity is expected in data and needed to be examined.

The present research is aiming to investigate the underlying prominent factors that lead to the usage and adoption of SaaS Cloud Computing using integrative model. This research is prediction-oriented in nature (exploratory) and has extension to existing theories. Moreover, Chin (1998) suggests to use PLS-SEM to either in theory development or theory confirmation.

In theory development, PLS-SEM is used to develop propositions by exploring the different relationship between different latent constructs. In line with this argumentation, Urbach and Ahlemann (2010) recommend to use PLS-SEM as statistical technique to test models. Besides, Hair et. al. (2017) recommends using Smart PLS 3.0 (PLS-SEM) in explorative research. Last but not least, the model postulated in this study, is rather complex and has many relations that need to be investigated; thus, the choice fall on Smart PLS 3.0 as it is recommended in complex structural models (Gupta et al., 2013).

To facilitate data analysis and achieve the objectives of the study, the researcher intends to use three statistical analysis tools namely: SPSS 21 and Smart PLS version 3.0, Microsoft Excel 2013 as well. The initial phase is to use Excel and SPSS version 21 (i.e., the demographic descriptive analysis, outliers' analysis, normality tests, and cross-tab analysis), and in the later phase is to proceed with the model estimation after exporting the file to be used in Smart PLS 3.0. It is noteworthy to highlight that Smart PLS 2.0 M3 uses two main theories (Hair et al., 2014, 2017):

- **Measurement Model theory:**

- Firstly, the internal consistency reliability where composite reliability of latent constructs should be  $> 0.708$  (in exploratory research 0.6 or 0.7 is acceptable) (Hair et al., 2014, 2017). Also, assessing Cronbach's alpha is a conservative measure in this stage of evaluation, which is in the range 0.6 - 0.9 (Hair et al., 2014, 2017).
- Secondly, indicator reliability where the outer loadings of the indicators should be  $\geq .708$  (less than that, the indicator can be deleted if it leads to an increase of composite reliability and/or AVE).
- Thirdly, convergent validity where the average variance extracted should (AVE) be  $\geq 0.5$  of the measures associated with the constructs; and finally the discriminant validity, which has three evaluation procedures (Hair et al., 2014, 2017): First, the outer loadings of the indicator should be higher than all its cross loadings with other constructs in the model (Cross-Loadings assessment); and secondly, the square root of the average variance extracted for each construct should be higher than its highest correlation with other constructs

(Fornell-Larker Criterion). Finally, Heterotrait-Monotrait ratio (HTMT should not contain 1 in its range) is assessed by means of bootstrapping in the final data collected.

In the measurement model assessment, also, the  $R^2$  values of the endogenous constructs, or the predictive power of the model, are assessed where values are described as substantial, moderate, or weak based on value of  $R^2$  (0.75, 0.50, or 0.25, respectively) (Hair et al., 2017). However, the more liberal criterion is used as a measurement in the current study where values of  $R^2$  (0.67, 0.33, or 0.19) are considered substantial, moderate, or weak, respectively (Chin, 1998).

After that, the assessment of the effect size ( $f^2$ ) is conducted to find out the contribution of each exogenous construct on the endogenous construct's  $R^2$  value where it is considered as having a small, medium, or large effect size according to the values of (0.01, 0.09 and 0.25, respectively) (Kenny, 2016). Following that, the predictive relevance of the Model is assessed by blindfolding procedure to obtain  $Q^2$  of the endogenous constructs. The model is considered to have a predictive validity if it has positive value of  $Q^2$  and above zero, and if it has negative value, the model is considered not having a predictive validity. Finally, Goodness of Fit (GoF) of the Model is not recommended to be used based on Hair et al., (2017).

▪ **Structural Model theory:**

- Firstly, the collinearity issues should be assessed for the structural model by examining the predictors' tolerance that should be  $> 0.20$  (or Variance Inflation Factor  $VIF < 5$ ).

- Secondly, the bootstrapping is used to measure the significance of the path coefficients (i.e., for hypotheses testing) and focus should be placed upon the critical values ( $t = 1.65$  at significance level = 0.10, or  $t = 1.96$  at significant level = 0.05,  $t = 2.57$  significant level = 0.01) for two tails hypothesis, and for the one tails hypothesis ( $t = 1.28$  at significance level = 0.10, or  $t = 1.65$  at significant level = 0.05,  $t = 2.33$  significant level = 0.01) (Hair et al., 2017).

#### **4.8 Pilot Study**

The study instrument underwent series of measures to ensure its appropriateness, clarity, content validity, comprehensiveness, and self-explanatory. The most important procedure in instrument preparation is the content validity. Content validity is defined as the degree to which an item is reflecting the content universe of a construct in which this construct will be, among other constructs, in an instrument that will be generalized (Straub, Boudreau, & Gefen, 2004).

To ensure the validity of the instrument used in the current study, series of verification procedures were performed. First of all, content validity was ensured through the established measurement from previously validated items obtained from literature review (with reliable scales in which each item/indicator has a reliability value 0.7 above), carefully checked meanings to reflect the respective construct, and changes made to suite the context of the study and its subject (Ahmed & Ward, 2016a; Stantchev, Colomo-Palacios, Soto-Acosta, & Misra, 2014). Then, the instrument underwent expert assessment and recommendations. Based on their feedback, the amendments were undertaking, and the content meanings were clarified. Noteworthy, re-checking the items is conducted to further assure their reliability in the context of

the study before finally deployed as recommended in literature (Hair, Money, Samouel, & Page, 2007).

After this initial stage, a pre-test was conducted with a small scale of the actual respondents, i.e. students and lecturers from two different Universities, namely: Universiti Utara Malaysia (UUM) and University Malaysia Perlis (UniMAP). More importantly, a pre-tested measure was conducted to double check the instrument appropriateness for the current study. So, it was sent to academics, experts in the area, specialists in the area, linguistic specialist, and questionnaire specialist. This group consisted of 10 academics, who checked the language, the content, the easiness of the questions, the wording, the length of each item, the presentation of the questionnaire, and the number of questions for each construct. Based on their comments, the amendments were made as follows: Some grammatical mistakes were eliminated, some sentences were rephrased or briefed, introductory sentence for a clearer instruction were added, and additional items were added from literature to have minimum of 4 questions in each construct (i.e., to avoid future analytical issues as recommended by questionnaire specialist Prof. Nic Qamariah). Their feedback and comments were taken into considerations and modifications took place with slight wording and explanation of some items as guided by literature (Ozturk et al., 2016).

It is noteworthy to mention that some pictures were added to facilitate the understanding of the SaaS Cloud Computing concept. After making the amendments, the questionnaire was rechecked by the experts again, and then, finally, it was forwarded to 3 Degree students from UniMAP, 3 PhD. Students from UUM, and 3 lecturers from UUM as well. This procedure is followed on performing pre-test to evaluate the final version of the pilot study and take different opinions of the sample

actual respondents on: the content, understanding, presentation of the online and hardcopy of the questionnaire, and time taken to answer it. The final questionnaire was released to be pilot-tested.

Following that, the pilot test stage was conducted from the categories of the same sample. The analysis is made to find out the internal reliability consistency, the construct validity, and the discriminant validity by using the statistical analysis program of Smart PLS M3, reports are presented at Appendix D of pilot tests. Based on the recommendations of Straub et al. (2004), the content validity was established by the different stages: the literature review, pre-test, pilot test, expert review, and empirical assessment by using Smart PLS rigorous analysis testing.

Above all, the recommendations of the examiners were taken into consideration and new items were added and one question wording was amended accordingly. Thus, and after all these series of validity steps, the final version of the instrument was released for the actual survey in two version, namely: the soft-copy and the paper-based copy questionnaires. These two versions are the final release of the instrument of the current study. In sum, this whole process is to confirm that each indicator is reliable and consistent with and relevant to its own construct and is suitable to be used in the survey as it is recommended by different scholars (Hair, Black, Babin, & Anderson, 2010).

#### **4.8.1 Results of the Pilot Study**

An electronic copy of the questionnaire in addition to the hardcopies were launched and distributed after the pre-test stage. Respondents from UniMAP and UUM participated in this pilot study. Noteworthy, recent recommendations of having relatively large sample of respondents in pilot study was adopted and based on various

recent literature such as Riefler, Diamantopoulos, and Siguaw (2012) that recommended the number of 100 questionnaires. Therefore, the pilot study conducted and analyzed using Smart PLS 2.0 M3 software to make sure of the internal consistency, reliability, and discriminant validity of the instrument.

The results revealed the confirmation of the constructs validity, internal consistency and reliability, as well as no discriminant validity issues were found, refer to Table D. 1, Table D. 2, and Table D. 3 at Appendix D for details. There was one exception for item TRI4 that has outer loadings less than 0.7. However, Hair et al. (2014) indicate that items with outer loadings in the range (0.4 - 0.7) can be removed if deleting increases CR or AVE above the recommended threshold. Otherwise, they are kept especially if removing them may affect the content validity of the construct. In the current case, CR and AVE were above the cut-off values, which is in line with above recommendation. Hence, TRI4 is kept for the actual questionnaire survey. Interestingly, in the final survey the loadings met the cut-off values. In sum, the instrument has been affirmed by the pilot study to be used in the actual questionnaire survey.

#### **4.9 Summary**

This chapter presented the research conceptual framework, the development of hypotheses, and given attention to the mediating and moderating effects assessment. Next, the research design explicated the scales, questionnaire structure, and research instruments used. Following that, the operational definitions were presented as well as the population related issues explained in detail, the sample frame, the unit of sampling, the sampling procedures, the sample size, the data analysis technique, and



finally, the data collection. In the last section, the pilot study was discussed, and the results highlighted.



## **CHAPTER FIVE**

### **DATA ANALYSIS AND RESULTS**

#### **5.1 Introduction**

This chapter presented the analysis of the data collected and the different phases of evaluating the model estimated with both the measurement model and the structural mode. In addition, the mediating and moderating effects were investigated carefully using the most rigorous methods of evaluating process with the most recent approaches used in Smart PLS 3.

Additionally, the multigroup analysis was conducted to find more insights on the differences between the students' group and the academic staff group on different relationships in the path towards the outcome of the study, i.e. AUSaaS. Noteworthy, the techniques of FIMIX and MICOM were used to find the unobserved heterogeneity in the model estimated as it is frequently overlooked by researcher in different social behavior studies as indicated by Hair et al. (2017).

#### **5.2 Data Screening**

The initial phase in the analysis is to investigate the overall responses by screening the responses' patterns (Hair et al., 2017). These responses may raise a flag to be eliminated if they have a suspicious or systematic pattern such as: straight lining, diagonal linings, or alternating extreme pole response (Hair et al., 2017). Against this background, 28 cases with this criterion were removed before any further analysis conducted. In addition to that, there were number of screening questions that ensures only those who comply with prescribed criteria are invited to participate. These

questions include the university affiliation and the occupation, in which those complying with these questions are accepted.

### **5.3 Missing Value**

During the initial data screening of the responses, there were cases found to have missing answers with minor or critical cases. Fortunately, the minor questions' cases are limited and in the demographic part of the questionnaire. Precisely, the university (4 cases) and the affiliation (10 cases). The amendments performed for the university items were to select the appropriate university by the researcher on the criterion that each university's collection procedure was separate from the other universities, so the obtained responses are not mixed up.

Similarly, the affiliation of schools was identified based on the distribution of questionnaire and filled questions accordingly. In addition, one case reported as having a missing value of the gender, in which it represents 0.2 of the total missing values. The amendments for this case was using the mean replacement as recommended by Hair et al. (2017).

On the other hand, the critical cases were identified wherein more than 50% of the demographics were not answered. These responses were excluded from the analysis as the demographics are essential part of identifying the categories under estimation. More importantly, in demographics there are three most important questions that give information about the following questions in the survey and estimates if the respondent answered these questions or not. Firstly, the questions pertaining the use of SaaS applications and services. secondly, the educational level and the occupation are of the main parts of the questionnaire that needed to be answered before proceeding to the

rest of the questions. So, if these parts are not answered, the responses missing these data were excluded from further analysis. Based on that, the number of these questions eliminated in the early stage of data screening were 5 cases and considered not valid responses.

#### **5.4 Outliers**

An outlier is defined as an extreme value that is different than other scores in one variable (univariate outlier) or a combination of strange and extreme scores on two or more variables (multivariate outliers) that are discreet from other cases (Tabachnick & Fidell, 2013). In the same line of definition, others define it as an observation that is inconsistent with the remainder of other responses (Barnett & Lewis, 1984). Having been included in the data set, the results of analysis will be distorted in any direction (Tabachnick & Fidell, 2013) and lead to unreliable results (Verardi & Croux, 2009).

One of the ways to detect the outliers is to evaluate the Mahalanobius distance by SPSS in regression. If the Mahalanobius distance obtained from regression is higher than chi-square values correspond to the number of indicators in the study, the case is omitted and considered as an outlier. As a result, 176 outliers were eliminated as not to affect and distort the accuracy of the analysis result cases (Tabachnick & Fidell, 2013).

#### **5.5 Normality Test**

The responses to questions collected are distributed with corresponded pre-defined categories (i.e., scale 1 to 5). Normal distribution of data is desirable when working with SEM (Hair et al., 2017). Although PLS-SEM does not make assumption of

normal distribution of data as it is a nonparametric statistical method, normal distribution gives better results, and extremely far away data from normality distribution makes less desired results (Hair et al., 2017). Hair et al. (2017) added that if the data is extremely away from normal distribution, this will affect the significance of the parameters and standard errors are inflated as a result of bootstrapping (Hair et al., 2017; Hair, Ringle, & Sarstedt, 2011; Henseler, Ringle, & Sinkovics, 2009).

Moreover, there are two main methods to test the normality distribution in any data, namely: statistical or graphical methods (Tabachnick & Fidell, 2013). The skewness and kurtosis are two components of normality that some researchers consider most in the normality tests (Hair et al., 2017). On the other hand, if the sample is large enough (i.e., greater than 200 responses), the graphical visualization is considered more than the inference tests such as the significance of skewness and kurtosis (Tabachnick & Fidell, 2013). The standard errors of skewness and kurtosis decreases with the larger sample sizes, and the visual distribution is more important than the inference tests, as aforementioned (Tabachnick & Fidell, 2013).

Based on the above argumentation, the research considered the histogram distributions of the items, as shown at Appendix C. The different figures for all items show that the distribution is acceptable, and the greatest frequencies are concentrated in the middle of the bell-shaped curve, with some frequencies towards the tails (Pallant, 2011). Figure 5.1 illustrates a distribution of AUSaaS latent construct, for all others, kindly refer to Appendix C for reference.

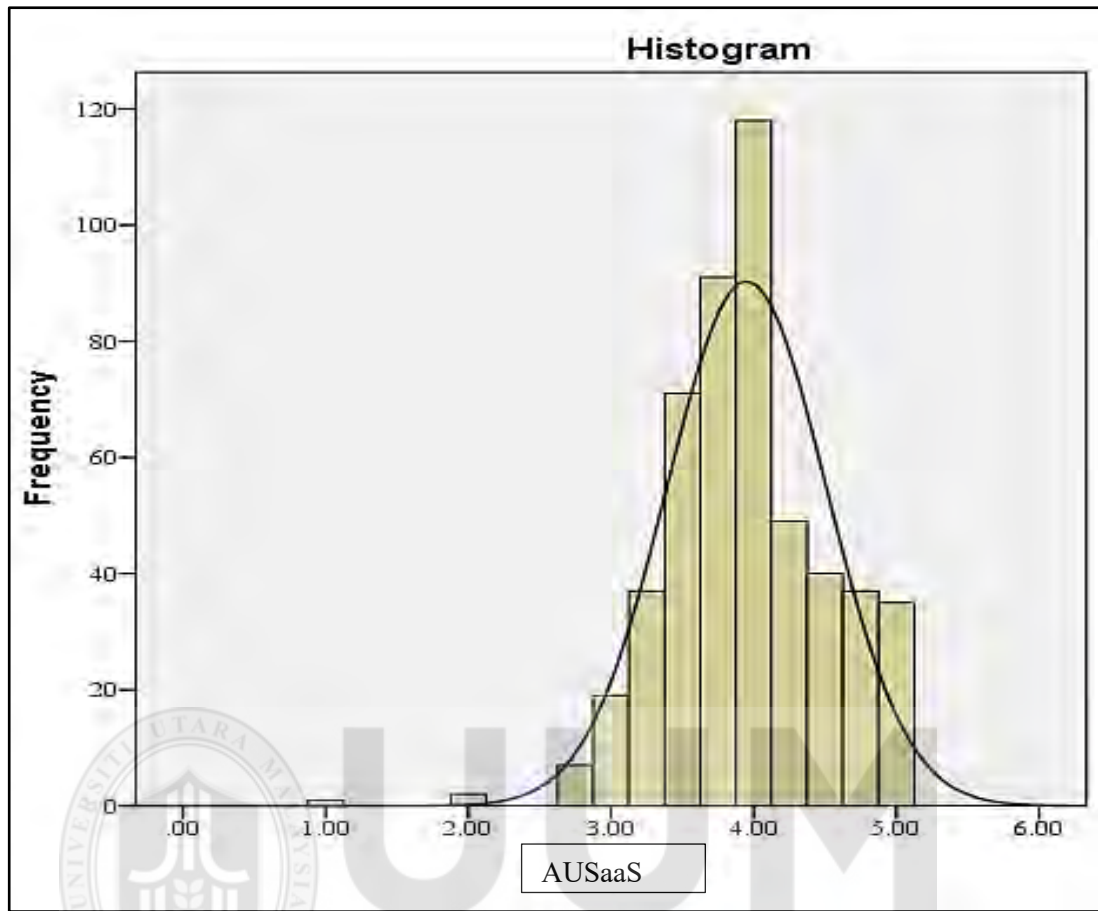


Figure 5.1. Distribution of normality curve of AUSaaS

### 5.6 Response Rate

The strategy followed to distribute the questionnaire is to use the hard-copy and the online version. The total number of distributed questionnaires as a hard-copy was 850. That is, 300 questionnaires at UUM, 300 at USM, 100 at UPSI, and 150 at UniMAP. In total, the returned questionnaires were 778. After the initial screening, the number of responses obtained were 745. The systematic random sampling was then used on these returned responses in which each second response was selected. This procedure yielded a total number of 373 initially valid responses of both groups, i.e. the student and academic staff groups. Refer to Table 5.1 and Table 5.2 for a summary.

Table 5.1

*Distribution of Hardcopy Questionnaire With Results*

University	District	Total distributed	Total returned Questionnaires	Valid responses
UUM	Kedah	300	276	269 (92%)
USM	Pulau Pinang	300	275	266 (91.6%)
UPSI	Perak	100	87	81 (87%)
UniMAP	Perlis	150	140	129 (93.3%)
Total		850	778	745 (87.6%)

On the other hand, the online version was sent via e-mail to different university lecturers. The mailing list was created by referring to the official website of the each of the four public universities and then navigated to different schools to build the list of the academic staff. Afterwards, the list of the four universities were organized in a way to distribute the questionnaire by selecting every second one in the list. This approach was followed for each university and the e-mails were sent at three different times during the working days, namely: at night, in the morning, and afternoon. This strategy followed to make sure that respondents check their e-mails at their convenience.

In addition, at weekends the reminders were sent to respondents. Another approach was followed to distribute the online questionnaire was through social media applications such as WhatsApp application for students' groups. Number of lecturers sent the link to their students to urge them to participate on the online version of the questionnaire, which is easy to answer, attractive, and accessible at their fingertips. Each student had an equal probability to participate and voluntarily.

The total period spent for collecting the responses was four months started on the 1st of October 2016 and ended on 30th of February 2017. The total number obtained from the online version was 625. The initial screening, however, of the questionnaire took place to validate the appropriateness of the responses collected. Consequently, the

remaining number after initial screening was 620. In same vein, the systematic sampling was performed for every second response to be chosen (i.e. for the online version). The total number of samples yielded was 310. In sum, the total number of obtained responses from both versions (before systematic sampling) was 1370. After systematic sampling, the responses gained were 683, where the outliers were eliminated (176) and the final result was a total number of 507.

The final response rate was calculated based on the total responses obtained by means of systematic analysis (683) divided by the total responses obtained from both versions (1370), wherein the yield response rate was (49.85%). This final number of responses were further advanced for the analysis phase. Table 5.2 summarizes the results.

Table 5.2  
*Sample Size Totals*

<b>Discription of the Questionnaire</b>	<b>Total distributed</b>
Number of Hardcopy Distributed Questionnaire	850
Retruned Responses	778
Valid for analysis after initial screening	745
Systimatically Sampled Valid Responses (Hardcopy)	373
Number of online Responses received	625
Valid Responses after initial screening	620
Systimatically Sampled (Online)	310
Total Reponses (both versions) Obtained	1370
Total Reponses (both versions) Systimatically Obtained	683
Responses Rate	(49.85%)
Mulrivarite Outliers Eleminated	176
<u>Valid Responses</u>	<u>507</u>

It is worth mentioning that the hard copies of the questionnaires targeted the students and lecturers at universities in different schools and locations. A briefing of the content of the questionnaire and the purpose, the way to answer, and the advantages to participate in such questionnaire was explained in addition to motivate them to participate by entering a Lucky Draw for a Power Bank at the end of the questionnaire



period. The strategy followed was to target different schools that are mostly non-IT-related schools and IT-related schools. A number of students at these schools provided help in the distribution process as well as encourages students to participate. Some of the students were selected to follow up and were trained to explain the distribution process as well as how to brief the content of the questionnaire.

For the academic staff, each room was visited to ask voluntarily for participation, many apologized, but number of lecturers welcomed answering the questionnaire. Surprisingly, number of lecturers helped in introducing the researcher to other academic staff to facilitate the distributions process. Besides, some lecturers apologized to answer as they already answered the online version of the questionnaire. Also, the ones already received the electronic version, replied as not to further re-send the questionnaire. Therefore, explanation with apology was sent to inform them of the nature of this randomly systematic sampling. In another aspect, to avoid possible sample bias, the researcher targeted different schools and different races that represent the variety of Malaysian culture and the harmony of the country.

### **5.7 Non Response Rate**

There is a consensus among researchers that the higher the response rate, the lower the non-response bias found (Malhotra & Birks, 2007). In addition, to increase the response rate, it is recommended to use different ways of the sources of the survey. Using different sources to collect data increases the response rate and, therefore, minimizes the bias, i.e. the non-response rate (Venkatesh, Sykes, & Zhang, 2011).

Actually, there are different ways to evaluate the non-response bias and one efficient way is to compare the early responses (i.e. returned on time) with the late ones (H. K.

Baker, Singleton, & Veit, 2011). This approach assumes that the late group of respondents are viewed as the nonresponse group sample in that they did not answer until further efforts are done by the researcher (H. K. Baker et al., 2011). A second approach, based on H. K. Baker et al. (2011), is to compare the characteristics of both groups or the early respondents with the population at large. This approach is followed by Viswanath Venkatesh et al. (2011), where the differences in demographics between the respondent and non-respondents of a survey questionnaire is evaluated as this approach is an indicator of the non-response bias.

Based on these arguments, the study assumes the early respondents are those whose responses received during the first three months from the date of inauguration date of the survey (369), and the late respondents are those responses received afterwards (138). There are number of techniques used such as t-tests or chi-square tests to evaluate the differences between the two groups. However, in the current study, the independent sample t-test is used that is included in SPSS package software. Table 5.3 and Table 5.4 depicts the results obtained.

It clear after running the t-test against the early and late group of respondents for the demographics of age, education, occupation, gender, and if the respondent is in the IT/IS field of study. Not surprisingly, the results revealed that there are not significant differences between the early or the late groups; therefore, the non-response bias does not exist in the current study. The detailed statistics do explain the mean, the standard deviation, the standard error mean, and the significance of the variance between the two groups.

Table 5.3  
*Group Statistics of The Early Respondents and Late Respondents*

	<b>Response</b>	<b>N</b>	<b>Mean</b>	<b>Std. Deviation</b>	<b>Std. Err Mean</b>
Age	Early Respondent	369	1.75	1.15	0.06
	Late Respondent	138	1.95	1.20	0.10
Education	Early Respondent	369	3.52	0.93	0.05
	Late Respondent	138	3.67	0.90	0.08
Occupation	Early Respondent	369	1.24	0.43	0.02
	Late Respondent	138	1.30	0.46	0.04
Gender	Early Respondent	368	1.67	0.47	0.02
	Late Respondent	138	1.63	0.48	0.04
Specialization of Computer Science IT Related Studies	Early Respondent	369	1.23	0.42	0.02
	Late Respondent	138	1.31	0.46	0.04



**UUM**  
Universiti Utara Malaysia

Table 5.4

*Independent Samples Test*

		Levine's Test for Equality of Variances		t-test for Equality of Means				95% Confidence Interval of the Difference		
		F	Sig.	t	df	Sig. 2- tails	Mean Difference	Std. Err Diff	Lower	Upper
Age	Equal variances assumed	0.65	0.42	-1.71	505	0.09	-0.2	0.12	-0.43	0.03
	Equal variances not assumed			-1.67	235.43	0.1	-0.2	0.12	-0.43	0.04
Education	Equal variances assumed	0.04	0.85	-1.56	505	0.12	-0.14	0.09	-0.32	0.04
	Equal variances not assumed			-1.59	254.2	0.11	-0.14	0.09	-0.32	0.03
Occupation	Equal variances assumed	6.78	0.01	-1.38	505	0.17	-0.06	0.04	-0.15	0.03
	Equal variances not assumed			-1.34	231.2	0.18	-0.06	0.05	-0.15	0.03
Gender	Equal variances assumed	2.61	0.11	0.86	504	0.39	0.04	0.05	-0.05	0.13
	Equal variances not assumed			0.85	239.82	0.4	0.04	0.05	-0.05	0.14
Specialization of Computer Science IT Related Studies	Equal variances assumed	12.09	0.00	-1.88	505	0.06	-0.08	0.04	-0.17	0.00
	Equal variances not assumed			-1.8	226.3	0.07	-0.08	0.05	-0.17	0.01

## 5.8 Description of Demographics Profile

Number of demographics were included in the questionnaire, namely: gender, age, educational level, ethnicity, occupation, university name, the type of SaaS Cloud Computing services used, and, finally, the school affiliation at university. Referring to Table 5.5, gender was assessed, and the results revealed that female participants are more than male participants, 66% and 34% respectively. The age of participants was checked, and it is found that majority of participants fall on the first category, i.e. category 18 - 26 (61.5 %), followed by category 36 - 44 (18.3%), then 27 - 35 (10.3%), after that 45 - 53 (5.9 %), and finally category above 53 (3.9 %). The results shadow the prominent age is for the young generation and that the least category is the older generation.

In terms of the educational level, the majority of participants were from bachelor's degree (57%), followed by PhD. degree (22.9%), then master's degree (16.2%), next Diploma (2.2%), and, finally, Certificate (1.8%). The results here reflect the nature of the population of the universities as the majority of students are in the bachelor category and the least is on the diploma category. With regard to ethnicity, the three-main dominant ethnic groups of Malaysia were questioned, and the results revealed that Malays have the majority of respondents (66.1%), followed by Chinese (17.6%), and lastly Indians with the least percentage (8.3%).

Table 5.5

*Demographic Characteristics of Participants*

Characteristic	Selection	Frequency/Percentage
Gender	1. Male	173 (34%)
	2. Female	334 (66%)
Age	1. 18 - 26	312 (61.5%)
	2. 27 - 35	52 (10.3%)
	3. 36 - 44	93 (18.3%)
	4. 45 - 53	30 (5.9%)
	5. Above 53	20 (3.9%)
Educational level	1. Certificate	9 (1.8%)
	2. Diploma	11 (2.2%)
	3. Bachelor	289 (57%)
	4. Master	82 (16.2%)
	5. PhD.	116 (22.9%)
Ethnicity	1. Malay	335 (66.1%)
	2. Chinese	89 (17.6%)
	3. Indian	42 (8.3%)
	4. Others	41 (8.1%)
Occupation	1. Student	375 (74%)
	2. Academic staff	132 (26%)
University (Higher Educational Institute)	1. UUM	245 (48.3%)
	2. UniMAP	75 (14.8%)
	3. USM	127 (25%)
	4. UPSI	60 (11.8%)
School/Faculty Affiliation In terms of Relatedness to Computer/IT Studies	1. Computer Science/ IT related schools	128 (25.2%)
	2. Non-Computer Science/IT related schools	379 (74.8%)

Regarding occupation, the students represent (74%) of the total respondents, while the academic staff represent (26%) of the total responses obtained. With respect to the university affiliation, most of the respondents were from UUM with percentage of (48.3%), followed by USM (25 %), next was UniMAP (14.8 %), and lastly was UPSI (11.8%). The results were not surprising, as they represent almost the strata of the sample except UPSI where the respondents were the least in participation.

The next category evaluated was the type of school affiliation in which the focus was to explore Non-Computer Science/IT or Computer Science/IT related studies of the different respondent's colleges/schools inside the universities. As can be seen from

Table 5.5, majority of responses were from the non-computer sciences/IT related faculties/schools with responses 379 (79.8%), compared with the computer sciences/IT related responses 128 that represents 128 (25.2%) of the total responses obtained. Figure 5.2 visualize this result. The results revealed in this section is pertinent with the aim to probe the general perception of the individuals of the HE institutes and not directly those who are actually expertise or have deep knowledge on the technology. In that view, the picture is clear on the dominance of the non-IT related participant and the results gained from this research would properly reflect the general view of the individual regardless of his/her views and perceptions regarding using, accepting, or adopting SaaS services and applications.

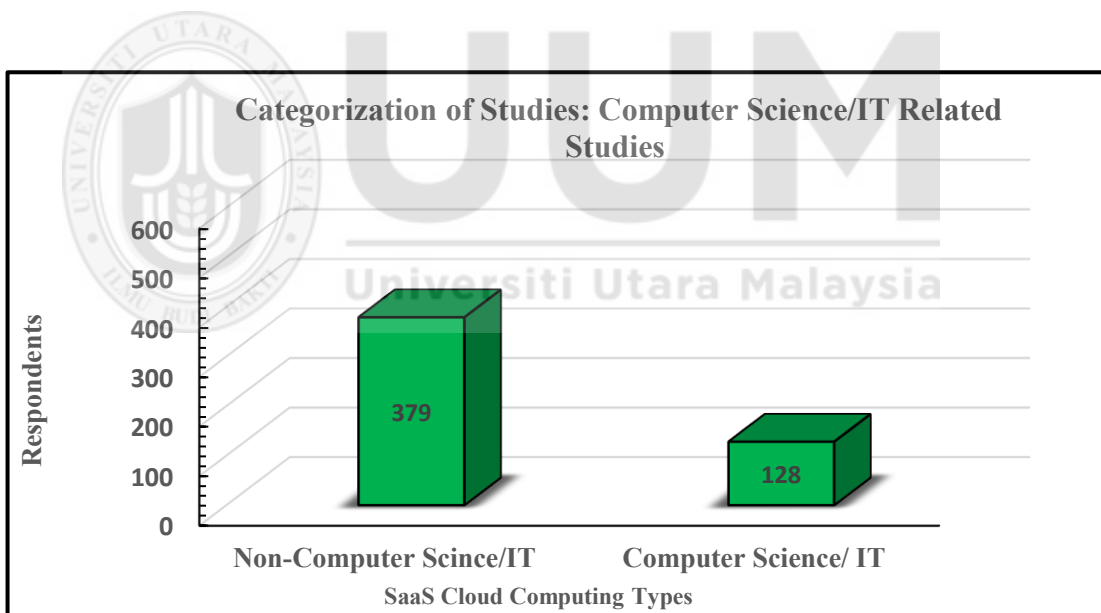


Figure 5.2. Categorization of studies of participants

On the other hand, by referring to Table 5.6, the type of SaaS Cloud Computing application used based on the categories defined on the questionnaire revealed that social media communication SaaS applications have the highest response (466), followed by E-mail services (384), next is the collaborated SaaS applications (346), then SaaS storage (265), next is entertainment and education media SaaS services

(147), and finally communication and calling SaaS-based services (39). These results are for both groups of respondents, i.e. students and academic staff, refer to Figure 5.3.

Table 5.6

*SaaS Cloud Computing Applications' Type of Responses*

Code	Description	Frequency
SaaS_T1	Collaborated SaaS Cloud Computing applications	346 (68%)
SaaS_T2	Social media communication applications	466 (92%)
SaaS_T3	E-mail services	384 (76%)
SaaS_T4	SaaS Cloud Computing storage	265 (52%)
SaaS_T5	Communication and calling services	39 (8%)
SaaS_T6	Entertainment or educational media	147 (29%)

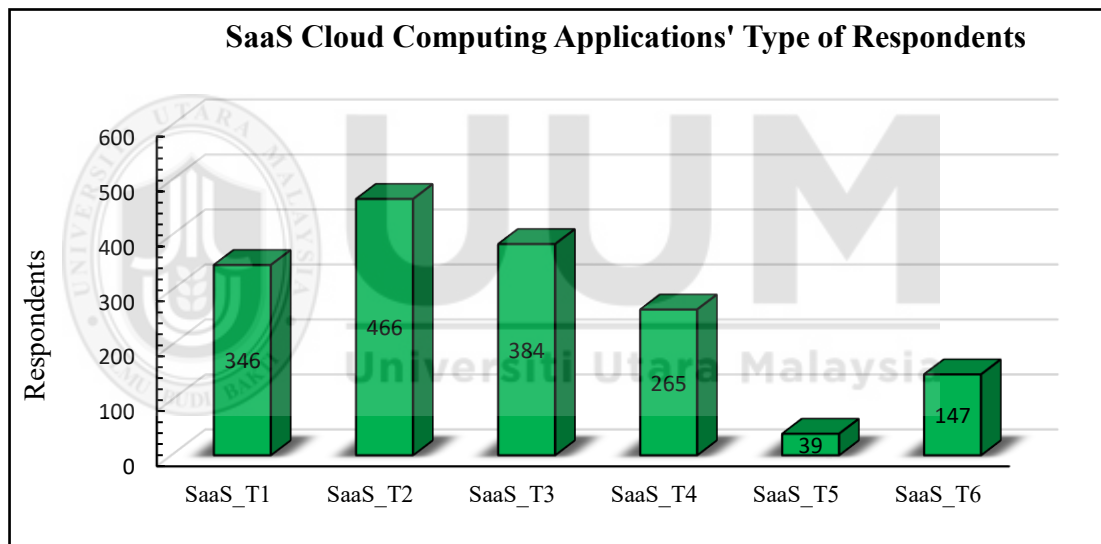


Figure 5.3. All responses of SaaS Cloud Computing service type

### 5.9 Measurement Model Assessment Procedure

The path models are developed based on two theories: the measurement theory and the structural theory. The measurement theory is referred to as how much each construct is measured (Hair et al., 2017, 2011). Actually, there are two types of constructs: reflective and formative constructs. In this research, the reflective measurement construct is used. On other hand, the structural theory is concerned upon how the



constructs are related to each other in the structural model (i.e., the relationship between their constructs) (Hair et al., 2017, 2011). Additionally, the model studied in this research is visualized in Figure C. 1 at Appendix C.

## **5.10 Reflective Measurement Model Assessment**

In the current model, the assessment of the reflective measurement model consists of the convergent validity (i.e. the outer loadings of the Latent Variables, their reliability, and the Average Variance Extracted (AVE)), the internal consistency reliability (i.e. Composite Reliability (CR), and Cronbach's Alpha), and discriminant validity. In this section, the assessment includes all reflective latent constructs of the model including the Low Order Constructs (LOC), and the composite constructs HOC (High Order Constructs). The approach followed in the assessment is based on the guidelines of (Hair et al., 2014, 2017).

### **5.10.1 Convergent Validity**

The convergent validity is the extent that the indicators, which are the measures of a construct, should correlate positively with other measures or indicators of the same construct and should converge or share a high portion of the variance of the same construct (Hair et al., 2017). The convergent validity is measured by the assessment of the outer loadings and the reliability of a construct in addition to the assessment of AVE. Table 5.7 shows the list of reflective constructs of the model with related values under consideration of the construct validity.

Number of things has to be taken into consideration with regard to convergent validity. First, outer loadings equal or above the cut-off value of 0.7 are acceptable and indicates

that the items have much share in common that is captured by the same construct (Hair et al., 2017). Besides, the squared value of the outer loadings of an item, referred to as the communalities, is the variance that is captured or explained by the construct of that item. This squared value of the standardized item outer loading is called item reliability. The cut-off value of indicator's reliability is equal or above 0.5, in which indicates that the item's explained variance by the construct is higher than the measurement error of the item (Hair et al., 2017).

On the other hand, previous literature suggests outer loadings of an item in the range of 0.5 (Hair et al., 2010) to 0.7 or higher (Hair et al., 2017; Henseler & Chin, 2010) are acceptable and meet the thresholds of reliability and validity. Furthermore, going through the evaluation process and referring to Table 5.7, the items show loadings above 0.7 in all the reflective constructs. It is worth mentioning that in reflective model, any item could be removed or eliminated if it has loadings less than the thresholds indicated above, or if removing it increases the composite reliability/AVE of the related construct (Hair et al., 2017).

Besides, items in reflective model are interchangeable and are viewed as equivalent manifestations of the same construct and removing these items is possible as long as the remaining items have sufficient content that the construct is capturing (Hair et al., 2017; Podsakoff, Bommer, Podsakoff, & MacKenzie, 2006). However, all the measurements met the criteria and there was not any need to remove any of the items. Moreover, the AVE of all constructs met the criterion and exceeds the threshold of (0.5). In addition, all items on all latent constructs speak in favor of having reliable measurements and exhibit a value in the range (0.56-0.82), which is more than the cut-

off value of 0.5. To further insure that items are loaded in the intended construct, assessment of internal consistency reliability was performed in the following section.

### **5.10.2 Measurement Model Internal Consistency Reliability Assessment**

Here, the assessment of internal consistency and reliability consists of the assessment of Composite Reliability (CR) and Cronbach's Alpha. Cronbach's alpha is the conservative measure of internal consistency reliability and assumes that all indicators are equally reliable and having equal outer loadings on the same construct. The cut-off values that are acceptable falls in the range of 0.6-0.9 (Hair et al., 2017). Also, Cronbach's alpha depends on the number of items and, therefore, tends to underestimate the internal consistency and reliability.

For these reasons, there is another measure that is used, which is referred to as Composite Reliability. Composite Reliability, however, takes into account the different outer loadings of the indicators (Hair et al., 2014, 2017; Sarstedt, Ringle, Smith, Reams, & Hair, 2014). Moreover, CR is the conservative measure of reliability as referred by Hair et al. (2017). Additionally, in explorative research, such as the current study, the cut-off values range 0.6 - 0.7 are considered acceptable, values in the range of 0.7 - 0.95 are satisfactory, whereas values below 0.6 are considered to indicate lack of internal consistency reliability, and values above 0.95 are not desirable (Hair et al., 2017).

In Table 5.7, the values of both measures are included and meet the satisfactory criteria of CR (0.84 - 0.9), and Cronbach's alpha in the acceptable range (0.74 - 0.9). Hence, both measures are reasonably considered and reported as suggested by Hair et al. (2017) to show the lower bound (i.e., Cronbach's Alpha) and the upper bound (i.e.,

Composite Reliability) of internal reliability and consistency of latent constructs. After this step, further analysis was performed to assess the discriminant validity of the constructs in the following section.

### **5.10.3 Discriminant validity assessment**

In discriminant validity assessment, the indicators of each construct are examined against another construct to ensure that they are loaded only in the intended construct. To do so, three assessment approaches were used to investigate the discriminant validity of the latent constructs, namely: the cross-loadings validation, the Fornell and Larker criterion, and Heterotrait-Monotrait ratio (HTMT) inference assessment (Hair et al., 2017). For the cross-loading validation, the loadings of items in an intended construct are tested against other loadings with other constructs. To meet this criterion, the loadings on the intended construct must be higher than other loadings with other constructs. In Table B. 1 at Appendix B, the results revealed that the criterion was met and none of the items loads higher with other constructs.

For the second criteria, Fornell and Larker Fornell and Larker (1981) criterion was used to evaluate different constructs and the results reveal that the square root of AVE of each construct in the diagonal is higher than all correlations or values with other constructs in all directions of the table (i.e., in the same raw and same column of each construct) (Fornell & Larker, 1981). Table B. 2 at Appendix B shows that the criterion was met.

Noteworthy, the previous two approaches to measure discriminant validity are not reliable as recent research pointed to this issue (Henseler, Hubona, & Ash, 2016; Henseler, Ringle, & Sarstedt, 2015). When two constructs are perfectly correlated, the

cross-loading validation is not enough. In addition, Fornell and Larker (1981) criterion approach performs poorly when the constructs differ only slightly (i.e., indicator loadings in the range of 0.6-0.8) (Hair et al., 2017). Therefore, the HTMT was suggested as a remedy for the two previous approaches (Hair et al., 2017; Henseler et al., 2015).

Consequently, HTMT inference ratio assessment was used in the current study. The bootstrapping procedure in Smart PLS M3 program was run to check if the confidence interval range does not include the value of 1 in any of its boundaries, in which the case is accomplished, refer to Table B. 3 in Appendix B. In sum, the values revealed in this analysis show that the three approaches speak in favor of establishing discriminant validity of all construct. Therefore, proceeding to the structural model evaluation can be made. You could refer to Figure C. 17 at Appendix C for a visualized result of the measurement model analysis.

Table 5.7  
*Results' Summary of The Measurement Models*

Latent Variable	Indicators	Loadings > 0.7	Indicator Reliability > 0.5	AVE > 0.5	Composite Reliability 0.6 - 0.9	Cronbach's Alpha 0.6 - 0.9	Discriminant Validity - HTMT Confidence Interval does not include 1
AUSaaS	AUSaaS1	0.71	0.5	0.56	0.84	0.74	Yes
	AUSaaS2	0.78	0.59				
	AUSaaS3	0.81	0.66				
	AUSaaS4	0.70	0.49				
BI	BI1	0.87	0.76	0.81	0.9	0.9	Yes
	BI2	0.88	0.77				

Table 5.7 continued

	BI3	0.93	0.81				
	BI4	0.90	0.81				
ATT	ATT1	0.88	0.77	0.72	0.9	0.87	Yes
	ATT2	0.77	0.59				
	ATT3	0.90	0.81				
	ATT4	0.85	0.72				
COM	COM1	0.90	0.81	0.82	0.9	0.89	Yes
	COM2	0.90	0.81				
	COM3	0.90	0.81				
PEU	PEU1	0.81	0.66	0.76	0.9	0.9	Yes
	PEU2	0.90	0.79				
	PEU3	0.92	0.81				
	PEU4	0.90	0.76				
PU	PU1	0.86	0.74	0.75	0.9	0.89	Yes
	PU2	0.87	0.76				
	PU3	0.87	0.76				
	PU4	0.86	0.74				
TRI	TRI1	0.81	0.66	0.65	0.88	0.82	Yes
	TRI2	0.83	0.69				
	TRI3	0.82	0.67				
	TRI4	0.75	0.56				
SN	SN1	0.86	0.74	0.8	0.9	0.9	Yes
	SN2	0.91	0.81				
	SN3	0.91	0.81				
	SN4	0.89	0.79				
SNPI	SNPI1	0.90	0.81	0.78	0.9	0.9	Yes
	SNPI2	0.71	0.64				
	SNPI3	0.92	0.81				
	SNPI4	0.92	0.81				
SNSI	SNSI1	0.89	0.79	0.79	0.9	0.9	
	SNSI2	0.86	0.74				
	SNSI3	0.91	0.81				

Table 5.7 continued

	SNSI4	0.90	0.81				
PBC	PBC1	0.82	0.67	0.71	0.9	0.86	Yes
	PBC2	0.85	0.72				
	PBC3	0.89	0.79				
	PBC4	0.80	0.66				
PBCFC	PBCFC1	0.85	0.72	0.68	0.89	0.84	Yes
	PBCFC2	0.86	0.74				
	PBCFC3	0.70	0.49				
	PBCFC4	0.87	0.76				
PBCSE	PBCSE1	0.86	0.74	0.75	0.9	0.89	Yes
	PBCSE2	0.91	0.83				
	PBCSE3	0.84	0.71				
	PBCSE4	0.86	0.74				
CRD	CDR1	0.88	0.77	0.77	0.9	0.9	Yes
	CDR2	0.90	0.81				
	CDR3	0.88	0.77				
	CDR4	0.86	0.74				
TRT	TRT1	0.88	0.77	0.79	0.9	0.9	Yes
	TRT2	0.86	0.74				
	TRT3	0.91	0.81				
	TRT4	0.90	0.81				
USecP (HOC)	CDR1	0.81	0.66	0.68	0.9	0.9	Yes
	CDR2	0.85	0.85				
	CDR3	0.81	0.86				
	CDR4	0.86	0.66				
	TRT1	0.82	0.67				
	TRT2	0.78	0.61				
	TRT3	0.85	0.72				
	TRT4	0.88	0.77				

### 5.11 Structural Model Assessment Procedure

In the previous sections, the evaluation conducted for the measurement model. The following step is to evaluate the structural model or the inner model. Also, the

assessment of the hypotheses is accomplished by examining the structural model. Moreover, the evaluation on this stage follows the guideline of (Hair et al., 2014, 2017) and builds mainly on the standard model estimation, the bootstrapping routine, and the blindfolding procedure Hair et al. (2014, 2017). Each step of the evaluation process is explained thoroughly in the following sections.

### **5.12 Collinearity Assessment**

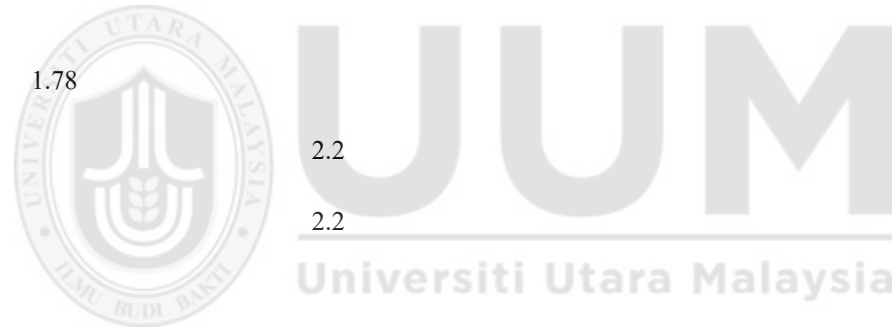
The first step in the evaluation stage of the structural model is to examine the collinearity of the model. This assessment is accomplished by evaluating the threshold of VIF (Variance Inflation Factor) that should be less than 5 to avoid collinearity issues of the construct and a requirement to proceed with the structural model evaluation. Each set of predictor constructs are examined against their outcome constructs (Hair et al., 2014, 2017). As can be seen in Table 5.8, all predictors meet the criteria of having a VIF value less than 5 for each set of predictors separately for each subpart of the structural model. The VIF values ranges between (1.0) and (2.95); consequently, the researcher proceeds to the next step of the evaluation process.



Table 5.8

*Collinearity Assessment of The Latent Constructs With VIF Values*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15I	16
1.ATT			1.6													
2.AUSaaS																
3.BI		1.3														
4.COM	2.85															
5.CRD																
6.PBC			1.78													
7.PBCFC						2.2										
8.PBCSE						2.2										
9.PEU	2.4															
10.PU	2.95															
11.SN			1.47													
12.SNPI													1.5			
13.SNSI													1.5			
14.USecP		1.4			1											1
15.TRI	1.5															
16.TRT																



### 5.13 Structural Model Path Coefficients Assessment

The estimates for the hypothesized relationships for the structural model are obtained by running the PLS algorithm, which is the standardized values of path coefficients. The values of path coefficients close to (+1 or -1) are considered strong relationship either positive or negative. On the contrary, the values near (0) are considered weak and normally not significant (Hair et al., 2017). The significance of the path coefficients is obtained by running the bootstrapping routine, which computes the t and p values in addition to confidence intervals. Reporting the three values are recommended by Hair et. al. (2017).

Further, the statistical significance is accomplished when the t values are larger than a threshold, which are for the two-tailed tests: 1.65 (at significance level of 10%), 1.96 (at significant level of 5%), and 2.57 (at significance level of 1%). On the other hand, the one tail critical values are: 1.28 (at significance level of 10%), 1.65 (at significant level of 5%), and 2.33 (at significance level of 1%). Moreover, the significance level for the studies that have explorative nature is 10% (Hair et al., 2017). In the current study, however, the significance level is selected to be of 5%.

Besides, the 95% confidence interval (CI) provides information about the significance of the path coefficients. If the range of CI revealed does not include a zero value, it indicates that the statistical significance of the value under consideration. By referring to Table 5.9, the values for different hypothesized relationships between the latent constructs are presented. Also, Figure C. 18 at Appendix C illustrates the results of the structural model.

To start with, by referring to Table 5.9, the results show the different predictors of ATT (i.e., COM, PEU, and PU) exhibit significant and positive relationship with values of ( $\beta = .40, t = 7.49, p < .00$ , CI significant), ( $\beta = .11, t = 2.24, p < .00$ , CI significant), and ATT ( $\beta = .33, t = 6.66, p < .00$ , CI significant) respectively. In contrast, TRI exerts a nonsignificant positive effect with value of ( $\beta = .06, t = 1.83, p = .07$ , CI nonsignificant). Thus, hypotheses H2a, H2b, and H2c are supported empirically by the findings, while H2d did not achieve the significant level.

In addition, predictors of SN (i.e., SNSI and SNPI) show also a positive and significant relationship with values of ( $\beta = .65, t = 15.49, p < .00$ , CI significant) and ( $\beta = .14, t = 2.61, p < .00$ , CI significant), respectively. Therefore, hypotheses H4a and H4b are supported. Likewise, the two predictors of PBC (i.e., PBCFC and PBCSE) exhibit a positive and significant relationship with values of ( $\beta = .27, t = 5.53, p < .00$ , CI significant) and ( $\beta = .61, t = 14.71, p < .00$ , CI significant), respectively; thereby, H5a and H5b are supported.

Also, the two LOC latent variables (i.e., CRD and TRT) of the HOC composite latent construct USecP show a significant and positive relationship with values of ( $\beta = .93, t = 130.70, p < .00$ , CI significant) and ( $\beta = .94, t = 154.24, p < .00$ , CI significant), respectively. This means, as indicated by Hair et al. (2014), that the two constructs are sufficiently highly correlated with USecP (HOC) composite construct to explain more than the 50% of each LOC's variance. Table 5.9 depicts the results.

Table 5.9

*Structural Model Significance Results - Path Coefficient*

Relationship	Path Coefficient	<i>t</i> value	<i>p</i> value	95% Confidence Interval	Significant? Yes/No
BI -> AUSaaS	0.55	14.53	0.00	[0.48-0.63]	Yes
ATT -> BI	0.62	18.44	0.00	[0.56-0.69]	Yes
COM -> ATT	0.40	7.49	0.00	[0.29-0.50]	Yes
PEU -> ATT	0.11	2.24	0.02	[0.02-0.22]	Yes
PU -> ATT	0.33	6.66	0.00	[0.24-0.43]	Yes
TRI -> ATT	0.06	1.83	0.07	[0.01-0.12]	No
PBC -> BI	0.21	5.27	0.00	[0.14-0.29]	Yes
PBCFC -> PBC	0.27	5.83	0.00	[0.17-0.35]	Yes
PBCSE -> PBC	0.61	14.71	0.00	[0.53-0.69]	Yes
SN -> BI	0.04	1.37	0.17	[0.00-0.12]	No
SNSI -> SN	0.14	2.61	0.01	[0.03-0.24]	Yes
SNPI -> SN	0.65	15.49	0.00	[0.56-0.73]	Yes
USecP -> AUSaaS	0.21	5.70	0.01	[0.14-0.28]	Yes
USecP -> CRD	0.93	130.70	0.00	[0.92-0.95]	Yes
USecP -> TRT	0.94	154.24	0.00	[0.92-0.95]	Yes

Moreover, the three main drivers of BI (i.e., ATT and PBC, and SN) show different results. ATT and PBC exhibit a positive and significant relationship with values ( $\beta = .62.$ ,  $t = 18.44$ ,  $p < .05$ , CI significant) and ( $\beta = .21.$ ,  $t = 5.27$ ,  $p < .05$ , CI significant), respectively, whereas SN did not show any significance relationship with BI although positive with rather very weak correlation ( $\beta = .04.$ ,  $t = 1.37$ ,  $p = .17.$ , CI nonsignificant). Hence, H1a and H1c are empirically supported. In contrast, H2b is not supported. More importantly, BI has the strongest effect on AUSaaS with large and significant effect with value of ( $\beta = .55$ ,  $t = 14.53$ ,  $p < .00$ , CI significant), followed

by USecP, which has a smaller significant effect ( $\beta = .21$ ,  $t = 5.70$ ,  $p < .00$ , CI significant) on AUSaaS.

Lastly, USecP and BI show a positive and significant relationship with the outcome AUSaaS with values of ( $\beta = .21$ ,  $t = 5.70$ ,  $p < .00$ , CI significant) and ( $\beta = .55$ ,  $t = 14.53$ ,  $p < .00$ , CI significant), respectively. Accordingly, hypotheses H1 and H3 are supported empirically. Table 5.10 provides a summary of the hypotheses' findings.

Table 5.10

*Summary of Hypotheses*

Hypothesis	Relationship	Findings
H1	BI ->AUSaaS	Supported
H1a	ATT->BI->AUSaaS	Supported
H1b	SN->BI->AUSaaS	Not Supported
H1c	PBC->BI->AUSaaS	Supported
H2	ATT->BI	Supported
H2a	COM-> ATT	Supported
H2b	PEU-> ATT	Supported
H2c	PU-> ATT	Supported
H2d	TRI-> ATT	Not Supported
H3	USecP->AUSaaS	Supported
H4	SN->BI	Not Supported
H4a	SNPI->BI	Supported
H4b	SNSI->BI	Supported
H5	PBC->BI	Supported
H5a	PBCSE->BI	Supported
H5b	PBCFC->BI	Supported
H6a	BI X ED -> AUSaaS	Supported
H6b	USecP X ED -> AUSaaS	Supported
H7	Group differences	Partially Supported

In addition to the above analysis, Hair et. al. (2017) emphasize the importance of undertaking the assessment of the relevance of the significant relationships of a model under consideration, in which many researchers do not focus on. Hair et. al. (2017) argues that if the path coefficient is significant, its size may not be critical to consider by decision makers or managerial levels (Hair et al., 2017).

In other words, when the size of path coefficient of one exogenous latent construct is higher than other exogenous latent construct, its effect on the endogenous construct is larger and means that its relevant influence on the endogenous construct is higher than the others with less path coefficient value. In this way, the researcher can pay attention for the salient predictors of a specific endogenous construct and decides which predictors have the strongest effect on the endogenous latent constructs under consideration.

Referring to Table 5.9, the results reveal that COM ( $\beta = .40$ ) achieved the strongest effect on ATT with a medium value of path coefficient, followed by PU that achieved a medium effect on ATT ( $\beta = .33$ ), then by PEU with small value of ( $\beta = .11$ ), whereas TRI has the smallest nonsignificant effect on ATT ( $\beta = .06$ ).

Looking at the antecedents of PBC, the results, also, reveals that PBCSE has the strongest effect on PBC with large value of ( $\beta = .61$ ); whereas PBCFC comes in the second position with a smaller and significant effect with value of ( $\beta = .27$ ). In addition, results show that SNPI has the strongest effect on SN with a large influence value of ( $\beta = .650$ ), whereas SNSI has a smaller effect on SN ( $\beta = .14$ ).

#### **5.14 Coefficient of Determination ( $R^2$ ) Assessment**

The coefficient of determination is used to evaluate the structural model predictive power and it represents the amount of the combined effects of all exogenous constructs on the endogenous latent construct. That is, the variance of the endogenous latent construct that is explained by the exogenous latent constructs connected to it. It is referred to as  $R^2$ , which is the squared correlation of the actual and predicted values, and represents the in-sample predictive power (Rigdon, 2012; Sarstedt et al., 2014).

The  $R^2$  suggested cut-off values suggested by Hair et al. (2017, 2011) and Henseler et al. (2009), which is a conservative criterion, to estimate the endogenous construct are 0.75, 0.50, and 0.25 and can respectively described as substantial, moderate, and weak. However, Chin (1998) has different cut-off values that are more liberal and fits in this explorative study. These values are widely used in reporting the  $R^2$  with cut-off values of 0.19 (weak), 0.33 (moderate), and 0.67 (substantiate) and, therefore, are adopted in this research.

Referring to Table 5.11, the two driver constructs ATT and PBC have substantiate  $R^2$  values of (0.66) and (0.68) that can be described as substantial, respectively. Besides, SN with highly moderate value of (0.54) that can be described as having relatively highly moderate value of  $R^2$ . Besides, ATT explained variance is by four antecedents (i.e., COM, PEU, PU, and TRI), while PBC variance is explained by two antecedents (i.e., PBFC and PBCSE), also SN variance is explained by two antecedents (i.e., SNPI and SNSI). Further, BI has a relatively substantial value of  $R^2$  (0.63), which its variance explained by the three driver constructs of ATT, PBC and SN. For the outcome AUSaaS, the highly moderate  $R^2$  value is (0.45) and is considered of high moderate value that USecP and BI have an influence on it and are the main drivers of it in the current study.

The explanation of the HOC construct does not hold on them, as this construct USecP is formed by including the indicators of all underlying LOCs constructs (i.e., CRD and TRT of USecP) in a repeated indicator approach. Therefore, we do not consider the value of  $R^2$  as these composite constructs are representing the LOCs constructs in parsimonious approach and the focus on the HOCs and not LOCs underlying them as explained by (Hair et al., 2014).

Table 5.11

*Endogenous Variables' R<sup>2</sup>*

<b>Endogenous Latent Variable</b>	<b>R<sup>2</sup> value</b>
AUSaaS	0.45
ATT	0.66
BI	0.63
PBC	0.68
SN	0.54

Pertinently, Hair et. al. (2017) indicate that the researchers examine not only the direct effect of a construct on another, but also the total effect of the construct on another construct via one or more mediators. The total effect is the sum of the direct and indirect effect of a one construct on another. The importance lays especially in explorative studies that take into consideration the driver constructs' effect on the criterion construct in the structural model that has one or more mediators. For this purpose, the study considers studying the total effect of driver constructs (ATT, PBC, SN) on the main target construct AUSaaS. Also, the antecedents of these three-main driver constructs on the main target constructs of BI and AUSaaS of the current study.

For example, by referring to Table 5.12, two of the main driver constructs of BI (ATT and PBC) has a pronounced total effect ( $\beta = .62$  and  $.21$ , respectively) with significant  $t$  value of (18.44 and 5.27, respectively), probability value of ( $p < 0.05$ ), and supported by the significance of the confidence interval that does not include zero in its range. However, SN shows a nonsignificant total effect on the target construct AUSaaS ( $\beta = .04$ ,  $t = 1.37$ ,  $p = .17$ ). Besides, assessment of the ATT antecedents shows that COM has the strongest total effect among the other three antecedents of ATT on BI and AUSaaS. That is, the COM has a significant total effect ( $\beta = .40$ ,  $t = 7.49$ ,  $p < .00$ , and CI significant) on ATT, and a significant total effect ( $\beta = .25$ ,  $t = 6.61$ ,  $p < .00$ , CI



significant) on BI, and on AUSaaS ( $\beta = .14, t = 5.78, p < .00, CI$  significant). On the second place, PU shows a significant total effect on BI ( $\beta = .21, t = 6.23, p < .00, CI$  significant) and on AUSaaS ( $\beta = .12, t = 5.81, p = .00, CI$  significant).

On the other hand, PEU has a very weak total effect on BI ( $\beta = .07, t = 2.25, p < .05, CI$  significant) and on AUSaaS ( $\beta = .04, t = 2.17, p < .05, CI$  significant) as well. Unlike the other antecedents of ATT, TRI has a nonsignificant total effect on both BI and AUSaaS ( $\beta = .04, t = 6.23, p = .07, CI$  nonsignificant; and  $\beta = .02, t = 1.87, p = .08, CI$  nonsignificant, respectively). If we look at the antecedents of PBC, we find that PBCFC has a significant total effect on BI ( $\beta = .06, t = 3.78, p = .07, CI$  significant) and on AUSaaS ( $\beta = .03, t = 3.58, p < .05, CI$  significant) as well. However, the total effect of PBCSE is higher than PBCFC on BI with total effect of ( $\beta = .13, t = 4.99, p < .00, CI$  significant) and on AUSaaS ( $\beta = .07, t = 4.69, p < .00, CI$  significant).

In addition, the two antecedents of SN did not show any significant total effect on either BI or AUSaaS. That is, SNPI has a nonsignificant total effect on BI ( $\beta = .03, t = 1.13, p = .26, CI$  nonsignificant) and on AUSaaS ( $\beta = .03, t = 1.37, p = .17, CI$  nonsignificant). The same holds on SNSI, total effect on BI is ( $\beta = .01, t = 1.11, p = .27, CI$  nonsignificant) and on AUSaaS ( $\beta = .01, t = 1.14, p = .25, CI$  nonsignificant).

Table 5.12

*Total Effect of Antecedents on Main Target Constructs*

<b>Latent Construct Total Effect</b>	<b>Path Coefficient</b>	<b>t Statistics</b>	<b>p Values</b>	<b>95% Confidence Interval Significance level</b>
ATT -> AUSaaS	.34	10.96	.00	[.29 - .41]
ATT -> BI	.62	18.44	.00	[.56-. .69.]
COM -> AUSaaS	.14	5.7	.00	[.08 - .19]
COM -> BI	.25	6.61	.00	[.18 - .32]
COM -> ATT	.40	7.49	.00	[.29 - .50]
PU -> AUSaaS	.12	5.81	.00	[.08 - .16]
PU -> BI	.21	6.23	.00	[.15 - .28]
PU -> ATT	.33	6.66	.00	[.24 - .43]
PEU -> AUSaaS	.04	2.17	.03	[.00 - .08]
PEU -> BI	.07	2.25	.02	[.01 - .14]
PEU -> ATT	.11	2.24	.02	[.00 - .08]
TRI -> AUSaaS	.02	1.87	.08	[.17 - .35]
TRI -> BI	.04	6.23	.07	[.00 - .08]
TRI -> ATT	.06	1.83	.07	[.00 - .13]
PBC -> AUSaaS	.12	4.90	.00	[.07 - .17]
PBC -> BI	.21	5.27	.00	[.137 - .29]
PBCFC -> AUSaaS	.03	3.58	.00	[.02 - .05]
PBCFC -> BI	.06	3.78	.00	[.03 - .09]
PBCFC -> PBC	.27	5.83	.00	[.53 - .69]
PBCSE -> AUSaaS	.07	4.69	.00	[.05 - .10]
PBCSE -> BI	.13	4.99	.00	[.08 - .18]
PBCSE -> PBC	.61	14.71	.00	[.52 - .69]
SN -> AUSaaS	.02	1.36	.17	[.00 - .07]
SN -> BI	.04	1.37	.17	[.00 - .12]
SNPI -> AUSaaS	.02	1.36	.17	[.00 - .04]
SNPI -> BI	.03	1.37	.17	[.00 - .08]
SNPI -> SN	.65	15.49	.00	[.56 - .73]
SNSI -> AUSaaS	.00	1.10	.27	[.00 - .01]
SNSI -> BI	.01	1.11	.27	[.00 - .02]
SNSI -> SN	.14	2.61	.01	[.03 - .24]
USecP -> AUSaaS	.21	5.70	.00	[.14 - .28]
BI -> AUSaaS	.55	2.25	.02	[.48 - .63]

### 5.15 Effect Size ( $f^2$ ) Assessment

In the previous section, the  $R^2$  of each endogenous construct was assessed and now the effect size  $f^2$  of each exogenous construct is to be evaluated, in which the model is evaluated when the exogenous construct does exist and when it is omitted from the model. This is to ensure whether the effect of the exogenous construct is substantive on the considered endogenous construct (Hair et al., 2017). The following Equation 5.1 is used to calculate the  $f^2$  effect size (Hair et al., 2017):

$$f^2 = \frac{R^2_{\text{included}} - R^2_{\text{excluded}}}{1 - R^2_{\text{included}}} \quad (5.1)$$

where,  $R^2_{\text{included}}$ : Refers to  $R^2$  value of the endogenous construct when the selected exogenous construct included in the model estimated. This value is obtained in the first run of PLS algorithm.  $R^2_{\text{excluded}}$ : Refers to  $R^2$  value of the specific endogenous construct when the exogenous construct is excluded from the model estimated. This value is obtained after omitting the exogenous construct and run the PLS algorithm for the second time.

Actually, there are two existing guidelines for evaluating  $f^2$  size of  $R^2$ , one is taken from Hair et al. (2017) in which the values of 0.02, 0.15, and 0.35 represent small, medium, and large. On the other hand, the other is slightly different and is based on that values of  $f^2$  (.02), which is considered small, (.13) is medium, and (.26) is large effect size (Loeser, Recker, Brocke, Molla, & Zarnekow, 2017; Wetzels, Odekerken-Schröder, & van Oppen, 2009). Consequently, values less than 0.01 indicate that there is no effect of a specific exogenous construct on a specific endogenous construct in the model estimated. More importantly, to evaluate the effect size of the moderating effect, the effect size tends to be small and therefore the values of  $f^2$  ranges from (.005) with

small effect, (.010) with medium effect, and (.025) with large effect size (Kenny, 2016).

Fortunately, the smart PLS M3 calculates the effect size automatically and the obtained values are presented in Table 5.13. For example, the  $f^2$  effect size of BI on AUSaaS ( $f^2_{BI---AUSaaS}$ ) has a pronounced large effect (.45) and higher than the  $f^2$  effect size of USecP on AUSaaS ( $f^2_{USecP---AUSaaS}$ ), which is small (.07). Besides, the  $f^2$  effect size of ATT on BI ( $f^2_{ATT---BI}$ ) has a pronounced large value of (.66). On the other hand, the effect size of PBC on BI ( $f^2_{PBC---BI}$ ) is small (.07), while SN has no effect on BI ( $f^2_{SN---BI}$ ) and the value is (.00).

In addition, while the effect size of COM on ATT ( $f^2_{COM---ATT}$ ) has a medium effect size (.16) and is the largest effect among its group, PU on ATT ( $f^2_{PU---ATT}$ ) has also a medium effect size of (.11), while PEU on ATT ( $f^2_{PEU---ATT}$ ) has a small effect size (.02), and lastly, TRI has the no on ATT ( $f^2_{TRI---ATT}$ ) where effect size is (.00).

Regarding the effect size  $f^2$  of PBCFC on PBC ( $f^2_{PBCSE---PBC}$ ), PBCSE has a pronounced effect size with a large value (0.52), while PBCFC has a relatively medium effect size on PBC ( $f^2_{PBCFC---PBC}$ ) with obtained value of (.10). Regarding the effect size of SNPI on SN ( $f^2_{SNPI---SN}$ ), the effect is considered small (.60), whereas the effect size of SNIS on SN ( $f^2_{SNIS---SN}$ ) is small (.03).

Table 5.13

*Effect Size  $f^2$  of Latent Constructs*

	ATT	AUSaaS	BI	COM	PBC	PBCFC	PBCSE	PEU	PU	SN	SNPI	SNSI	TRI
ATT			0.66										
BI		0.45											
COM	0.16												
PBC			0.07										
PBCFC					0.10								
PBCSE					0.52								
PEU	0.02												
PU	0.11												
SN			0.00										
SNPI											0.60		
SNSI												0.03	
USecP		0.07											
TRI	0.01												



### 5.16 Blindfolding and Predictive Relevance ( $Q^2$ ) Assessment

The coefficient of determination is the in-sample predictive power of a model (Sarstedt et al., 2014), whereas the  $Q^2$  is the model's out-of-sample predictive power or predictive relevance that researchers should evaluate to ensure the predictive relevance and accuracy of a model (Geisser, 1974; Stone, 1974). The  $Q^2$  is measured for the reflective endogenous constructs by means of blindfolding procedure in Smart PLS M3 program using omission distance  $D$ . Values larger than (.00) of  $Q^2$  indicates that the predictive relevance of the path model does exist. The  $Q^2$  sample technique omits every  $d^{\text{th}}$  data point and estimates the parameters with remaining data points, and consequently the estimates are then used to predict the true omitted data points (Henseler et al., 2009). In other words, the  $Q^2$  is measured based on the input of the true data points and the predicted one in the procedures.

In applying the blindfolding, there are two steps: The first step is to obtain the latent constructs' scores with the path coefficients of the structural model, and the second step is to predict the omitted data points of the indicators in the measurement model by using the predicted latent construct score (reflective endogenous) of the previous step. The omission and prediction process in blindfolding depends on the omission distance  $D$ , in which the recommend value is between 5 to 10 (Hair, Sarstedt, Ringle, & Mena, 2012) with the condition of dividing the  $D$  selected value by the number of responses and the result should not contain an integer number so as not to repeat the deletion of the same set of observations in each round (Hair et al., 2017).

To evaluate the predictive relevance of certain reflective endogenous construct in the model, the  $Q^2$  values greater than zero suggests a predictive relevance, while values

less than zero indicates lack of predictive relevance. To calculate the  $Q^2$ , the output of running the blindfolding procedure yields the cross-validated redundancy approach value, which has both information from the structural and measurement model of a construct that is used to assess the predictive relevance of that specific endogenous construct based on guideline by Hair et. al. (2017).

Referring to Table 5.14, the  $Q^2$  of all the reflective endogenous construct of the model indicates a predictive relevance of the endogenous constructs AUSaaS, BI, ATT, PBC, and SN. For example, AUSaaS has a  $Q^2$  value of (.25) and BI has a value of (.51), which all of them have values for  $Q^2$  greater than zero indicating a predictive relevance of these latent endogenous reflective constructs. Likewise, ATT has a  $Q^2$  value of (.47), SN a value of (.43), and PBC a value of (.48) indicating predictive relevance of these constructs.

### 5.17 Effect Size ( $q^2$ ) Assessment

After the assessment of  $Q^2$ , the effect size  $q^2$ , which is the relative impact of the predictive relevance, is calculated using the following Equation 5.2 (Hair et al., 2017):

$$q^2 = \frac{Q^2_{\text{included}} - Q^2_{\text{excluded}}}{1 - Q^2_{\text{included}}} \quad (5.2)$$

where,  $Q^2_{\text{included}}$ : Refers to  $Q^2$  value of the endogenous construct when the selected exogenous construct included in the model estimated. This value is obtained in the first run of blindfolding routine on Smart PLS 3 Program.  $Q^2_{\text{excluded}}$ : Refers to  $Q^2$  value of the specific endogenous construct when the exogenous construct is excluded from the model estimated. This value is obtained after omitting the exogenous construct and run the blindfolding routine on Smart PLS M2 Program for the second time.

The guidelines for evaluating  $q^2$  effect size are taken from Hair et al. (2014, 2017) and the model indicates having a small, medium, or large effect size when the values are .02, .15, and .35, respectively. Unfortunately, the smart PLS M3 does not calculate the  $q^2$  effect size automatically and to obtain the values the formula above is used after running blindfolding routine two times, one including all the model construct and the other is after eliminating the respective constructs that are antecedents of the target latent construct under consideration.

Back to Table 5.14, the results are summarized for the purpose of demonstrating different values. For example, the  $q^2$  effect size of BI on AUSaaS ( $q^2_{BI---AUSaaS}$ ) has a medium effect (.18), while the predictive relevance  $q^2$  effect size of USecP on AUSaaS ( $q^2_{USecP---AUSaaS}$ ) is very small (.07). Besides, the predictive relevance  $q^2$  effect size of ATT on BI ( $q^2_{ATT---BI}$ ) has a pronounced value of (.36) and the effect is considered of being large. On the other hand, the predictive relevance effect size of PBC on BI ( $q^2_{PBC---BI}$ ) is small (.04), while SN has very small effect on BI ( $q^2_{SN---BI}$ ) and the value is (.01).

In addition, while the predictive relevance effect size of COM on ATT ( $q^2_{COM---ATT}$ ) has a small effect size (.05), PU on ATT ( $q^2_{PU---ATT}$ ) has also a small effect size of (.04), while PEU on ATT ( $q^2_{PEU---ATT}$ ) has no effect size (.00). Also, TRI has no effect size on ATT ( $q^2_{TRI---ATT}$ ) and the value is (.00).

Regarding the effect size of PBCSE on PBC ( $q^2_{PBCSE---PBC}$ ), PBCSE has a highly medium predictive relevance effect size with value of (.20), while PBCFC has a small effect size on PBC ( $q^2_{PBCFC---PBC}$ ) with obtained value of (.04). Regarding the effect size of SNPI on SN ( $q^2_{SNPI---SN}$ ), the effect has a highly-pronounced value of (.43), whereas the effect size of SNIS on SN ( $q^2_{SNIS---SN}$ ) is small (0.01).



Table 5.14

*Summary Results of The Endogenous Constructs of The Structural Model*

	AUSaaS			BI		
	R <sup>2</sup>	Q <sup>2</sup>	R <sup>2</sup>	Q <sup>2</sup>	Q <sup>2</sup>	
	0.45	0.24	0.63	0.48		
	Path Coefficients	f <sup>2</sup> Effect Size	q <sup>2</sup> Effect Size	Path Coefficients	f <sup>2</sup> Effect Size	q <sup>2</sup> Effect Size
ATT				0.62	0.66	0.36
PBC				0.21	0.07	0.04
SN				0.05	0	0.01
BI	0.55	0.45	0.18			
UsecP	0.21	0.07	0.03			
		<b>ATT</b>			<b>PBC</b>	
	R <sup>2</sup>	Q <sup>2</sup>	R <sup>2</sup>	Q <sup>2</sup>	Q <sup>2</sup>	
	0.66	0.44	0.68	0.45		
	Path Coefficients	f <sup>2</sup> Effect Size	Path Coefficients	f <sup>2</sup> Effect Size	q <sup>2</sup> Effect Size	
COM	0.40	0.16	0.05			
PEU	0.11	0.02	0.00			
PU	0.33	0.11	0.04			
TRI	0.06	0.01	0.00			
PBCFC			0.27	0.10	0.04	
PBCSE			0.61	0.52	0.20	
		<b>SN</b>				
	R <sup>2</sup>	Q <sup>2</sup>				
	0.54	0.40				
	Path Coefficients	f <sup>2</sup> Effect Size	q <sup>2</sup> Effect Size			
SNPI	0.65	0.60	0.43			
SNSI	0.14	0.03	0.01			

### 5.18 Mediation Effect Assessment

In the current research, the bootstrap of the indirect effects is measured, Preacher and Hayes (2004, 2008) approach and the guideline steps of Hair et. al. (2017) were used. Therefore, and against this background and argument, the bootstrap is performed to assess the current study and the results of the three mediating hypotheses are investigated. Figure C. 19 illustrates the mediation analysis of the model postulated. Worth mentioning, before investigating the mediating relationships, there are pre-requisites that has to be met before proceeding with the mediation analysis. The measurement model has to be checked against its reliability, discriminant validity, and collinearity.

Based on the results in the previous sections, these criteria are met and proceeding to mediation analysis is warranted. After that, the indirect effect and its significance is evaluated against its significance; if this condition is met, then the direct effect and its significance is evaluated. The results can be obtained by running the PLS algorithm and bootstrapping procedure in SmartPLS 3 program. Based on the results of the correlation and its significance, the level of mediation is defined as explained in Section 4.3.2.1 and its subsection.

By referring to Table 5.15, the results obtained show that the indirect effect from ATT via BI to AUSaaS ( $\beta = .25$ ) has an empirical *t* value of (6.82), yielding *p* value of (.00). The 95% confidence interval speaks in favor of the statistical significance of the indirect effect of ATT via BI to AUSaaS, as it does not include a zero in its range. Furthermore, the direct effect from ATT to AUSaaS ( $\beta = .09$ ) has a *t* value (1.58) that presents *p* value of (.11), which indicates a nonsignificant direct effect.

Table 5.15

*Summary Results of Mediation Assessment*

	<b>Direct Effect</b>	<b>t Value</b>	<b>p Value</b>	<b>95% Confidence Interval (CI)</b>	<b>Significance? Yes/No</b>	<b>Indirect Effect</b>	<b>t Value</b>	<b>p Value</b>	<b>95% Confidence Interval (CI)</b>	<b>Significance? Yes/No</b>
ATT -> BI -> AUSaaS	0.09	1.58	0.11	[0.00-0.21]	No	0.25	6.82	0.00	[0.1-0.33]	Yes
Total Effect	0.34	6.33	0.00	[0.23-0.44]						
Type of Mediation	Indirect-Only Mediation (Full Mediation)									
PBC -> BI -> AUSaaS	0.16	3.14	0.00	[0.06-0.26]	Yes	0.09	4.33	0.00	[0.06-0.14]	Yes
Total Effect	0.24	4.59	0.00	[0.14-0.35]						
Type of Mediation	Complementary Mediation (Partial Mediation)									
SN -> BI -> JUSaaS	0.06	1.28	0.20	[0.00-0.16]	No	0.02	1.36	0.18	[0.00-0.05]	No
Total Effect	0.07	1.50	0.13	[0.0-0.12]	Yes					
Type of Mediation	No-Effect Non-Mediation									

The 95% confidence interval supports this result, as it includes a zero value in its range. To summarize, the direct effect is not significant, while the indirect effect is significant. These results prove the mediating effect of BI in the relationship between ATT and AUSaaS and the type of mediation is indirect-only mediation or full mediation (Hair et al., 2017; Nitzl, 2016). Accordingly, H1a is empirically supported.

The same applies to the mediating role of BI on the relationship between PBC and AUSaaS. The statistics show that the indirect effect ( $\beta = .09$ ) has an empirical *t* value (4.33), indicating a *p* value of (.00), and supported by the confidence interval of being statistically significant. To further proceed with the analysis, the direct effect ( $\beta = .16$ ) has an empirical *t* value (3.14) and a *p* value (.00), supported by the confidence interval significance of the direct effect in the relationship from PBC via BI to AUSaaS. As can be observed, the direct and indirect effects are significant. This is indicative of a partial mediation as both the direct and indirect effects are significant. Consequently, this warrants additional assessment of the product of the direct and indirect effects. The results reveal that they have a positive value and in the same direction. Hence, the complementary mediation is assumed (Hair et al., 2017). Hence, H1c is supported empirically.

The last mediating effect of BI on the relationship between SN and AUSaaS was investigated. Based on Table 5.15. the results reveal that the indirect effect of SN to AUSaaS ( $\beta = .02$ ) has a *t* value of (1.36) and a *p* value of (.18), with confidence interval that includes zero in its range. As a result, the indirect effect is not statistically significant. To further proceed with the analysis of the direct effect, the results show that the direct effect ( $\beta = .06$ ) has a *t* value (1.28) that presents a *p* value of (.20) with confidence interval that includes zero in its range. Thus, the direct effect is also not

significant, in which the case is showing no-effect nonmediation of BI in the relationship between SN and AUSaaS. Based on these findings, hypothesis H1b is not supported empirically in the current study. Table 5.16 summarizes the findings of this section.

Table 5.16

*Results of Mediation Hypotheses*

<b>Hypothesis</b>	<b>Relationship</b>	<b>Findings</b>
H1a	ATT->BI->AUSaaS	Supported
H1b	SN->BI->AUSaaS	Not Supported
H1c	PBC->BI->AUSaaS	Supported

**5.19 Multigroup Analysis MGA**

This step of analysis is presumed to measure if there are any significant differences between the hypothesized relationship between students and lecturers in the postulated relationships on the model under study. On the other hand, heterogeneity in the aggregate data has an impact on the data being interpreted and can lead to misinterpreted the results and to affect the generalizability of the study (Matthews et al., 2016). Hence, and for the sake to advance in this analysis, recent research emphasized on two mean procedures to be accomplished to proceed with MGA, namely: Estimating the parameters in the structural model to find out if there is unobserved heterogeneity in the aggregate level and the measurement model invariance or equivalence.

Dealing with unobserved heterogeneity is tested by using FIMIX-PLS (Finite Mixture Invariance) technique, which is the first and one of the best approaches that emerged to deal with such issues (Matthews et al., 2016; Sarstedt, 2008); and secondly, MICOM

(i.e., Measurement Invariance Composite Model) approach by Henseler, Ringle, and Sarstedt (2016), which is used to uncover the invariance of the measurement model and to insure that survey questions are understood equally among the respondents and they are really measuring what is intended to be measured equally among these different respondents.

Moreover, the FIMIX-PLS is the first and best understood approach to measure the heterogeneity in the measurement model (Matthews et al., 2016; Sarstedt, 2008) that simultaneously “estimates structural model parameters and ascertains the data structure’s heterogeneity by calculating the probability that the observations will belong to a certain segment so that they fit into a predetermined number of segments” (Matthews et al., 2016, p. 220).

### **5.19.1 Uncovering Structural Model’s Heterogeneity Using FIMIX-PLS**

As indicated in the previous section, FIMIX-PLS is used to measure the unobserved heterogeneity in the model. Therefore, the procedure was run using Smart PLS 3.2.3, and after series of running the algorithm, using the guidelines in Matthews et al. (2016) and the example provided with steps to guide the implementations of the procedures to follow, the results revealed two segments.

To explain, the segment sizes were above the minimum sample size (54) based on R square of 0.25, maximum eight arrows pointing at a construct, at a significance level of 5% with statistical power of 80%. In addition, the overlap of the segments produced by the explanatory variable (i.e., Occupation variable with OC1, for student, and OC2 for lecturer) was above the 60% (i.e. the recommended satisfactory threshold) of the partitions produced by FIMIX-PLS (Hair, Jr., Sarstedt, Matthews, & Ringle, 2016).

Table 5.17 illustrates that an overlap is of about 61 per cent (i.e.,  $273+36/507=0.609$ ), which align with the aforementioned guidelines.

After identifying the number of segments to retain in analysis, the next step is to estimate segment-specific models by importing the file that included the FIMIX grouping to the original data set, creating the different groups based on FIMIX two segments and OC two groups, and then run the PLS Algorithm. Bootstrapping procedure was run to find out the significance of the different relationships.

First, the measurement model evaluation process is to take place initially before proceeding with further analysis, as guided by Hair et. al.(2017) and in Matthews et al. (2016). Table 5.18 revealed that the evaluation of the different FIMIX-PLS groups and the ones produced by the explanatory variable (i.e., OC\_G1 and OC\_G2) have met the reliability, validity criteria, and discriminant validity discussed in the previous sections and following guideline by Hair et. al. (2017). However, FIMIX\_G2 did not meet the discriminant validity criteria (i.e., using HTMT inference) in two relationships PBCSE -> PBC and SNPI -> SN. Nevertheless, they are not considered a violation of the assessment of different segments as the main focus is on the observed effects related to the occupation of the respondents as indicated in Matthews et al. (2016).

Secondly, after running the bootstrap procedure, the results obtained are shown in Table 5.18. Going through the different path coefficients relationship, the results reveal that there are differences in the values through all relationships among the FIMIX groups and the those produced by the explanatory variable OC.

Remarkably, the relationship PEU -> ATT is negative on FIMIX\_G1 ( $\beta = -.07$ ) but not reflected in OC\_G1 ( $\beta = .13^{***}$ ) or OC\_G2 ( $\beta = .12$ ). Also, SN -> BI has a negative relationship ( $\beta = -.2$ ) on OC\_G1; however, it is positive ( $\beta = .08^*$ ) and significant on group OC\_G2, whereas in FIMIX\_G1 (.03) and FIMIX\_G2 (.1) are positive and nonsignificant. Besides, SNSI -> SN has a negative relationship ( $\beta = -.01$ ) on OC\_G1, whereas this value is positive and significant on OC\_G2 ( $\beta = .25^{***}$ ), FIMIX\_G1 ( $\beta = .12^*$ ), and FIMIX\_G2 ( $\beta = .08^{**}$ ). In addition, TRI -> ATT is not significant in the two FIMIX groups FIMIX\_G1 and FIMIX\_G2 ( $\beta = .04, .05$ , respectively) also in OC\_G1; while it is significant on OC\_G2 ( $\beta = .1^*$ ).

Table 5.17

*Segments Produced by FIMIX-PLS and Related Explanatory Variable*

Group Coding (Student/Lecturer)	FIMIX_G1	FIMIX_G2
OC_1	273	102
OC_2	96	36

The third step is to evaluate the weighted  $R^2$  of the different endogenous constructs and comparing the values of the aggregate data set with those produced by FIMIX groups and by the explanatory variable, OC. To explain, the weighted  $R^2$  is calculated by multiplying the relative segment size with the related  $R^2$  of the different endogenous constructs with the different groups, as results shown in Table 5.18. Comparing the values of the aggregate model with those produced by FIMIX and OC explanatory variable, the findings show that there is an increase in the in-sample predictive power for the main DV of this study, i.e. AUSaaS (.46 to .47) and SN (.54 to .56). However, BI decreased in value (.63 to .62), ATT and PBC remained constant (i.e., .66, .68, respectively).



The overall test yields that heterogeneity based on the occupation (i.e., to be a student or academic staff) has an effect on the model partially in some paths as indicated above, and the next step before going to MGA analysis of the two groups OC\_G1 and OC\_G2 is to ensure measurement invariance, which is assessed in the following section.

Table 5.18

*Summary Results of Aggregate Data and Group Specific Results*

Relationship	Original Sample	FIMIX_G1	FIMIX_G2	OC_G1	OC_G2
N	507	369	138	375	132
Relative Segment size (%)	100	.728	.272	.740	.260
Path					
ATT -> BI	.62***	.58***	.63***	.63***	.56***
BI -> AUSaaS	.53***	.5***	.5***	.54***	.55***
COM -> ATT	.40***	.37***	.63***	.45***	.20*
PBC -> BI	.22***	.23***	.17	.18***	.29***
PBCFC -> PBC	.27***	.26***	.00	.25***	.3***
PBCSE -> PBC	.61***	.54***	1.00***	.61***	.62***
PEU -> ATT	.11**	.14**	-.07	.13**	.12
PU -> ATT	.34***	.34***	.31***	.29***	.50***
SN -> BI	.04	.03	.10	.08*	-.02
SNPI -> SN	.65***	.56***	.91***	.55***	.79***
SNSI -> SN	.14***	.12*	.08**	.25***	-.01
USecP -> AUSaaS	.18***	.16***	.23**	.18***	.20***
TRI -> ATT	.06*	.04	.05	.04	.01*
Reflective Measurement Assessment					
Convergent Validity (AVE)	Y	Y	Y	Y	Y
Reliability (Composite Reliability, Cronbach's alpha)	Y	Y	Y	Y	Y
Discriminant Validity (HTMT inference)	Y	Y	N	Y	Y
R Squared					
ATT	.66	.6	.77	.67	.64
AUSaaS	.46	.4	.60	.46	.50
BI	.63	.59	.69	.64	.56
PBC	.68	.54	1.00	.66	.73
SN	.54	.40	.95	.54	.61

Table 5.18 continued

Weighted R squared			
ATT	.66	.67	.66
AUSaaS	.46	.47	.47
BI	.63	.64	.62
PBC	.68	.68	.68
SN	.54	.56	.56

### 5.19.2 Assessing Measurement Model's Invariance Using MICOM

Before proceeding with MGA analysis, the measurement invariance should take place as a precondition for multigroup analysis to ensure that all respondents understand the questions equally among different groups of respondents. MICOM, (i.e., Measurement Invariance of Composite Model) approach by Henseler, Ringle, et al. (2016), is the first approach to accomplish the measurement invariance, which relies on the inference statistics using the permutation procedure in Smart PLS 3. In other words, MICOM used to uncover the invariance of the measurement model, to ensure that survey questions are understood equally among the respondents, and they are really measuring what is intended to be measured equally among these different respondents (Henseler, Ringle, et al., 2016). This measure is hardly used by researchers in the academia as it is a new approach and it needs a further extensive usage and understanding of the heterogeneity concept in survey quantitative research.

MICOM is a three-step approach; step one and two (i.e., configural and compositional invariance) ensure partial measurement invariance establishment, in which it give a green light to go further to discover variances among different groups of the survey by using Multi-group analysis. Step three, however, is the equality of mean values and variance. If the first two steps are met, and the third is also established, this confirms the full measurement invariance. That is, in the later, pooling of data is possible to uncover the differences among the respondents and the use of MGA as well. It is worth

mentioning that if there are problems in the Step 1 and/or Step 2, the researcher cannot proceed to conduct multigroup analysis (Henseler, Ringle, et al., 2016).

Starting with Step 1, the configural invariance: it is established here as a result of the identical three aspects, namely: The settings for the model estimations are the same for both groups, data treatment for the whole model, the group-specific data is identical for both groups (OC\_G1 and OC\_G2), and setup of the measurement and structural model is identical for both groups (Henseler, Ringle, et al., 2016).

In Step 2, the compositional invariance is assessed and requires that ( $c = 1$ ) or greater than 5% confidence interval. In other words, if the 5% confidence interval value is less or equal than the correlation between the two groups, this indicates that the compositional invariance is established. After running the permutation calculations in Smart PLS 3, the results reveal that the value of  $c$  (correlations between the groups for a specific construct) is equal to 1 in all cases and substantiate that none of the values of  $c$  are significantly different than one, in which  $p$  value supports this result, as illustrated in Table 5.19.

Table 5.19

*MICOM Results of The Measurement Model- Compositional Invariance Assessment*

<i>Composite</i>	<i>Correlation c value (=1)</i>	<i>5% quantile of the empirical distribution of Cu (should be <math>\leq c</math>)</i>	<i>p value (should not be significant)</i>	<i>Compositional invariance</i>
AUSaaS	1.0	.99	.5	Yes
BI	1.0	1.0	.9	Yes
PBC	1.0	1.0	.2	Yes
PBCFC	1.0	1.0	.3	Yes
PBCSE	1.0	1.0	.7	Yes

Table 5.19 continued

SNPI	1.0	1.0	.3	Yes
SNSI	1.0	1.0	.8	Yes
USecP	1.0	1.0	.9	Yes

Therefore, the compositional invariance is established for the model. In this stage, Step 1 and Step 2 are established; therefore, we have in this case achieved the partial measurement invariance, and thus, the researcher concludes that proceeding to compare the path coefficients of the OC\_G1 and OC\_G2 is possible using Multi-group analysis (MGA). It is possible, also, to proceed with mean and variance equality assessment (Step 3) to further investigate if the full measurement invariance is established or not.

In Step 3, the equality of mean and variance across groups is estimated to ensure the full measurement invariance is established. If the mean and the variance are equal to zero and nonsignificant, pooling data is to be taken into consideration to improve the statistical power of the structural model. In this case, if running MGA reveals that there are structural differences between the two groups, the model has to be extended by including moderating interaction effect that accounts to the differences in the structural relationships of the model (Henseler & Fassott, 2010; Henseler, Ringle, et al., 2016). Otherwise, the data is pooled if the MGA reveals no differences in the structural relationships of the model (Henseler, Ringle, et al., 2016) to increase the statistical power of the model estimated in the study.

As can be seen in Table 5.20 and Table 5.21, many of the constructs did not achieve mean differences as the differences in mean value does not reside in the interval of the lower or higher bound of (95% confidence interval) and the p value is significant,

which is the case it should not be to accomplish the full measurement equality or invariance. Hence, proceeding with pooling the data for further analysis does not hold. In this case, we revert to proceed with MGA to test the difference between the two groups of respondents, the student and academic staff groups.

Table 5.20

*MICOM Results of The Measurement Model- Mean Difference Assessment*

Composite	Difference of the composite's mean value (= 0)	95% Confidence Interval	p value (should not be significant)	Equal mean variances?
AUSaaS	-.23	[-.20,.19]	.00	No
BI	-.44	[-.2,.20]	.00	No
PBC	-.27	[-.21,.19]	.00	No
PBCFC	-.40	[-.19,.19]	.00	No
PBCSE	-.19	[-.20,.20]	.10	No
SN	-.03	[-.21,.19]	.80	No
SNPI	.06	[-.20,.19]	.50	No
SNSI	.32	[-.21,.18]	.00	No
USecP	.09	[-.21,.18]	.30	No

Table 5.21

*MICOM Results of The Measurement Model- Variance Ratio Assessment*

Composite	Logarithm of the composite's Variance ratio (= 0)	95% Confidence Interval	p value (should not be Sig.)	Equal variances?
AUSaaS	-.15	[-.36, .36]	.40	Yes
BI	.39	[-.35,.30]	.00	No
PBC	.36	[-.36,.35]	.00	No
PBCFC	.42	[-.34,.34]	.00	No
PBCSE	.14	[-.34,.33]	.50	Yes
SN	-.37	[-.33,.34]	.00	No

Table 5.21 continued

SNPI	-.14	[-.33,.35]	.40	Yes
SNSI	-.58	[-.37,.42]	.00	No
USecP	-.01	[-.28,.33]	.90	Yes

### 5.19.3 MGA assessment

Continuing the last phase of multigroup analysis, the results will give a clue of whether there is a difference between the two groups in the structural model or not. In SmartPLS program, the first thing to do is to generate the two groups that are supposed to be evaluated in terms of any significance difference between them in the related relationships of the current research. After having two distinctive groups, i.e. OC\_G1 and OC\_G2 as revealed from the FIMIX analysis in Section 5.19.1, the multigroup analysis (MGA) is run to find out the differences, if exist. Then, the values obtained of the differences are examined against their significance. If there is a significant difference, this yields different perceptions on the results obtained for the aggregate model, or the full set of data.

The MGA analysis was run on SmartPLS program. Considering the values of significance, i.e. values equal to or less than .10 and values equal to or greater than .95 (Sarstedt et al., 2011), and after referring to Table 5.22, results reveal that the relationships COM → ATT ( $\beta = .24, p < .05$ ), PU → ATT ( $\beta = .21, p = .95$ ), SN → BI ( $\beta = .11, p < .05$ ), SNPI → SN ( $\beta = .24, p = 1 - 1 = .00$ ), and SNSI → SN ( $\beta = .26, p < .05$ ) have significant differences between the two groups, i.e. OC\_G1 and OC\_G2, with regard to these specific path relationships. Other relationships seem to have no significant differences. So, there are five group-specific path coefficients differences so far.

Table 5.22

*Path Coefficients Differences between Student OC1 and Academic Staff OC2 Groups*

<b>Relationship</b>	<b>Path Coefficients-diff (  GROUP_OC (1.0) - GROUP_OC (2.0)  )</b>	<b>p-Value (GROUP_OC (1.0) vs GROUP_OC (2.0))</b>
BI -> AUSaaS	.03	.63
ATT -> BI	.08	.18
COM -> AUSaaS	.24	.03
PEU -> ATT	.01	.44
PU -> ATT	.21	.95
TRI -> ATT	.05	.81
PBC -> BI	.11	.89
PBCFC -> PBC	.05	.71
PBCSE -> PBC	.01	.54
SN -> BI	.11	.03
SNPI -> SN	.24	1.00
SNSI -> SN	.26	.00
USecP -> AUSaaS	.03	.66

In addition to that, further investigation of the total effects is assessed, and Table 5.23 substantiate that there are differences between the two groups for the above mentioned group-specific path coefficients under consideration, namely: SNPI paths (i.e. toward SN, BI, AUSaaS), SNSI paths (i.e. towards SN, BI, AUSaaS), SN paths (i.e. towards BI and AUSaaS), COM paths (i.e., towards ATT, BI, and AUSaaS), and finally PU towards ATT. These results support the previous findings on the relationships significant differences between the group of students and lecturers. This gives more confidence that there are some differences between the two groups regarding the total effect

Table 5.23

*The Total Effect Differences between The Two OC Groups (Students and Lecturers)*

Relationship	Total Effects-diff (  GROUP_OC (1.0) - GROUP_OC (2.0)  )	p-Value (GROUP_OC (1.0) vs GROUP_OC (2.0))
BI -> AUSaaS	.03	.63
ATT -> BI	.08	.18
ATT -> AUSaaS	.03	.33
COM -> ATT	.24	.03
COM -> AUSaaS	.09	.03
COM -> BI	.17	.01
PEU -> ATT	.01	.44
PEU -> AUSaaS	.01	.39
PEU -> BI	.02	.37
PU -> ATT	.21	.95
PU -> AUSaaS	.06	.88
PU -> BI	.10	.86
TRI -> ATT	.05	.81
TRI -> AUSaaS	.02	.77
TRI -> BI	.03	.77
PBC -> AUSaaS	.07	.89
PBC -> BI	.11	.89
PBCFC -> AUSaaS	.03	.88
PBCFC -> BI	.04	.89
PBCFC -> PBC	.05	.71
PBCSE -> AUSaaS	.04	.89
PBCSE -> BI	.07	.88
PBCSE -> PBC	.01	.54
SN -> AUSaaS	.06	.03
SN -> BI	.11	.03
SNPI -> AUSaaS	.04	.06
SNPI -> BI	.07	.05
SNPI -> SN	.24	1.00
SNSI -> AUSaaS	.01	.04
SNSI -> BI	.02	.03
SNSI -> SN	.26	.00
USecP -> AUSaaS	.03	.66

After extensive investigation of the relationships of the model, the above results substantiate that there is a significant difference between the students' group and the academic staffs' group in terms of direct and total effect of some path coefficients'



relationships. These relationships are concentrated in the tendency of the respondents in terms of the influence of superior and peer towards SN, BI, and AUSaaS. Moreover, the other relationship is mainly in the influence of COM on ATT, BI, and AUSaaS. Also, SN towards BI and AUSaaS, and finally, PU towards ATT. These relationships give more insights of the differences in the group-specific relationships. Hence, hypotheses H7 is partially supported in terms of the highlighted paths.

### **5.20 Educational Level (ED) Moderating Effect Assessment**

Sequel to discussion and explicated literature review of the concept and assessment procedures of the moderation effect, the following paragraphs demonstrates the results obtained from the analysis of the educational level on the relationships between BI and USecP constructs, from one hand, and AUSaaS, from the other hand. However, number of points are highlighted in this assessment measures. First, it should be noted that the assessment of the moderation effect is a complementary analysis.

Secondly, the moderator is evaluated in terms of its reliability, convergent validity, and discriminant validity. Thirdly, the attention is turned to the interaction effect significance and the effect size to interpret the results and not the moderator itself. Following that, if there is a significant effect, the moderating effect do exist.

The next step is to evaluate the effect size of that correlation of the interaction term. More importantly, the effect size in general is small in studying the moderation as indicated largely in literature, and can be said to have small (.005), medium (.010), or large effect size (.025) based on the review of the literature (Hair et al., 2017; Kenny, 2016). As a last note, the moderator differentiates from the mediator in that it has a

role of an exogenous construct or IV with its relationship with the DV or the outcome that meant to be moderated (Chiu et al., 2017).

The moderating effect of ED on the relationships BI → AUSaaS (interaction effect ED x BI) and USecP → AUSaaS (interaction effect ED x USecP) are evaluated in the following paragraphs after the evaluation of ED in terms of measurement level validity, which the accomplished in our model. Initially, the relationships BI → AUSaaS (with interaction effect ED x BI) are assessed by running both the PLS algorithm and bootstrapping.

To start with the analysis, the ED construct is added to extend the model with its indicators. Then, the interaction term is created by identifying the DV (AUSaaS), the moderator ED, and the IV in this case BI or USecP. Following that the orthogonalizing approach is selected. After the acceptance of the entries, the SmartPLS automatically creates the interaction terms (ED x BI and ED x USecP). After these initial steps, the PLS algorithm and bootstrapping are run with the standard settings (i.e., 5000 samples, path weighing scheme, no sign change, complete bootstrapping, BCe bootstrap, two-tailed with .10 significance level, and missing value treatment (mean replacement).

The results obtained shows the measurement reliability and validity of ED are met and no violations of the measurement model criteria were observed. After running the bootstrapping procedure, the significance level is evaluated, which the focus should only paid towards the interaction term as per the recommendation of Hair et al. (2017) on the moderating effect of the interaction. As can be seen from the results obtained, the interaction effect ED x BI has a significant positive relationship with AUSaaS ( $\beta = .08$ ) at ( $p < .05$ ) with a medium effect size  $f^2$  (.010), whereas the simple effect in the

relationship BI -> AUSaaS is ( $\beta = .54$ ). Figure C. 20 illustrates the results at Appendix C. Besides, the results disclose the significant role of ED and with medium effect size. In other words, the moderating effect of the educational level do exist in this relationship.

On the same way, the relationships USecP -> AUSaaS (with interaction effect ED x USecP) is evaluated and the result exhibits that the interaction effect ED x USecP has a significant positive effect on AUSaaS ( $\beta = -.10$ ) at ( $p < .05$ ) with a medium effect size  $f^2$  (.01), whereas the simple effect in the relationship USecP -> AUSaaS is ( $\beta = .21$ ). Figure C. 20 illustrates the results at Appendix C. The results disclose the significant and positive relationship of ED in the said relationship with a medium size effect. Table 5.24 illustrates the results the results obtained of this section.

Table 5.24

*Summary of Moderating Hypotheses*

Hypothesis	Moderation Relationship	Findings
H6a	BI x ED -> AUSaaS	Supported
H6b	USecP x ED -> AUSaaS	Supported

**5.21 Importance Performance MAP Analysis (IPMAP)**

Importance Performance MAP analysis (IPMAP) is another important feature that extends the results of PLS-SEM by contrasting the total effect of the predecessors of a specific construct (i.e., endogenous construct), which presents the importance of these predecessors on the target construct in a scale of 100, with the performance of the predecessors on that construct in which they represent the average values of these predecessors in an unstandardized form (Hair et al., 2017).

The total effect expresses the importance of the predecessors in shaping and predicting the target endogenous constructs. The importance of IPMAP resides in identifying the high important predecessor on the target construct and the relatively low performance predecessors so that there is an area of improvements for those predecessors that may shed the light for a managerial decisions and improvements (Hair et al., 2017).

By running IPMAP in Smart PLS M3, the interpretation of the values of importance and performance is as follows: Each unit increase in the performance of a predecessor, it increases the performance of the target endogenous construct by the size of the unstandardized importance value (i.e., the total effect) of the predecessor construct. To accomplish the objective of this research, the IPMAP results of the target constructs (i.e., BI, ATT, PBC, and SN) were assessed separately to shed the light on the constructs that are the main predictors and shape the target constructs.

The first step is to investigate the antecedents of BI (i.e., ATT, PBC, and SN), ATT (i.e., COM, PEU, PU, and TRI), PBC (i.e., PBCFC and PBCSE), and SN (i.e., SNPI, SNSI). First, antecedents of BI were assessed and Table 5.25 exhibits that ATT has the highest importance (.52) in predicting BI compared with PBC (.11) and SN (.23). Besides, ATT has the highest performance (72.66) among the other driver constructs of BI, namely: PBC (67.66) and SN (64.44).

Further, as can be seen from the results, there is a considerable room for improvement in performance for all these variables in the scale from 0 to 100. Moreover, the importance is high, which infer the relevance of improving the performance of these constructs towards the enhancement of the performance of BI. Last observation can be

noted as ATT has to be given the most attention for improving its performance, followed by PBC, and finally SN.

Table 5.25

*Summary of IPMAP for BI Construct*

Predecessors	Importance	Performance
ATT	.52	72.66
PBC	.11	67.66
SN	.23	64.24

In Figure 5.4 the relationship between the performance and importance of the antecedents of BI (ATT, SN, and PBC) and BI are visualized.

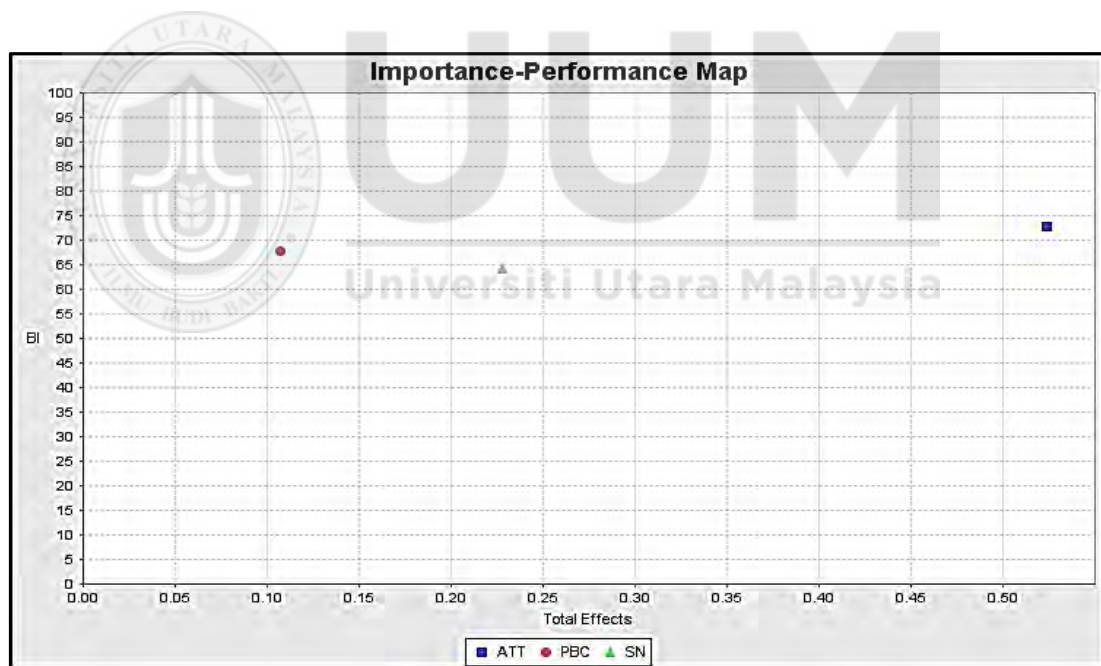


Figure 5.4. IPMAP analysis for BI and its antecedents

Secondly, antecedents of ATT were assessed. Table 5.26 exhibits that PEU and COM have higher importance (.36) and (.29), respectively, in predicting ATT compared with PU (.16), which is relatively less important. Besides, these three constructs give proof of their relevance in improving their performance that eventually will improve the

performance of AUSaaS. However, TRI (.07) has almost no effect with ATT that gives a clue on not having a relevance to improve its performance. Furthermore, almost all the antecedents have a relatively similar performance value of around (70), which is considered a medium performance. Yet, there is still a considerable room for improving their performance in the scale of 100, which, in return, will improve the performance of ATT.

Table 5.26

*Summary of IPMAP for ATT Construct*

Predecessors	Importance	Performances
COM	.29	69.77
PEU	.36	70.67
PU	.16	70.85
TRI	.07	69.36

Figure 5.5 the relationship between the performance and importance is visualized.

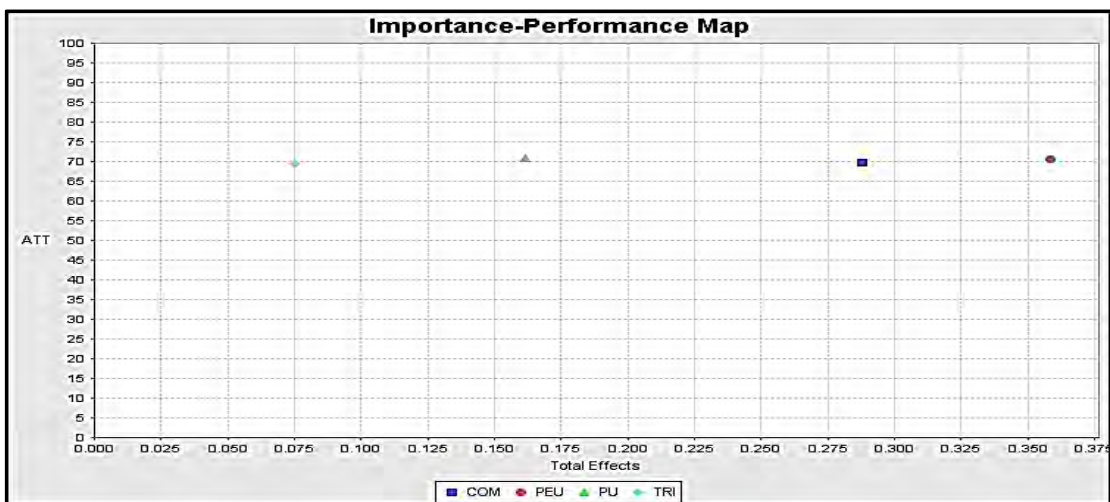


Figure 5.5. IPMAP analysis for ATT and its antecedents

Thirdly, antecedents of PBC were assessed. Table 5.27 exhibits that PBCFC has the highest importance (.56), while PBCSE has the lowest importance (.23) in predicting

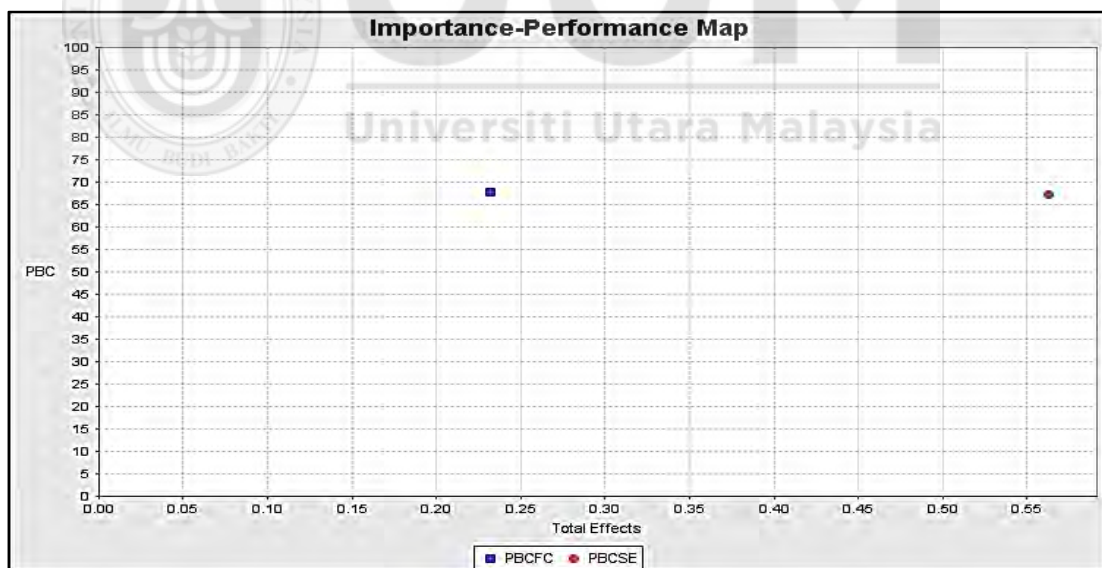
PBC. This means that the focus on PBCFC should be considered from a managerial point of view and improving it should be considered to improve the performance of AUSaaS cloud computing. However, both antecedents have almost similar performance value of around (67), which is considered a medium performance and there is a scope to improve their performance in the scale of 100.

Table 5.27

*Summary of IPMAP for PBC Construct*

Predecessor	Importance	Performances
PBCFC	.23	67.76
PBCSE	.56	67.19

Further, Figure 5.6 exhibits the relationship between the performance and importance for PBC constructs.



*Figure 5.6. IPMAP analysis for PBC and its antecedents*

Fourthly, antecedents of SN were analyzed, and the results presented in Table 5.28 exhibits that SNPI has the highest importance (.44), while SNSI has the lowest importance (.32) in predicting SN. This gives the confidence to focus on improving

the performance of SNPI as a priority, then to improve the SNSI as a second priority to improve the overall performance of AUSaaS usage, acceptance, or adoption.

Regarding the performance, both antecedents have almost similar performance value, where SNPI has a performance of (65.11), while the performance for SNSI is (66.05), in which both values indicate a medium performance. This indicates that there is still a considerable room for improvement of both constructs pertaining their performance in the scale of 100.

Table 5.28

*Summary of IPMAP Analysis of SN*

Predecessors	Importance	Performances
SNPI	.44	65.11
SNSI	.32	66.05

Further, Figure 5.7 illustrates the relationship between the performance and importance for SN constructs.

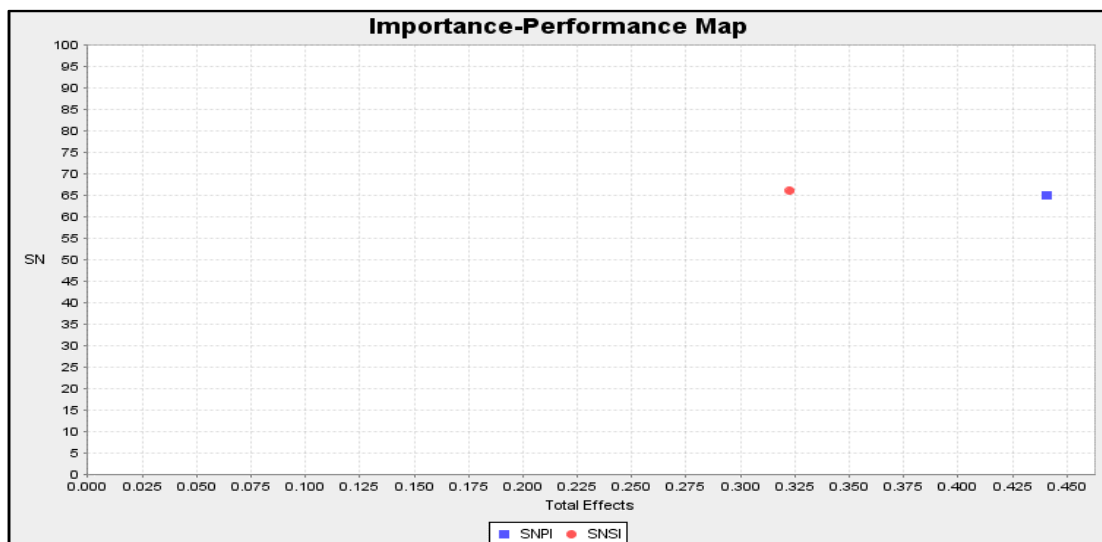


Figure 5.7. IPMAP analysis for SN and its antecedents



The second step is to investigate the main driver constructs of AUSaaS that are directly connected with it (i.e., BI and USecP) to further have insight of the predictors that have the most importance effect among them. Table 5.29 represents the results of this analysis and revealed that BI has the highest importance (.61) and a relevance for improvement its performance (70.34) in a scale of 100 to improve the outcome AUSaaS. This means that it has to be given the highest priority to improve the performance of the outcome of the study. On the other hand, USecP has a very weak importance (.01) and almost no relevance to improve its performance. However, the performance of all these driver constructs has a high performance of around (70) and there is room to improve their performance in the scale from 0-100.

Table 5.29  
*Summary of IPMAP Analysis of AUSaaS*

<b>Driver Construct</b>	<b>Importance</b>	<b>Performances</b>
BI	.61	70.34
USecP	.01	64.87

Further, Figure 5.8 illustrates the relationship between the performance and importance for AUSaaS constructs.

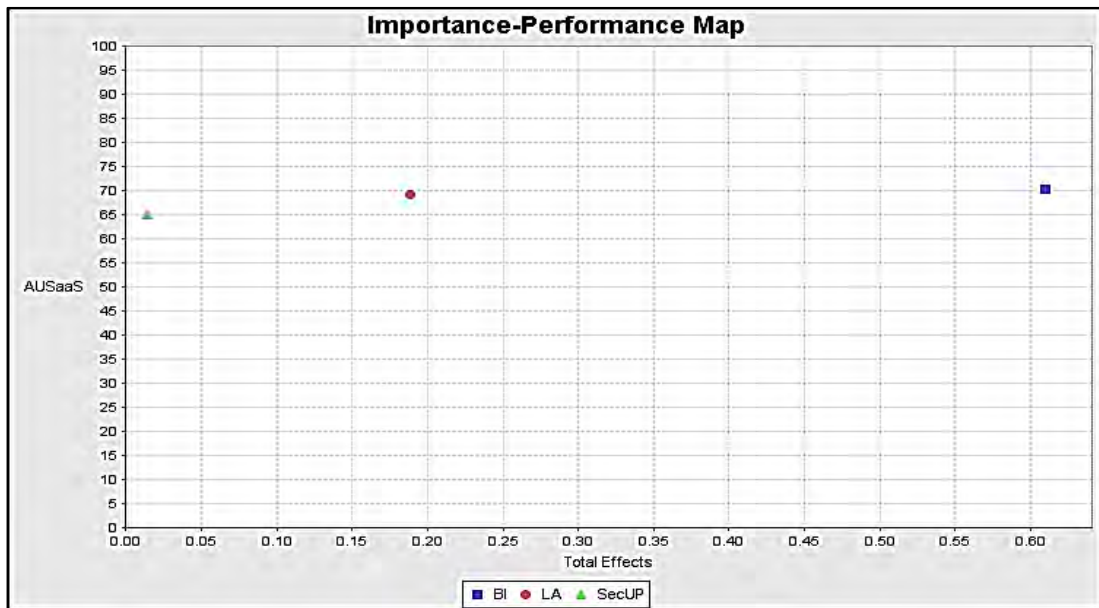


Figure 5.8. IPMAP analysis for AUSaaS and its driver constructs

## 5.22 Summary of The Hypotheses

The following Table 5.30 summarizes the findings related to the hypothesis of the current study.

Table 5.30

### Hypotheses Testing Results

Hypothesis	Statement	Findings
H1.	Behaviour intention (BI) has a direct and statistically significant positive relationship with the usage, acceptance, or adoption of SaaS Cloud Computing services (AUSaaS).	Supported
H1a.	BI has a mediating influence on the relationship between attitude (ATT) and AUSaaS.	Supported
H1b.	BI has a mediating influence on the relationship between subjective norms (SN) and AUSaaS.	Not supported
H1c.	BI has a mediating influence on the relationship between perceived behaviour control (PBC) and AUSaaS.	Supported
H2.	Attitude (ATT) has a direct positive and statistically significant relationship with BI.	Supported
H2a.	Compatibility (COM) has a statistically significant relationship with ATT towards using, accepting, or adopting SaaS Cloud Computing services.	Supported
H2b.	Perceived ease of use (PEU) has a statistically significant relationship with ATT toward using, accepting, or adopting SaaS Cloud Computing services.	Supported
H2c.	Perceived Usefulness (PU) has a statistically significant relationship with ATT on AUSaaS Cloud Computing.	Supported

Table 5.30 continued

H2d.	Trialability (TRI) has a statistically significant relationship with ATT toward using, accepting, or adopting SaaS Cloud Computing services	Not supported
H3.	User Security Predisposition (UsecP) is expected to have a statistically significant influence on accepting, using, or adopting SaaS Cloud Computing services.	Supported
H4.	Subjective norms (SN) is expected to have a statistically significant relationship with BI toward accepting, using, or adopting SaaS Cloud Computing services.	Not supported
H4a.	Peer influence (SNPI) is expected to have a statistically significant relationship with SN.	Supported
H4b.	Superiors' influence (SNSI) is expected to have a statistically significant relationship with SN.	Supported
H5.	Perceived behaviour control (PBC) is expected to have a statistically significant relationship with BI to use, accept, or adopt SaaS Cloud Computing services.	Supported
H5a.	Self-efficacy (PBCSE) is expected to have a statistically significant relationship with BI to use, accept, or adopt SaaS Cloud Computing services.	Supported
H5b.	Facilitating Conditions (PBCFC) (i.e., resources and technology) are expected to have a statistically significant relationship with BI to use, accept, or adopt SaaS Cloud Computing services.	Supported
H6a.	There is a statistically significant moderating effect of Educational Level (ED) on the relationship between BI and AUSaaS.	Supported
H6b.	There is a statistically significant moderating effect of Educational Level (ED) on the relationship between UsecP and AUSaaS.	Supported
H7.	It is expected to have a statistically significant difference between the two groups (i.e., students and academic staff) in HE sectors on the relationships towards accepting, using, or adopting SaaS Cloud Computing services.	Partially Supported

### 5.23 Summary

This chapter presented the analysis of the collected data with different phases of filtration process until the actual statistical evaluation is conducted in subsequent sections. The research has conducted extensive, rigorous, and reliable approaches that emerged with recent analytical approaches found in literature. It started with the analysis of the measurement model to find out if the questionnaire items along with their constructs are meeting the acceptable criteria to proceed to the Second Approach of the hypotheses testing. Results were promising and in line with the acceptable criteria on the measurement model. Then, in the next step, the hypotheses testing using

the structural modeling analysis was performed and the results obtained for the different relationships postulated. After that, the mediating effects' testing was investigated for the role of BI as a mediator. The results revealed its full mediation with ATT, partial mediation with PBC, and no mediation effect on SN. Following that, the multi-group analysis using state of the art analytical investigation existed in literature, where different stages were performed. Next, the moderating effects of education level were analyzed and proved the moderating effect of ED in the relationships postulated.

In addition, different advanced methods used in the analysis different phases such as: IPMAP, the effect sizes  $f^2$  and  $q^2$ , MICOM, and FIMIX. These extended advanced tests were used to ensure that the results revealed follows a rigorous analysis beyond the basic and fundamental approaches followed generally in the social sciences research. The last part of this section summarized the findings of the results of different hypotheses where out of 19 hypotheses, only 15 hypotheses were found to be significant. For example, BI, ATT, PBC, and USecP were significant, while SN did not show significance with BI. Table 5.30 demonstrates the hypotheses for easy reference.

## **CHAPTER SIX**

### **DISCUSSION OF RESULTS AND CONCLUSION**

#### **6.1 Introduction**

The organization of this chapter is presented as follows. Firstly, the discussion of the hypotheses is presented and related support from literature is demonstrated with interpretation. Then, the personal use of SaaS services among respondents were further discussed and explained with supported illustration. After that, the research questions and objectives were discussed. Next, the revised version of the model was presented. Additionally, the implications of the study in terms of theoretical implications, the practical implications, and methodological implications were presented. Followed by the limitation of the current study and suggestions for future studies. Finally, the conclusion is presented.

#### **6.2 Discussion of The Hypotheses Results**

##### **6.2.1 The Effect of BI on AUSaaS**

Hypothesis 1 states that behavior intention (BI) has a direct and statistically significant positive relationship with the usage, acceptance, or adoption of SaaS Cloud Computing services (AUSaaS). The empirical investigation of this study is supporting the hypothesis H1. In the context of the current study, BI is defined as the degree in which the individual- student and academic staff- using, accepting, or adopting the personal level of SaaS Cloud Computing services has formulated conscious plans to use or not use these services in the future that were provided by SaaS provider.

The findings indicate that both student and academic staff have formulated conscious plans to use, accept, or adopt SaaS Cloud Computing services in the future. Also, this result implies that the more the respondents have positive thinking towards the innovation of SaaS services and applications, the more likely they would use, accept, or adopt it in their future work either privately or on work-related tasks. Besides, the inferences drawn from the study suggest that the respondents of both groups of participants have a strong intention towards the use, acceptance, or adoption of SaaS services and this strong intention leads to the actual adoption of this innovative technology. More importantly, the empirical support is evident in the strong relationship between BI and AUSaaS that evolves around the fact of the strong intention of participants towards SaaS services.

Besides, intention is regarded as the baseline for an effective adoption of innovation (F. T. S. Chan & Chong, 2013; Martins et al., 2016). Worth mentioning, the adoption of an innovation goes through different stages, starting with a systematic stages towards the adoption (F. T. S. Chan & Chong, 2013; Martins et al., 2016). Initially, the evaluation process takes place. Afterwards, when realizing the benefits or features that encourages the user to continue, this signals the intention for the actual adoption (F. T. S. Chan & Chong, 2013).

To reflect these views, the user of SaaS services in the context of the study, evaluates the benefits. If they presume its tangle benefits and features, a positive and favorable feeling is emerged. That feeling signals the decision to adopt. Therefore, and based on the findings, BI exerts the strongest influential effect of AUSaaS. That reflects the strong intention of the respondents towards the use, acceptance, or adoption of SaaS services.

To conclude, previous works have supported the relationship of BI towards the use or adoption of technology (Ahmed & Ward, 2016a; Pinheiro et al., 2014; Sonthiprasat, 2014; Taufiq-Hail, Ibrahim, & Yusof, 2017b; Taufiq-Hail et al., 2017b; Taylor & Todd, 1995; Velázquez, 2014), where this study is not an exception.

### **6.2.2 The Mediating Effect of BI on the Relationship between ATT and AUSaaS**

Hypothesis H1a states that BI has a mediating influence on the relationship between attitude (ATT) and AUSaaS. The hypothesis gained support empirically in this study and has proven that BI mediates the relationship between ATT and AUSaaS. In addition, Table 5.15 confirms this relationship in that the direct effect is not significant ( $\beta = .09$ ), while the direct effect is statistically significant ( $\beta = .25$ ) and the type of mediation is full mediation.

To interpret the findings, the direct effect is not significant and implies that even though the individual (i.e., student or academic staff) has a positive feeling towards AUSaaS cloud computing, it did not directly translate into action to use, accept, or adopt SaaS Cloud Computing. The results also suggest that there is an indirect effect of ATT that is related to AUSaaS. Both results, the nonsignificant direct effect and the significant indirect effect, suggest a mediating effect of BI.

Besides, the findings shed more light on the fact that individual's evaluative judgment on SaaS services is processed by intention to determine the motivation to the action of using, accepting or adopting SaaS Cloud Computing as explicated in a recent study by Mafabi et al. (2017) in knowledge sharing. In other words, and based on the positive feelings and cognitive outcomes, the individual develops and builds goals and mechanisms to perform the action of using, accepting, or adopting SaaS services.

These goals are eventually contributing to the intention to perform the action of using, accepting, or adopting SaaS Cloud Computing (Mafabi et al., 2017).

In principle, the literature lent support of the theoretical foundation and emphasized the important mediating role of BI in the relationship between the actual behavior (or adoption, usage, acceptance) and ATT, SN, and PBC (Ajzen & Madden, 1986; Fishbein & Ajzen, 1975). Moreover, other studies pointed out to the mediating effect of intention on the relationship between ATT, SN, and PBC with AB (Albarq & Alsughayir, 2013; T.-Q. Peng et al., 2012). Additionally, T.-Q. Peng et al. (2012) asserts that BI is an important mediator between the AB and other psychological factors.

To conclude, it can be said that favorable formed attitude of respondents has stimulate their intention as an early stage in the adoption process to take decision in using, accepting, or adopting SaaS services. This mediating stage is stronger and more influential in direction of the adoption of SaaS services than the direct relationship between ATT and AUSaaS. The role of intention in a pre-stage of the adoption stage has been explicated and advocated in previous research in which this research is no exception (F. T. S. Chan & Chong, 2013; Martins et al., 2016).

### **6.2.3 The Mediating Effect of BI on the Relationship between SN and AUSaaS**

Hypothesis H1b states that BI has a mediating influence on the relationship between subjective norms (SN) and AUSaaS. This relationship is not supported empirically in the current study, refer to Table 5.30. In fact, Table 5.15 contend that the relationship between SN and AUSaaS cloud computing is not mediated. To explain, the direct ( $\beta = .02$ ) and indirect effect ( $\beta = .02$ ) in the relationship are weak and nonsignificant,



giving more support for the nonsignificant role of BI in the mediating effect in the proposed relationship. In principle, this rigorous and extended analysis is made to ensure that the testing of the hypothesis undergoes strict evaluation.

In addition, the weak relationship between SN and BI implies the individuals do not pay much attention to the surrounding social circle in building their behavior of future plans to use, accept, or adopt SaaS innovative and noble technology. This result is in line with recent research on using noble technologies (Alalwan et al., 2017). Although the relationship contradicts with the hypothesis in the context of the study, this gives more insight in this explorative research on the nature of individuals in Malaysian higher education. That is, the students and academic staff have their own strategy in future plans that builds upon their own perceptions of future use of innovative technology such as SaaS Cloud Computing.

Besides, if we look at the direct effect of SN to AUSaaS, we further find that the correlation between the two is weak and nonsignificant that emphasizes and warrants the minor effect of social beliefs in formulating the behavior of using, accepting, or adopting SaaS services and gives more room for individuals to decide their usage or not of this technology away from the influence, recommendations, or perceptions of others in social community inside the university or outside campus.

#### **6.2.4 The Mediating Effect of BI on the Relationship between PBC and AUSaaS**

Hypothesis H1c states that BI has a mediating influence on the relationship between perceived behavior control (PBC) and AUSaaS. This relationship is supported empirically in the current study, refer to Table 5.30. In fact, Table 5.15 contend that the relationship between PBC and AUSaaS is mediated by BI and the type of

meditation is complementary or partial mediation. The direct ( $\beta = .16$ ) and indirect effect ( $\beta = .09$ ) of the relationship is significant and this gives additional proof of the partial mediation. In fact, this rigorous and extended analysis is made to ensure that testing of the hypothesis undergoes strict evaluation as there is scarcity of research that studied the mediating effect of BI on the actual behavior in academia (Mafabi et al., 2017).

In addition, the direct positive and significant effect of PBC toward AUSaaS suggests that the individual has formulated his/her belief to use, accept, or adopt SaaS Cloud Computing based on his/her perceived controllability. However, the indirect positive and significant effect on AUSaaS also suggests that there is another way of this effect through the intention of the individual. That is, when an individual has a belief in his capabilities and in control of the facilitating conditions, he/she develops goals and strategies that drive his/her motivation (intention) to perform the actual behavior of AUSaaS. Both directions, the direct and indirect, implies that there is a mediating effect of BI in relationship between PBC and AUSaaS. More precisely, the total effect in this relationship is reduced by the indirect effect through BI, which provide more space to the direct effect and the indirect effect.

To conclude, the direct effect of PBC means that there is a possibility that the user of SaaS services if having a strong understanding, more skills, availability of resources, and time to use, it is more likely that they take this challenge and start using the services with no previous stage of evaluation. These users can be said to be the innovators in the stages of the adoption of innovative technologies as explained by Roger (1983). On the other hand, the indirect effect of PBC is much higher and reflect that majority of respondents believe that the evaluation process is a priori and to

formalize their positive belief, where, in turn, signals their intention to adopt SaaS. This direction of explanation is advocated by number of researches (F. T. S. Chan & Chong, 2013; Martins et al., 2016).

### **6.2.5 The Direct Effect of ATT on BI**

Hypothesis 2 states that attitude (ATT) has a direct positive and statistically significant relationship with BI. The empirical investigation of this study is supporting hypothesis H2. Also, ATT is defined as the degree of favorability or unfavourability felt by the individual in higher education in relation to the usage, acceptance, or adoption of SaaS Cloud Computing in the personal level of the services provided.

The findings revealed the relationship between ATT and BI is significant and with large effect of ATT on BI ( $\beta = .62$ ). This implies that ATT wields its strong significant influence on BI. Furthermore, the R<sup>2</sup> result of ATT is reflecting its importance in the model proposed by the given value of 66%, which is considered substantial. This result can be interpreted as explained by Ajzen (1991) that ATT is created by a belief based on the evaluation, appraisal, or judgement of a certain behavior, and this belief creates a motivation to conduct that action as a result of this salient belief. This motivation or intention is consequently driving to that specific behavior such as AUSaaS cloud computing.

In other words, SaaS Cloud Computing online services, the 24-hour access to applications, storage, and tools with convenience of the location and usage of variety of devices to access SaaS Cloud Computing services make it advantageous compared with other conventional methods. These tangible benefits create a belief on the

individual that motivates him/her to use, accept, or adopt an innovative technology such as SaaS Cloud Computing.

Besides, the traditional methods - such as using computers at office hours, accessing data using USB devices that may malfunction easily, or the limited use and sharing capabilities of files, data, or multimedia at university premises - can be a source of disturbance for the individual (student or academic staff). These limitations can be avoided by SaaS Cloud Computing services that influence the individual's positive appraisal between the conventional methods or SaaS services, and therefore, creates a positive feeling that develop a belief, which motivates him/her to use, accept, or adopt SaaS Cloud Computing.

In other words, the more favorable attitude the participant possesses toward SaaS services and applications, the stronger the positive feelings are hold, the more behavior intention formulated, and the behavior to be conducted. This finding lines with the conclusion of where they emphasized that the favorable attitude creates a favorable and vital role on the intention.

This result mirrors the previous works in different contexts, where the ATT exerts a strong influential role on BI (Al-Hujran, Al-Debei, Chatfield, & Migdadi, 2015; Hung et al., 2012; Jain et al., 2017; M. Kim & Qu, 2014; Taufiq-Hail, Ibrahim, & Yusof, 2017a; Thoradeniya et al., 2015; Ting, Run, & Thurasamy, 2015; L.-H. Wu, Wu, & Chang, 2016). The past literature and theories, also, affirm that there is a strongly positive and significant relationship between ATT and BI, and ATT is an important antecedent of (Ajzen, 1991; Fishbein & Ajzen, 1975; Taylor & Todd, 1995). To

conclude, the behavior intention to use, accept, or adopt SaaS services can be stimulated by the favorable attitude as emphasized by Ramayah et al. (2009).

#### **6.2.5.1 The Direct Effect of COM on ATT**

Hypothesis H2a states that compatibility (COM) has a statistically significant relationship with ATT towards using, accepting, or adopting SaaS Cloud Computing services. The empirical results lend support for hypothesis H2a. In the current study, COM is defined as the extent to which the SaaS Cloud Computing services fit or perceived to be consistent with the services that the individual, in higher education, use in a computer in his/her university or privately. Also, the extent in which the SaaS Cloud Computing services' usage, acceptance, or adoption fit or perceived to be consistent with the existing technological services, past experiences, and needs where the individual can use in a computer or smart device in his/her university or privately.

Besides, the relationship between COM and ATT is positively and significantly correlated ( $\beta = .40$ ) and their association is considered high. The findings highlight the critical role of COM in forming the ATT of the participants in the context of the study. The results can be interpreted according to Rogers (1983), the more compatibility and accordance of the technology that the user can obtain, the more likely this technology is adopted, used, or accepted. That is, the individual (student or academic staff) if (s)he finds that the new technology of SaaS Cloud Computing has its compatibility with what (s)he is using but with better features, the likeability that (s)he will use, accept, or adopt it is with higher probability.

Furthermore, Rogers (1983) argues if an idea is not compatible with a well-known, common, or highly accepted values and norms, it will not be accepted rapidly as the

one compatible in any social science. In other words, the compatibility is a critical factor for the individuals to accept, use, or adopt the SaaS Cloud Computing when they compare it with conventional daily usage of other available technologies. If SaaS Cloud Computing is not compatible with what they know and have the sense of convenience, they will probably do not proceed with using, accepting, or adopting it. They will stick to the technology that is compatible and has more features to add. The argument was stressed by Lian et al. (2014) in which they opine that the more compatibility to the systems and application that the user have while using the services of clouds, the more helpful and feasible the adoption of cloud computing do occur.

Moreover, this result goes in accordance with prior literature in the critical role of COM on ATT in different contexts (Agag & El-Masry, 2016; Ahmed & Ward, 2016b; Hafezi, Abdavi, & Pashaie, 2016; M. Kim & Qu, 2014; S. G. Lee et al., 2013; Susanto & Goodwin, 2013; Tweel, 2012). Also, COM is supported by many theories as it influences ATT. For instance, DTPB and DOI give significant support of COM as an antecedent of ATT (Rogers, 1983; Taylor & Todd, 1995).

To conclude, to enhance the favorable attitude towards SaaS services and applications, SaaS services providers should pay more attention to stimulate the compatibility of their services to be a perfect match to the users' systems either in their smart devices or the computers. This is clear in the results obtained, where COM is the most influential factor of ATT

#### **6.2.5.2 The Direct Effect of PEU on ATT**

Hypothesis H2b states that perceived ease of use (PEU) has a statistically significant relationship with ATT toward using, accepting, or adopting SaaS Cloud Computing

services. The results revealed lend support for hypothesis H2b. Also, in PEU is defined as the degree in which the SaaS Cloud Computing services' usage, acceptance, or adoption are free from worries, difficulties, or effort to achieve the perceived performance.

By referring to the empirical findings, they assert that the relationship between PEU and ATT is empirically positive and significant with a correlation of ( $\beta = .11$ ). This implies that the participants assessment of the perceived ease of use of SaaS services aligns with their ATT towards using, accepting, or adopting it in their daily errands either privately or pertaining their academic tasks.

Besides, the findings shadow the fact on that ATT towards the use, acceptance, or adoption of SaaS services would be favorable if PEU is felt by the participants and is being significant. This significant effect reinforces the favorable ATT and thus drives to the usage, acceptance, or adoption of SaaS services. On the other hand, in recent years, many services were shifted to the Internet to be processed or stored as a result of its easiness. For instance, many SaaS services such as social network sites or applications (e.g., Facebook, WhatsApp or Google and Microsoft services, etc.) are using SaaS services to accomplish this goal of ease of use and achieve this easy trend to the public. Thus, the ease of use is an appropriate means toward the attitude to use, accept, or adopt innovative technology such as SaaS service.

Additionally, Davis (1989) articulate that easiness creates a feeling of being free from worries, difficulties, or effort to achieve the perceived performance when using the innovative system. In other words, the easier the technology perceived by the

individual, the more likely that this technology influences the attitude to accept, use, or adopt SaaS Cloud Computing.

Additionally, the results obtained are lining up with previous findings in literature theoretically as in theories such as TAM, DOI, and DTPB (Davis, 1989; Rogers, 1983; Taylor & Todd, 1995) or empirically in different contexts (Ahmed & Ward, 2016b; Ayeh et al., 2013; Gallos et al., 2011; Hung et al., 2012; E. Park & Kim, 2014; Susanto & Goodwin, 2013).

To sum up, the favorable attitude towards SaaS services and applications can be enhanced by stimulating the easiness of services or applications. This can be achieved by the SaaS providers in the design of their services and the interface of the application to use them.

#### **6.2.5.3 The Direct Effect of PU on ATT**

Hypothesis H2c states that perceived usefulness (PU) has a statistically significant relationship with ATT on AUSaaS. Moreover, PU is defined as the degree in which the SaaS Cloud Computing services' usage, acceptance, or adoption are perceived to be better to use, access, understand faster, and be reliable to be accessed as compared with the conventional methods of storing/ uploading/ sharing different data in local hard drive or inside local server.

Hypothesis H2c gained empirical support in the current research. The results denote that PU has a positive and significant effect ( $\beta = .33$ ) on ATT of individual to use, accept, or adopt SaaS Cloud Computing. This implies that the favorability of ATT can be reinforced if the user of SaaS services is having a strong feeling of its usefulness



and its relative advantage compared with other technologies already used, practices, tried, or tested. Therefore, the perceived usefulness of any innovative technology, such as SaaS services, would lead to higher likability to be used, accepted, and adopted. In other words, when the technology is useful and presumed to be better than its supersedes, it would be perceived as useful (Davis, 1989; Rogers, 1983) and, therefore, has an influence on the attitude to use it, accept, or adopt it.

The result is not surprising as prior research has similar findings on this respective relationship and gained support theoretically (Davis et al., 1989; Rogers, 1983; Taylor & Todd, 1995) and empirically (Ahmed & Ward, 2016a; Giovanis et al., 2012; Huh et al., 2009; Hung et al., 2012; M. Kim & Qu, 2014; Lai & Hitchcock, 2017; Renda dos Santos & Okazaki, 2016). Ramayah et al. (2009), also, emphasized that if the perception of usefulness is high toward a certain innovation, ATT would be more favorable towards the use, acceptance, or adoption of the innovation.

Additionally, H.-L. Yang and Lin (2015) indicated that when IT supports the user in his/her tasks, it is evident that the perceived usefulness of an IT is giving advantage to the user and increases the usage of IT. This also leads to the increase of the intention towards using IT. Moreover, the authors pinpoint that when the system provides support, help, or information to the user, the user would be more likely to continue using it as the perceived usefulness is achieved. However, if the system fails to achieve the tasks or performance that are the objective of the user, the user would inevitably lose the trust in the system (H.-L. Yang & Lin, 2015) To summarize, PU is an important technological factor in the use and adoption of innovation such as SaaS services.

#### 6.2.5.4 The Direct Effect of TRI on ATT

Hypothesis H2d states that trialability (TRI) has a statistically significant relationship with ATT toward using, accepting, or adopting SaaS Cloud Computing services. Also, TRI is defined as the degree in which the SaaS Cloud Computing services on the personal level are tested prior to the actual usage, acceptance, or adoption for a limited time.

The hypothesis is found not to be empirically supported in this study. Furthermore, TRI demonstrated a weak nonsignificant influence ( $\beta = .08$ ) on ATT of individual to use, accept, or adopt SaaS services. This finding can be interpreted as individuals at university levels are already acquainted with SaaS services based on their daily usage of many applications inside or outside the academic work/study. Although they might not know it is based on Cloud technology, as many uses the services of SaaS in their mobile applications, portal usage, or computer software packages, they have experience to use SaaS application in daily routines.

To further explain, it is assumed by the insignificant role of TRI on ATT that the participants have prior experience with the usage of SaaS services and this is not a first time use of this technology, so they have already gained the knowledge and prior experience to use it and to judge its benefit. Therefore, this construct did not show its critical role in shaping or reinforcing the favorability of ATT towards using, accepting, or adopting SaaS services.

This result is not surprising as being accustomed to something, it is more likely not to make further changes or influences in the way the individual act, that is their attitude to use, accept, or adopt SaaS services. Similar findings found in previous works in that

TRI does not have an influence on ATT (Gallos et al., 2011; Y. Park & Chen, 2007). Y. Park and Chen (2007) reported that trials before using smartphone would not have a positive effect on the respondents' ATT. Also, He, Duan, Fu, and Li (2006) reported that TRI is exerting a relatively weak correlation in predicting the adoption of innovations.

### **6.2.6 The Direct Effect of USecP on AUSaaS**

Hypothesis 3 states that User Security Predisposition (USecP) is expected to have a statistically significant influence on accepting, using, or adopting SaaS Cloud Computing services. To explain the findings, Table 5.9 demonstrates that the relationship between USecP and BI is significant and exhibiting an influence of USecP on BI ( $\beta = .21$ ). This finding gives more insight in this explorative nature of the current research on the individuals' in Malaysian higher education context in that the students and academic staff have trust and confidence on the SaaS service providers with the belief that their privacy and security are maintained. That positive security predisposition is reflected in their usage and acceptance of SaaS services, in which the significant correlation is evident.

It is worthwhile that CRD has been proven in different studies to have a positive and significant relationship with BI and ADP of specific behavior (Ariff et al., 2012; Engwanda, 2014; Fan et al., 2013; Hanafizadeh et al., 2014). Similarly in the current research, the strong correlation between CRD and USecP is clearly evident in the results obtained CRD ( $\beta = .93$ ). Consequently, this behavior of the respondents gives more insight on the proper credibility (i.e. privacy and security) that they perceive while using the SaaS Cloud Computing services. Hence, including CRD as a

dimension of USecP shows its relevance on the acceptance and usage of SaaS Cloud Computing services and aforementioned results.

Besides, few studies focused on the direct relationship between TRT and the adoption, behavior, or actual use of technology, namely: Yee-Loong Chong et al. (2010), Hanafizadeh et al. (2014); and Engwanda (2014). Their results shed light on the positive and significant role of TRT on the actual behavior. In the same vein, the results of USecP is in line with the previous works, and TRT exhibits an empirically positive and significant relationship with AUSaaS. The strong correlation (i.e., TRT has  $\beta = .94$ ) draw more support in including it as a dimension of USecP. Hence, the findings support including TRT as one dimension of USecP construct.

To interpret the results, it can be said that when the respondent is content with SaaS applications or services that (s)he uses on daily bases (e.g., WhatsApp, twitter, Facebook, e-mail/storage/multimedia SaaS Cloud Computing services), this creates a feeling of trust that may evolve into confidence of SaaS providers that eventually reflects into an action to accept and adopt SaaS services and applications.

In other words, it can be inferred that this trust, sense of security, and privacy that the respondents have is reflected in the significant relationship between USecP and AUSaaS. To explain, the positive security predisposition of the respondents is seeming to be fairly acceptable in terms of the usage or acceptance of SaaS. Also, if a student/lecturer at the university uses Dropbox, as an example or other SaaS Cloud Computing online services, to store and share his/her files, this student, consequently, is utilizing innovative technology that exposes him/her to different security threats. These threats may hinder him/her from proceeding in his/her transactions over

unsecure internet in case of no trust on the service provider measures in securing these transactions. Accordingly, the sense of trust and convenience make the respondents accept and continue to use SaaS services.

Furthermore, keeping their storage with SaaS Provider's infrastructure reflects the respondents' positive security predisposition on SaaS providers. Similarly, the installation or usage of programs/programming tools obtained from the SaaS providers and using them in their own devices shed more light on this bilateral trust and sense of positive security predisposition.

In principle, trust and the positive feeling of security play vital roles in the success in computer environments' operations and are strong determinants of the decision to adopt an online innovation (Ooi & Tan, 2016; H.-L. Yang & Lin, 2014). The internet, which is the medium of SaaS services, creates the sense of uncertainty because of lack of rules to govern the rights of the users on a large scale (H.-L. Yang & Lin, 2014). Besides, if the SaaS provider acts in a benevolence manner, having integrity, and shows strong competence, this would lead to create a sense of security and trust (Ooi & Tan, 2016; H.-L. Yang & Lin, 2014).

Previous researches confirm that without a mutual trust between the trustor and the trustee in unsecure environments, such as transactions over the internet when using SaaS services, a long-term relationship cannot be established (Ooi & Tan, 2016). In that view, the unsecure environment creates a sense of uncertainty and fear and if the user of technology does not have enough trust, the establishment of long-term relationship, especially in the virtual communities such as SaaS social media services, is not possible or is likely weak (H.-L. Yang & Lin, 2014).

In other words, the potential of the providers' opportunistic behavior if perceived by the trustor or the user of SaaS services, this may hinder the use of its services. On the other hand, if a sense of trust, security, and privacy are perceived, the potential of such fears are reduced and thus motivates to use, accept, or adopt the innovation (in this case SaaS services).

To conclude, drawing on the findings obtained, the effect of user security positive predisposition (USecP) construct is evident in the current research and infers that there is a positive sense of relationship between the respondents and SaaS providers. Consequently, that positive feeling leads to mutual relationship and reflected in belief to use, accept, or adopt SaaS applications and services.

#### **6.2.7 The Direct Effect of SN on BI**

Hypothesis H4 states that subjective norms (SN) is expected to have a statistically significant relationship with BI toward accepting, using, or adopting SaaS Cloud Computing services. Besides, SN is defined as the extent in which SaaS Cloud Computing services' users expect others to use/accept/adopt or not to use/accept/adopt SaaS services combined with the motivation that those others would comply with them.

The obtained results disclosed that hypothesis H4 is not gaining support empirically in the current study. To explain more, the findings of the relationship between SN and BI is not significant and exhibiting a SN weak influence on BI ( $\beta = .04$ ). Although this result contradicts with hypothesis H4, the findings give more insight in this explorative research on the nature of individuals in Malaysian higher education context.

That is, the students and academic staff have their own strategy in future plans that builds upon their own perceptions of future use of SaaS services and not much affected by the social grouping inside or outside the university campus. In other words, the weak correlation between SN and BI warrants the minor effect of social influence in formulating the behavior of AUSaaS and gives more room for individuals to decide their usage or not of this technology away from the influence, recommendations, or perceptions of others in the social community.

Besides, the reported findings infer that SN is not so important in predicting the intention to use SaaS services as respondents have, possibly, higher level of education, knowledge, skills, or experience that makes their decision to use, practice, accept, or adopt SaaS services belongs to themselves. Also, this implies that the social pressure of family members, colleagues, supervisors, or peers is limited. This view is in line with the findings of Md Husin and Ab Rahman (2016), where they explained the lower influence of SN towards BI due to the fact that in voluntary perspective it does not hold, rather it is more influential in mandatory usage perspective.

In addition, another inference pertaining the weak and no influence of SN on BI could be explained due to the fact that SN is more influential in the early stages of system development and where people have no prior experience (C.-D. Chen et al., 2007). Besides, Schierz, Schilke, and Wirtz (2010) highlighted the crucial role of the social context in advocating the use of innovative technology and its vital role in the decision process. However, they noted that its influence is more apparent in the early stages of development of the systems or in its early phases of diffusion. Accordingly, based on the dissipation of smart devices with various types, the wide spread and proliferation of applications that are used on daily basis, and the fast pace of technology

advancements that universities adopted in their syllabus, made the influence of others less likely to decide the intention to take any decision towards SaaS services usage, acceptance, or adoption.

Moreover, the findings here are similar to those reported with prior research in this respective relationship (Deng, Liu, & Qi, 2011; Gao & Deng, 2012; Md Husin & Ab Rahman, 2016; Picazo-Vela et al., 2010; Shiau & Chau, 2016; Taufiq-Hail et al., 2017a, 2017b; H. C. Yang & Zhou, 2011; W. Zhang & Gutierrez, 2007).

#### **6.2.7.1 The Direct Effect of SNPI on SN**

Hypothesis H4a states that peer influence (SNPI) is expected to have a statistically significant relationship with SN. The findings lend support for hypothesis H4a empirically. That is, SNPI has a positive and significant relationship with SN with large effect ( $\beta = .65$ ) indicating its high influence on SN in the context of the study.

To interpret the results obtained, it can be inferred that the peers influence (either for students or academic staff) has an effect in the social circle, which can lead to the actual use of SaaS services among the group of individuals. Take for example, if a student at the university is using Dropbox (i.e., a SaaS Cloud Computing online service) to store and share his/her files, this student, consequently, is utilizing innovative technology that makes him/her different than those who do not use this technology. Therefore, (s)he may urge other students in his/her social circle to use this technology as it is more reliable, accessible, and with higher capabilities than using traditional USB storage device. This influence, by means of encouraging or being outstanding among others, makes others use SaaS services accordingly.



The same thing applies to lecturers, who can access lectures' presentations and different pedagogical resources and at the same time share it with students and receives their comments whenever the lecturer deems it necessary. This lecturer, who is using SaaS services, can influence others (i.e. colleagues or friends in their social circle) by means of encouragement to accomplish different tasks through the usage of SaaS Cloud Computing services (e.g., portal or online services) and talk it to others in terms of its efficiency, reliability, and tangible benefits that makes teaching a fun.

On the other hand, this result is not surprising as many studies in prior literature support the significant and positive relationship between peers and SN (Ahmed & Ward, 2016a; Huh et al., 2009; Lai & Hitchcock, 2017; Ma et al., 2016; P.-L. To et al., 2008).

#### **6.2.7.2 The Direct Effect of SNSI on SN**

Hypothesis H4a states that superiors' influence (SNSI) is expected to have a statistically significant relationship with SN. The results disclosed that hypothesis H4a is empirically supported. SNSI has a positive and significant relationship with SN ( $\beta = .14$ ) indicating its influence on SN in the context of SaaS services adoption.

To interpret the results obtained, the student/lecturer at the university when using, for example, Google Forms (i.e., a SaaS online service) to share files or use it with collaboration with his/her colleagues/students or even to edit audio or video files online, this student/lecturer, consequently, is utilizing innovative technology and thus, has more experience than others that do not know much about such technology availability or its features. Hence, (s)he becomes a superior in this context that makes

others in the social circle look at him/her as superior and wants to obtain the same skills and benefits in the social circle.

Also, for lecturers, when imparting new skills that are available as services of SaaS Cloud Computing, they are regarded as superiors for students, and therefore, the students attentively listens and learns from them. Additionally, the academic staff in the same way, when they get to know new innovative skills that one of their colleagues possesses, they are influenced by this superior and try to mimic or learn these skills to be used with their own classes and their students. Consequently, they become superiors for their students.

Moreover, this finding is lent support with other findings in literature (Ahmed & Ward, 2016a; Hung et al., 2012; Ma et al., 2016; Rana et al., 2015; P.-L. To et al., 2008) where SNSI is having a significant positive relationship with SN. The inference drawn from the study suggests that universities should use the knowledge of superior influence to reinforce the perceptions of academic staff by continual training and exposure to new services of SaaS. This superiority, then, would lead them to guide and influence the students in using, accepting, or adopting these new innovative services of SaaS. This view is reflected by the findings of Ma et al. (2016) where he disclosed the role of SNSI in influencing SN and to utilize this knowledge towards the acceptance and adoption of an innovation.

#### **6.2.8 The Direct Effect of PBC on BI**

Hypothesis H5 states that perceived behavior control (PBC) is expected to have a statistically significant relationship with BI to use, accept, or adopt SaaS Cloud Computing services. It is defined as perceived ease or difficulty in performing different

tasks using SaaS Cloud Computing services (in the personal level) and it is assumed to reflect past experience, of the individuals to use technology skills, in addition to the anticipated obstacles to perform such tasks with SaaS Cloud services.

The empirical investigation goes in line with the hypothesis and lend support to H5 in that PBC has a positive and significant relationship with BI. To explain, the correlation between PBC and BI is positive and significant that gives support for its importance to be included in the model proposed, although with small impact on BI ( $\beta = .21$ ).

Moreover, the  $R^2$  result of PBC is reflecting its importance in the model proposed by the given value of 68%, which is the highest value amongst the antecedents of BI and considered substantial. This affirms the dominance of PBC and its crucial role in predicting BI. This can be interpreted as explained by Ajzen (1991) in performing a certain behavior, the individual has created a belief of the behavior either to be easy or difficult, and this belief is based on the prior experience and the anticipated impediments.

In other words, the perceived ease or difficulty that the individual has in performing different tasks using SaaS services and based on his/her prior experience, skills (s)he possesses, and the anticipated obstacles to use technology, develops and creates a motivation or intention to use, accept, or adopt the SaaS Cloud Computing in their academic/private life. This motivation or intention is consequently driving to the acceptance, usage, or adoption of SaaS services. That is, the more one has control over the facilitating resources and believes of his/her competence, the higher intention that one is having and consequently accepting, using, or adopting SaaS Cloud Computing.

Besides, the results suggest that the perceived constraints that the user of SaaS services assumes can decide whether or not the actual acceptance/adoption would be accomplished based on the degree of this perception of this constraint. That is to say, the higher degree of constraints felt by the user, the more hinderance towards the usage, acceptance, or adoption of SaaS services. However, based on the strong significant and positive relationship obtained, the findings suggest that the users are motivated in this technology and have the required capabilities towards this innovation. This view is in line with TPB as stressed by C.-D. Chen et al. (2007)

The past literature and theories, also, affirm that there is a strongly positive and significant relationship between PBC and BI, for instance TPB and DTPB (Ajzen, 1985, 1991; Taylor & Todd, 1995). Furthermore, other studies provide support of the current findings in this research (Ahmed & Ward, 2016b; Aloulou, 2017; Hung et al., 2012; Mafabi et al., 2017; Susanto & Goodwin, 2013; Taufiq-Hail et al., 2017a; Thoradeniya et al., 2015).

It is worthwhile to probe on the findings of recent research by Md Husin and Ab Rahman (2016). They stated that with a positive perception of ease that one owns, there is a greater possibility to adopt the behavior under study. In other words, if the perceived action of the usage of innovation is under the capability and one's control, it would be more likely to perform the action in question. Therefore, drawing on the findings and supported by the previous works, the inclusion of PBC in the model postulated to probe the salient factors affecting the usage, acceptance, or adoption process of SaaS services was indeed a worthwhile to obtain better understanding of the phenomenon under investigation.

### **6.2.8.1 The Direct Effect of PBCSE on PBC**

Hypothesis H5a states that self-efficacy (PBCSE) is expected to have a statistically significant relationship with BI to use, accept, or adopt SaaS Cloud Computing services. By referring to the results revealed, we find that the relationship is supported empirically. To explain, the results showed that a positive and significant relationship between PBCSE and PBC in which the correlation is large ( $\beta = .61$ ).

To interpret the findings, as mentioned in previous chapters, Self-efficacy is the capability of a person at higher education (i.e., a student or lecturer) to use computer, technological device, or even applications or services that are based on innovative and noble technology such as SaaS Cloud Computing, to complete a certain task (Compeau & Higgins, 1995; Ramayah et al., 2014). In that sense, the higher self-efficacy that the individual possesses, the stronger the belief to use, accept, or adopt innovative technology such as SaaS services in which the individual presume it under his/her control. In other words, when the individuals have high computer self-efficacy, the perception that they will be able to use, accept, or adopt SaaS online services will be under their control.

Based on the findings, PBCSE demonstrated a positive trend towards PBC and that means the participants look at the obstacles that they might be faced during their usage of SaaS services and applications as a challenge. This view is in accordance with the social cognitive theory (Bandura, 1986) in that the higher the self-efficacy ones possess in doing a certain action, the more likely to perceive difficult tasks encountered as something to be challenged and controlled rather than to be evaded (Bandura, 2012; Ozturk et al., 2016).

In addition, the result obtained is lining up with previous findings in literature and gives more support of the current findings (Ahmed & Ward, 2016a, 2016b; Hung et al., 2012; M. Kim & Qu, 2014; Ma et al., 2016; Susanto & Goodwin, 2013; Taylor & Todd, 1995). Therefore, the inference drawn from the study is that PBCSE is an important element in the adoption process of SaaS services and these skills have to be under deep attention to be cultivated at the higher education institutes to go hand in hand with the fast-growing developments of SaaS services and applications.

#### **6.2.8.2 The Direct Effect of PBCFC on PBC**

Hypothesis H5b states that facilitating conditions (PBCFC) (i.e., resources and technology) are expected to have a statistically significant relationship with BI to use, accept, or adopt SaaS Cloud Computing services. The outcome of the analysis assures that this relationship is ascertained in that PBCFC has a positive and significant relationship with PBC ( $\beta = .27$ ) in the setting of Higher Education represented by university students and academic staff.

As can be understood from facilitating conditions (i.e., these include but not limited to Internet connectivity, smart devices and computers availability, in addition to time and money), they are important elements to study adoption or acceptance of innovative technology, as is the case with SaaS services. Therefore, the better the facilitating conditions and availability of low rate access to SaaS services, availability of time, and money to subscribe to the internet or buy a technological device to access SaaS services, the more likely individuals will be able to use SaaS service when they realize its benefits and capabilities.

Also, the results imply that PBCFC is available in general for the individuals at the university represented by free access of internet, have the time to use the facilities at libraries or in class, and have the connectivity through computers available in labs or smart devices that they possess. As an outcome of the availability of the facilitating conditions, the user will be more inclined to have the positive feeling of control, whereby this feeling leads to the usage, acceptance, or even adoption of the innovation.

This result goes hand in hand with other findings in literature (Ahmed & Ward, 2016a; Huh et al., 2009; M. Kim & Qu, 2014; Susanto & Goodwin, 2013; Taylor & Todd, 1995) where it signifies the importance of the facilitating conditions in the acceptance or adoption of an innovative technology such as SaaS services. The inclusion of PBCFC factor in the models of technology acceptance is crucial as it acts as a facilitator and support element in electronic online services. This view is reflected in the findings of Ahmed and Ward (2016b) works.

## **6.2.9 The Moderating Effects**

### **6.2.9.1 The Moderating Effect of ED on the Relationship between BI and AUSaaS**

Hypothesis H6a states that. there is a statistically significant moderating effect of Educational Level (ED) on the relationship between BI and AUSaaS. The results speak in favor of hypothesis H6a and is empirically supported in the current study. Furthermore, results show that the interaction effect ED x BI has a medium effect that exerts a significant positive relationship with AUSaaS ( $\beta = .08$ ) at significant level ( $p < .05$ ), whereas the simple effect in the relationship BI  $\rightarrow$  AUSaaS is ( $\beta = .53$ ), refer to Figure C. 20 at Appendix C. This result is further supported by the diagram of the relationship in the simple slop plot and indicates that with higher level of education

that the individual possesses, the higher intention to adopt SaaS Cloud Computing technology.

To better understand the moderating effect, the relationship is visualized using the simple slope plot as illustrated in Figure 6.1. The middle line is the average level of the moderator ED or the mean value. The upper most line is the mean value of ED plus one standard deviation unit of the interaction effect ( $.54 + .08 = .62$ ), which is steeper and indicates that with higher education level, the stronger effect of BI towards AUSaaS. On the other hand, the lower most line is the mean value of ED minus one standard deviation unit ( $.54 - .08 = .46$ ) of the interactive effect (ED x BI), which indicates with lower educational, the lower BI towards AUSaaS is shown.

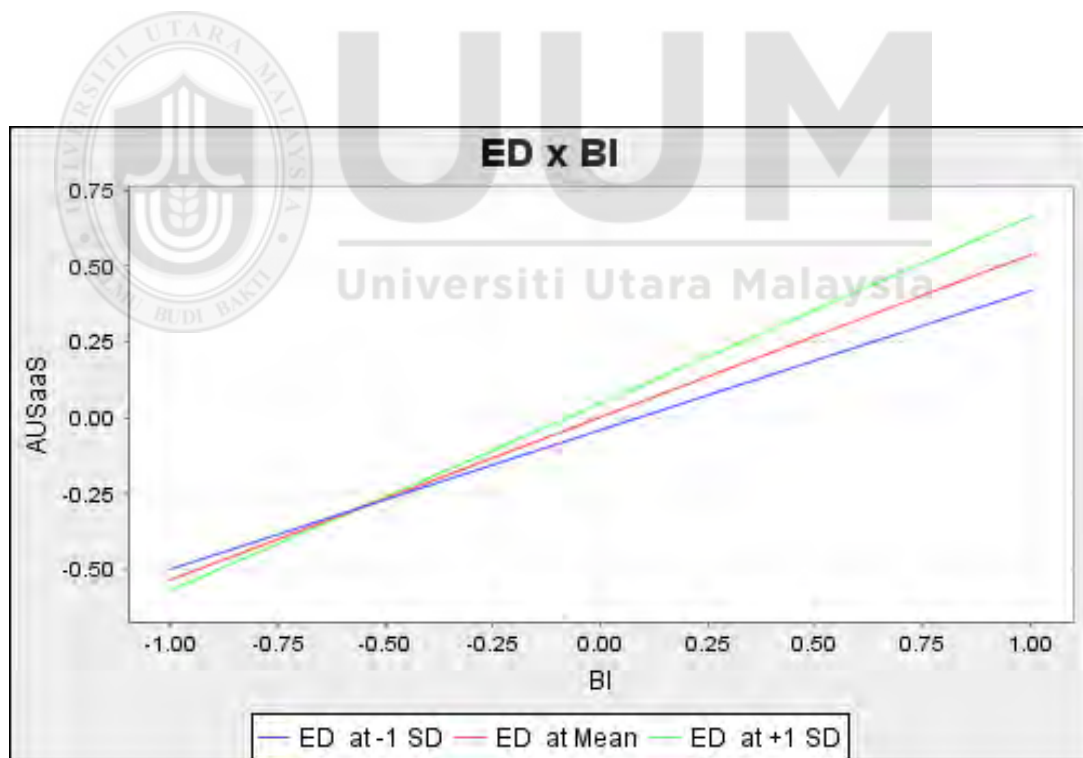


Figure 6.1. Moderating effect of ED on the relationship between BI and AUSaaS

This result is not surprising as prior literature shows that when educational level varies, this leads to various cultural perspectives that the user obtains and thus makes him/her less/more likely to conform and be open to global ideas (Joglekar, 2014). Similarly, E.



W. Baker et al. (2007) emphasize the importance of education as a crucial factor in accepting new technologies in organizations' behavior. That is, when the individuals benefit from the training they get, they would have greater exposure to technology and, therefore, make them better users of technology and professionals in this regard. Thus, education renders them adopters of new technology regardless of job-related knowledge or opportunities (E. W. Baker et al., 2007).

Another interesting findings by Riffai, Grant, and Edgar (2012) where the innovation of adopting online-Banking, which needs technical skills and knowledge, was investigated in Oman. Their findings shed light on the crucial effect of the level of education in the adoption process, where the adoption rate of online-Banking increased with higher education level of the users. Hence, this can be reflected in the current study in that the adoption or acceptance of SaaS services increases by the increase of educational level.

#### **6.2.9.2 The Moderating Effect of ED on the Relationship between USecP and AUSaaS**

Hypothesis H6b states that there is a statistically significant moderating effect of Educational Level (ED) on the relationship between USecP and AUSaaS. The findings of the empirical study affirm hypothesis H6b. That is, the results show that the interaction effect ED x USecP has a significant negative medium effect on AUSaaS ( $\beta = -.10$ ) at significant level ( $p < .05$ ), whereas the simple effect in the relationship USecP  $\rightarrow$  AUSaaS is ( $\beta = .21$ ), refer to Figure C. 20 at Appendix C for illustrative results.

To better understand the moderating effect of ED on USecP, the relationship is visualized using the simple slope plot as illustrated in Figure 6.2. The middle line is the average level of the moderator ED or the mean value. The lower most line is the mean value of ED plus one standard deviation unit of the interaction effect ( $21 + (-.10) = 11$ ), which is flatter and indicates that with higher education level, the less behavior intention to go and use, accept, or adopt SaaS Services. On the other hand, the upper most line is the mean value of ED minus one standard deviation unit ( $21 + .10 = .31$ ) of the interactive effect (ED x BI), which indicates with lower educational, the higher intention that the respondents demonstrate towards AUSaaS.

In other words, this can be inferred that with more education that the individuals possess, their positive security perception, i.e. trust on SaaS provider is lower combined by the sense of security and privacy felt of their private data transaction or stored on SaaS clouds, would become less and consequently hinders them to use, accept, or adopt SaaS services. These security concerns and worries are increased by the level of education in that the participants gain more knowledge on the security threats that can be encountered during their transaction process or after storing their private data. The security measures followed by the SaaS providers cannot make them feel convenient when using different services and applications.

This finding can be interpreted in a different way. While the level of education decreases, it is apparent that the respondents have more positive security feelings towards the SaaS providers. That is, they are confident of the security measures followed by the providers and a feeling of privacy is attained during the transaction process when using their different services.

Another significant finding that emerged from the current study is that the academic staff, and those with higher level of education, are less confident by the security measures that are followed by the SaaS providers. The feeling of trust in safeguarding their private data either when transactions occur or when they are stored in the cloud of the SaaS provider is less likely to take place. This is mostly occurring by the level of education they possess combined by the skills, experience, and broad thinking of the academic staff compared by the students' trend.

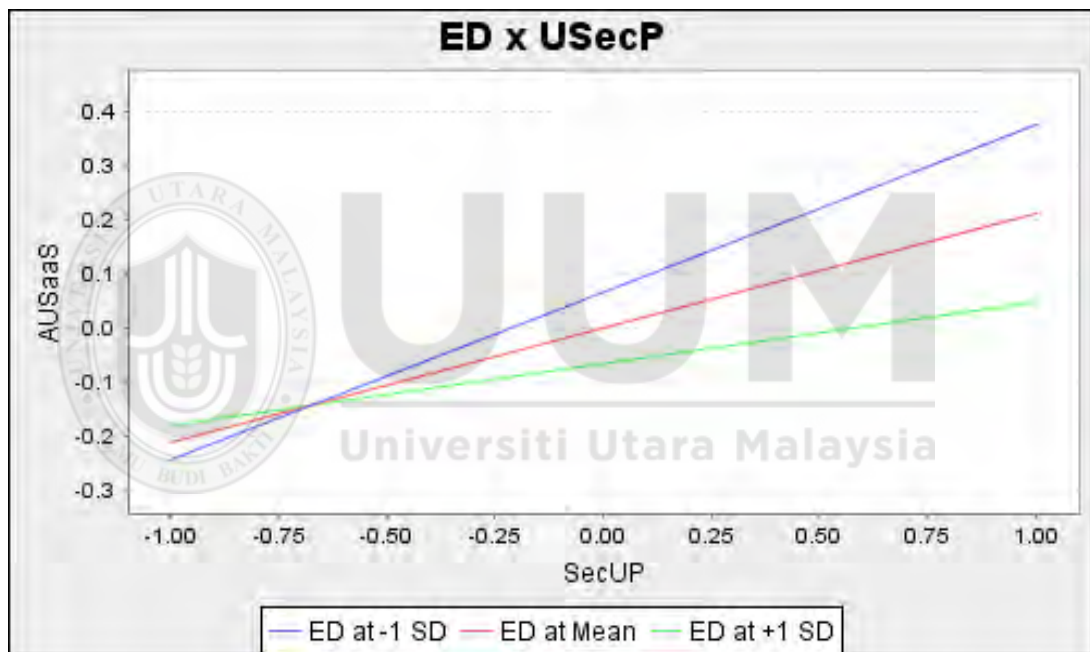


Figure 6.2. Moderating effect of ED on the relationship between BI and USecP

#### 6.2.10 The Difference between Student Group and Academic Staff Group in Using, Accepting, or Adopting The Personal Level of SaaS Cloud Computing

Hypothesis H7 states that It is expected to have a statistically significant difference between the two groups (i.e., students and academic staff) in HE sectors on the relationships towards accepting, using, or adopting SaaS Cloud Computing services. The results obtained in the extensive analysis disclose partial support for the

hypothesis H7. It is worth mentioning that the differences were analyzed in terms of the different relationships toward using, accepting, or adopting SaaS Cloud Computing services.

Schloderer, Sarstedt, and Ringle (2014) explained that there may be a different effect of different groups in the relationships that may bias the final result on the aggregate level. Moreover, Sarstedt et al. (2011) and Becker et al. (2013) emphasized the importance of investigating the heterogeneity of the population under study or it may lead to inaccurate managerial conclusion. To emphasize, statisticians stress that sometimes there could be relationships with differences in the behavior of different groups of participants. This does not mean that the differences are significant (Pallant, 2011). Therefore, additional tests should take place to affirm this significance or not (Pallant, 2011). was performed.

Based on these considerations, the study conducted extensive and a rigorous testing and evaluation with the most recent methods (i.e., FIMIX, MICOM, and MGA) to gain more insights on this matter, refer to Chapter Four. Additionally, these tests are of the most recent used in quantitative studies and that are scarcely found in academic published works. After running these tests, results revealed that the relationships SNPI and SNSI towards SN, COM towards AUSaaS, and PU towards ATT were found to have significant differences among the two groups of respondents.

Moreover, further investigation of the total effects was assessed, and Table 5.23 substantiate that there are differences between the two groups. These group-specific path coefficients under consideration disclose significant differences between the two groups of respondents, namely: SNPI paths (i.e. toward SN, BI, AUSaaS), SNSI paths

(i.e. towards SN, BI, AUSaaS), SN paths (i.e. towards BI and AUSaaS), COM paths (i.e., towards ATT, BI, and AUSaaS), and finally PU towards ATT. These results support the hypothesis in the existence of differences between the two groups, although partially. Figure C. 21 depicts the different paths coefficients for the both groups.

The results may imply that the social influence does not have much support on the decision to use, accept, or adopt SaaS services. Moreover, the influence of peer and superior has a pronounced effect on the student group. However, in the academic staff group the superior influence has no effect but the peer influence has a pronounced effect on them. This can imply that the students are still of the young generation that are more socially connected and influenced by peers or superiors, while academic staff are more inclined to listen and follow advice of other peers, who are trusted and are source of information based on their experience. Based on the findings, SN relationship with BI is suggested to be excluded in the final model.

The other difference is the concept of compatibility, where it is with stronger effect in the student group and not significant and negligible in the academic group. This can indicate that students are more frequently using different devices, application, and services that made them be aware of keeping these compatible with their needs and already owned devices.

To explain more, the respondents may use a new application that is compatible with the version they have in their android smart devices and not to go to applications that need higher specifications of the hardware or operating system, which they do not own. Besides, the findings may infer that the students are more eager to try and based their

final decision to keep the services or applications that are more compatible with their own devices. Unlike the academic staff group, they tend to use the more stable applications and tend to be convenient with is released. The compatibility does not highly enforce their attitude or intention to use SaaS services.

In terms of perceived usefulness (PU), the trend of the academic group is obviously stronger towards ATT, whereas in the student group is significant but rather weaker in its effect on ATT. The trend of academic staff may imply that the usefulness of any service of applications has a crucial and vital role in forming their attitude towards the innovation. On the other hand, this trend is somehow little for the student group, but with less importance.

Markedly, majority of the relationships postulated in terms of the technical trends, the security trends, and the personal trends and capabilities are not statistically different between both groups. Figure C. 21 illustrates the group-specific paths to further shed more light on the relatively similar behavior of both groups. Generally speaking, the overall results, which show no significant differences among the two groups in MGA test, imply that there is no real difference between academic staff and students at university level in the perception of future plans (i.e., their intention) in using, accepting, or adopting SaaS Cloud Computing services. Also, it can be said that both groups have already established the intention to use, accept, or adopt this technology as each of them have the proper knowledge to continue using or adopting SaaS Cloud Computing as part of their academic life.

Moreover, it is evident from the results gained that both groups are having enough skills and technical capabilities to decide the usage of the innovative technology such

as SaaS services and applications. It may highlight that the trend of both groups is lining up in a similar trend towards the common belief that SaaS is a technology that can be depended on and of real and tangible benefits that can change the course in the academic life. Besides, it can be inferred that there is a common mind-set in that SaaS services is a reliable and secure environment that both groups are trusting and proven to be an essential part of the respondents daily personal level usage.

Therefore, it can be said that after extensive and rigorous investigation of the relationships of the model, the above results substantiate that there is a significant difference between the students' group and the academic staffs' group in terms of direct and total effect of some of the path coefficients relationships. Hence, hypotheses H7 is supported partially in terms of the highlighted paths.

### **6.3 Probing The Personal Use of SaaS Services among Respondents' Groups**

The general analysis in Section 5.8, shows the general trend of the two groups of respondents in terms of the different services utilized on the personal level. Apparently, there is no big difference among the two groups. On the other hand, in the aim to investigate the difference, in more details, between the student group and the academic staff group in terms of the usage of SaaS services different categories, Figure 6.3 and Figure 6.4 visualize the results revealed.

To explain, the researcher found that both groups exert high perception in using SaaS\_T2 (Social media communication applications), followed by SaaS\_T3 (E-mail services) and SaaS\_T1 (Collaborated SaaS Cloud Computing applications), then SaaS\_T4 (SaaS Cloud Computing storage), after that SaaS\_T6 (Entertainment or educational media), and, finally, SaaS\_T5 (Communication and calling services).

Apparently, the respondents are more inclined to use social media more than other SaaS services, where this finding can highlight the importance of this service and utilize it in future applications that can cater the pedagogy. This indicates no differences between the students and the academic staff in the usage of these services.

Other observation is that the least services, among other SaaS services and application, is SaaS\_T5 in both groups, which needs to be looked at with special attention in reasons behind that. One possible reason could be that social media is more used in communication than the direct call using the communication services. Other observation is that SaaS\_T2 is the prominent services among all, where it shows high number of respondents concentrated in this category. Besides, Figure 5.3 is supporting this view when combining both categories in the analysis of this trend of both groups.

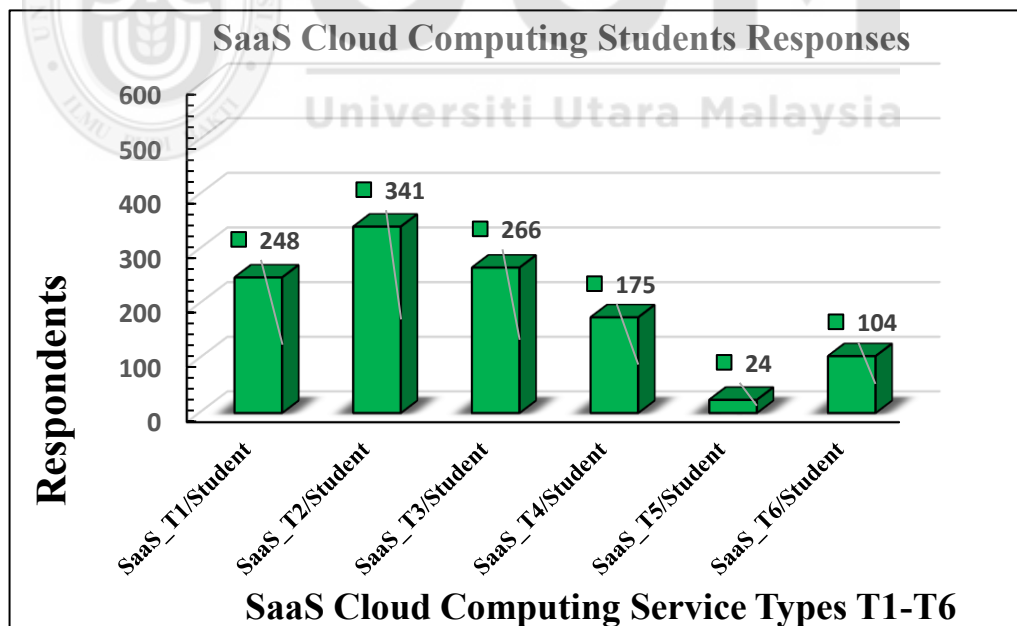


Figure 6.3. Responses of the student category in terms of SaaS services usage



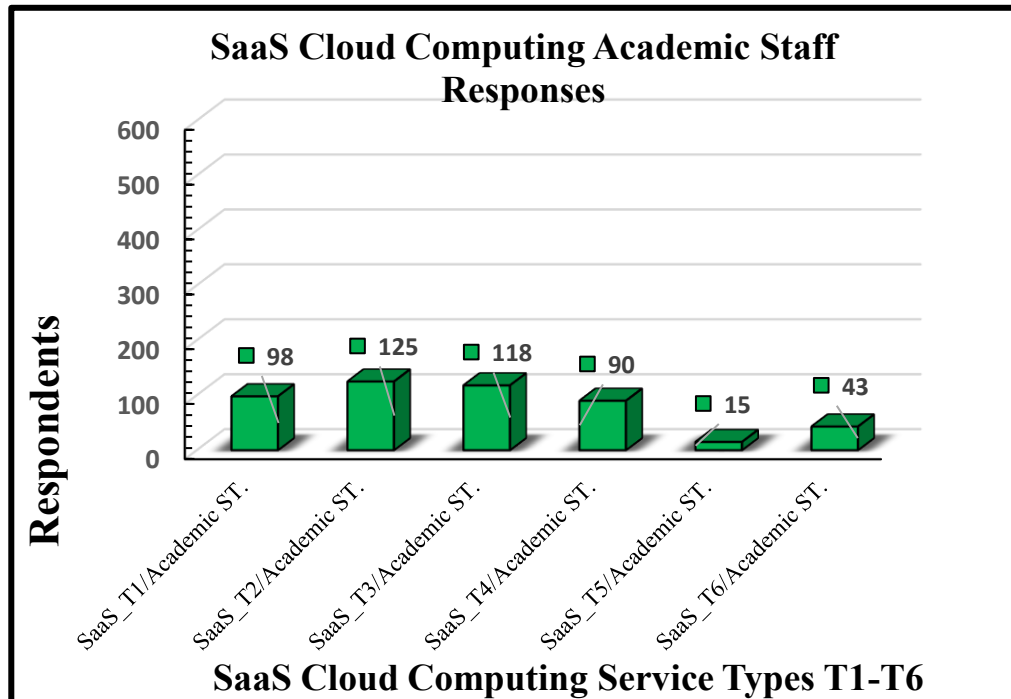


Figure 6.4. Responses of the academic staff category pertaining to SaaS services usage

#### 6.4 Research Questions of The Study

The research questions of the current study were answered in this research. The following subsections give more light of the fulfillment of these research questions and their associated objectives.

##### 6.4.1 Research Question 1 and Objective 1

This research question was answered and the research objective 1 was achieved through the review of various works in past literature in different fields of technology, or those used innovative technology in their research to investigate the influential factors that affect using, accepting, or adopting innovation. Various theories and models were investigated that used either adopted models or theories, integrated version of one or more theories/models, and extension of theories. The extensive literature review in light with the most important factors that affect adopting or using

an innovation were investigated and the author reached to use and DTPB and DOI theories as the model with extension of one newly added construct, i.e. USecP.

Additionally, different factors influencing the behavior, the usage, or the adoption have been identified that can be said, the technological factors (i.e., PEU, PU, COM, and TRI) that affect the attitude, the social factors (i.e., SNPI and SSI) that affect social norms, and the control factors (i.e., PBCFC and PBCSE) that affect perceived behavior control. All these factors have been proven empirically in this study except TRI and SN that were insignificant in the relationships postulated. The explanation was provided in the previous sections.

The overall results lend support for the main factors influencing the outcome of the study, AUSaaS. The following Table 6.1 summarizes the contributing factors of using, accepting, or adopting SaaS services with their measurements.

Table 6.1  
*Salient Factors Contributing to The Usage, Acceptance, or Adoption of SaaS Services*

<b>Operational Latent Variable/ No. Items</b>	<b>Survey Items</b>
Adoption and Usage of SaaS Cloud Computing (AUSaaS)	<ol style="list-style-type: none"> <li>1. I prefer online SaaS Cloud Computing services (e.g., store my data on the web, watching Youtube movies, listening to online music, calling friends using Tango or imo, etc) than using conventional methods (e.g., using USB drive, watching movies on DVD, or normal telephone calls).</li> <li>2. I frequently use online SaaS Cloud Computing services for my work/academic studies (e.g., uploading my data/accessing e-mail, sharing files on Facebook, opening Pdf files online, watching Youtube, etc.).</li> <li>3. I believe that I could tell others the advantage of using SaaS Cloud Computing services in my academic study/work.</li> <li>4. I would have no difficulty explaining why SaaS Cloud Computing services may or may not be beneficial.</li> </ol>
Behaviour Intention (BI)	<ol style="list-style-type: none"> <li>5. I Intend to continue using SaaS Cloud Computing online services in my work /academic studies.</li> <li>6. I will strongly recommend online services from SaaS Cloud Computing providers to others.</li> </ol>

Table 6.1 continued

	7. I plan to continue using SaaS Cloud Computing services frequently this term and onward.
	8. Assuming that I have access to Internet, I intend to continue using SaaS Cloud Computing services.
Attitude (ATT)	9. Using the SaaS Cloud Computing services is a good idea. 10. Using SaaS Cloud Computing services is a wise idea. 11. I like the idea of using the SaaS Cloud Computing services. 12. Using SaaS Cloud Computing online services is beneficial to my academic studies/work.
Compatibility (COM)	13. Using SaaS Cloud Computing services will fit well with the way I work and my lifestyle. 14. Using SaaS Cloud Computing services fits well with my academic needs and values. 15. SaaS Cloud Computing services and applications are compatible with my preferred work practices.
Perceived Ease of Use (PEU)	16. It would be easy for me to become skilled at using online SaaS Cloud Computing services (e.g., access webmail, share files in WhatsApp or Facebook, open Pdf file online on web browser, etc.) 17. Learning to use online SaaS Cloud Computing services is easy for me. 18. I would find the online SaaS Cloud Computing services easy to use. 19. Using SaaS Cloud Computing online services is clear and understandable.
Perceived usefulness (PU)	20. Using online SaaS Cloud Computing services would facilitate in achieving my duties in work/academic studies. 21. Using online SaaS Cloud Computing services would provide access to useful academic information. 22. Using online SaaS Cloud Computing services would save my time when working with electronic information (e.g., reading online, downloading articles). 23. Using SaaS Cloud Computing online services increases productivity by accessing my data anytime and anywhere.
User Security Predisposition (USecP):	24. I would trust SaaS Cloud Computing provider to offer secure transaction to access my data (e.g., access my e-mail, my files on Microsoft OneDrive). 25. I would trust SaaS Cloud Computing provider to provide me online services to help in conducting my work/academic studies on the web. 26. I would trust my SaaS Cloud Computing provider to provide secure data connections using strong security codes to conduct my transactions over the Internet. 27. I feel confident that legal and technological aspects of SaaS Cloud Computing provider are adequate to protect my data. 28. Using SaaS Cloud Computing applications and services would not disclose my personal information. 29. I would find SaaS Cloud Computing services secure in conducting my transactions and working with online applications provided from SaaS Cloud Computing providers. 30. I trust in the ability of SaaS Cloud Computing services provider (e.g., Google) to protect my privacy.

Table 6.1 continued

Peer Influence (SNPI)	<p>31. SaaS Cloud Computing services are really secure to use in my work/academic research.</p> <p>32. My friends would think that I should use the SaaS Cloud Computing services. My friends would think that I should use the SaaS Cloud Computing service.</p> <p>33. I want to do what my classmates/colleagues think I should do.</p> <p>34. My classmates/ colleagues recommend that I should use SaaS Cloud Computing services.</p> <p>35. Colleagues/Classmates who are important to me would think that I should use SaaS Cloud Computing services in my academic studies/work.</p>
Superior Influence (SNSI)	<p>36. I will have to use SaaS Cloud Computing services and applications because my professors/supervisors require it.</p> <p>37. Generally speaking, I want to do what my professors/supervisors think I should do.</p> <p>38. My professors/supervisors would think that I should use SaaS Cloud Computing services and applications. I will have to use SaaS Cloud Computing services and applications because my professors/supervisors require it.</p> <p>39. I would be able to use SaaS Cloud Computing services and applications.</p>
Perceived Behaviour Control (PBC)	<p>40. I would be able to use SaaS Cloud Computing services and applications.</p> <p>41. Using SaaS Cloud Computing services (e.g., storing files on the web) is entirely within my control and capability.</p> <p>42. I have the resources and the ability to use SaaS Cloud Computing services.</p> <p>43. I have the knowledge to use SaaS Cloud Computing services.</p>
Self-Efficacy (PBCSE)	<p>44. I would feel comfortable using SaaS Cloud Computing services.</p> <p>45. I could easily use SaaS Cloud Computing services on my own.</p> <p>46. I know enough to use SaaS Cloud Computing services.</p> <p>47. It is important to me to use SaaS Cloud Computing services, even if there is no one around to show me how to use it.</p>
Facilitating Conditions (PBCFC)	<p>48. I have the Internet equipment (modems, ADSL, Wi-Fi accessibility etc.) required to use online SaaS Cloud Computing services.</p> <p>49. I have the time to use online SaaS Cloud Computing services.</p> <p>50. I have enough money to buy the hardware (e.g., Tablet, Smartphone, Laptop) to access and use online SaaS Cloud Computing applications and services.</p> <p>51. It is important to be able to use SaaS Cloud Computing services when I need it.</p>

## 6.4.2 Research Question 2 and Objective 2

The perceived security predisposition is a major element in the acceptance or adoption of any innovation especially when innovation is accessed over unsecured medium, i.e. the internet, to obtain the services needed or to achieve the goal of using

it to facilitate the productivity, performance, or convenience that is not achieved by former usage of other technologies. The literature reviews were conducted thoroughly and results showed that trust, privacy, and security are the most dominant factors that gain extensive support in the use of innovation over unsecured medium. More precisely, these factors have shown their importance in studying cloud computing as explained in many studies of cloud computing and proven their applicability in the current study.

USecP is a newly added multi-dimensional factor to the model with an aim to test its appropriateness empirically, which consists of two dimensions, namely: TRT and CRD. Interestingly, USecP was proven to be empirically suitable and validated in the model postulated and, hence, contributes to the holistic model proposed. Besides, its influence on the process of acceptance and adoption is evident by its significant relationship with AUSaaS as tested and explained earlier in Chapter 6 and Chapter 5.

To conclude, the research objective 2 was met and the research question was answered.

Table 6.2 shows the contributing construct of user security positive predisposition, USecP with its measurements.

Table 6.2

*Contributing Factor of User Security Predisposition to The Usage, Acceptance, or Adoption of SaaS Services*

Operational Latent Variable/ No. Items	Survey Items
User Security Predisposition (USecP):	<ol style="list-style-type: none"> <li>1. I would trust SaaS Cloud Computing provider to offer secure transaction to access my data (e.g., access my e-mail, my files on Microsoft OneDrive).</li> <li>2. I would trust SaaS Cloud Computing provider to provide me online services to help in conducting my work/academic studies on the web.</li> <li>3. I would trust my SaaS Cloud Computing provider to provide secure</li> </ol>

Table 6.2 continued

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	data connections using strong security codes to conduct my transactions over the Internet.
4.	I feel confident that legal and technological aspects of SaaS Cloud Computing provider are adequate to protect my data.
5.	Using SaaS Cloud Computing applications and services would not disclose my personal information.
6.	I would find SaaS Cloud Computing services secure in conducting my transactions and working with online applications provided from SaaS Cloud Computing providers.
7.	I trust in the ability of SaaS Cloud Computing services provider (e.g., Google) to protect my privacy.
8.	SaaS Cloud Computing services are really secure to use in my work/academic research.

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### 6.4.3 Research Question 3 and Objective 3

The research question was answered and the research objective 3 was achieved by probing the previous works to investigate the role of demographics in moderating the relationships. The moderation concept was explicated with care in the previous chapters and supported with diagrams to simplify the understanding of the moderation effect empirically.

Besides, previous studies emphasized on the significant role of education in the process of the usage, acceptance, or adoption of innovation. Therefore, it was tested against its influence in moderating the effect of BI and USecP towards the final outcome of the study, AUSaaS.

The effects were extensively examined in a rigorous analysis to better test the results with most recent approaches used in literature. The findings supported the role of education in the relationships aforementioned and gives evidence to its validity and appropriateness to be included in the study. To conclude, the Objective 3 is met and answering the research question is achieved by the results and interpretation provided in previous sections in this chapter, refer to Section 6.2.9 and its subsections for details.

#### **6.4.4 Research Question 4 and Objective 4**

To answer research question and the research objective 4 of the study, different things were followed. First of all, the sample of the current study targeted individuals at higher education in four Northern part of the Malaysian Peninsula. Secondly, four different main campus of the four universities were targeted to draw the sample. These universities have different specialties ranged from education, sciences, engineering, and business. This variety gives more insight and diversity of the perception of the targeted respondents. The unit of sampling was the students and academic staff from different backgrounds- i.e. education, sciences, engineering, and business schools in the four universities.

The purpose was to use the word individual to refer to the subject under study. This refers to a student entity and academic staff entity who are not in the field of IT or IS to gain a broader view and general perception of different elements of the sample. Additionally, they were of different ages, cultures, races, and level of education that makes the investigation of the difference in perception between the two groups meaningful as respondents.

Moreover, the most rigorous and most recent approaches of investigating the differences between the two groups were used that lacks in majority of research studies using SmartPLS analysis. First of all, FIMIX as a technique to ensure that the sampel can be divided into the groups hypothesized is used and confirm the existance of heterogeneity of two distinct groups of student and academic staff.

Secondly, MICOM procedure was used, which is the most rigorous technique to ensure that the respondents equally understand the questions in the same way, and they

understand the questions as intended by the research. This has been confirmed and based on the recent literature in analysis using guidelines of Hair et al. (2018) among others. As a last step, the MGA was used to test the differences between the students and the academic staff perception on the different paths towards the the final outcome of the study. The results revealed that there are differences in limited relationships as explained in Section 6.2.10, in terms of the direct and total effect of PU towards ATT, COM, SNPI, and SNSI towards ATT, BI, and AUSaaS. These were the only relationships emerged from the multigroup analysis. Therefore, these differences found between the two groups; however, they did not show the significant level and proved by MGA testing approach.

To conclude, the differences were found in terms of specific paths highlighted above and this gave support of the existing difference between the student group and the academic staff group as hypothesized. Therefore, the objective is met and the research question is answered.

### **6.5 Revised Model of SaaS Adoption and Acceptance Model**

In light with the results revealed, the study outcome is presented in the following revised version of the model in Figure 6.5.



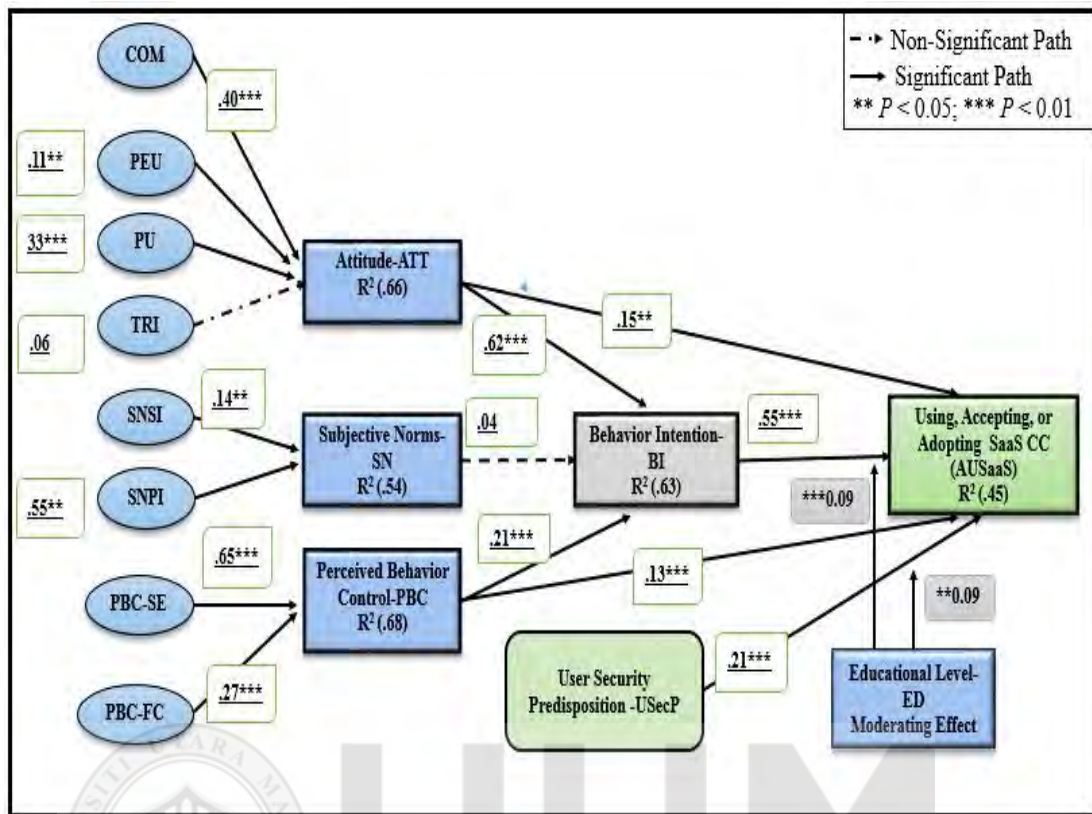


Figure 6.5. Revised model of the study

Based on the results obtained, the model was revised to reflect the findings of the current study. As shown in Figure 6.5, all the relationships are significant in terms of the main constructs such as ATT and PBC towards BI. However, SN revealed to have a non-significant effect with BI. Additionally, all antecedents of ATT exerted a significant effect towards attitude except TRI, which is not significant. Moreover, antecedents of SN were all significantly and positively related with SN. In addition, antecedents of PBC were also correlated positively and significantly with PBC. Not surprisingly, USeCP, which is a new construct to the model with a second-order nature, exerted a positive and significant relationship with AUSaaS. Lastly, the moderating effect of the educational level was significant with regard to the relationships BI → AUSaaS and USeCP → AUSaaS.

## **6.6 Implications of The Study**

### **6.6.1 Theoretical Implications**

The study integrated two theories, DTP and DOI, in addition to the inclusion of the security concerns of individuals (i.e., security, trust, and privacy) in one composite latent construct, USecP. The integration of different theories with extension provides a broader explanation of the phenomenon under investigation, increases the predictive power of the model, and covers wider aspects of a phenomena that aimed to be explored.

The correlation of these extended variables was found to be significant and positive (i.e., in most cases except SN and TRI relationships), which is lining up with the hypotheses of the study, and further gives insight of these two notions to the area of cloud computing in general and SaaS Cloud Computing in specific. Moreover, the inclusion of security, privacy, and trust, in which they were combined in one parsimonious construct of USecP, has proven its reliability and validity, thereby, and based on the findings, contributes to the body of knowledge and literature. Moreover, the inclusion of these new constructs in the proposed model has not been practiced in any model in previous works. The idea of compacting the models in parsimonious way is a recent trend that is favored by many scholars (Hair et al., 2017).

Furthermore, the study's proposed model was successfully proven its strength to explain the attitude, social norms, the perceived behavior control, the user security perceptions towards adopting SaaS Cloud Computing. In addition, the moderating role of educational level was significant in which it further supports the hypotheses and extend the model effectively.

By referring to the predictive relevance  $Q^2$  in Section 5.16, the researcher finds that the model shows an acceptable predictive relevance ranging from 0.24 to 0.48, which are all above the cut-off value of zero. This implies that the model is accepted in terms of providing solutions for the issue under investigating of the current research.

Further, the values of the predictive relevance are important to accept the model as argued by many researchers in the academia (Hair et al., 2011; Henseler et al., 2009; Muraina, 2015) in addition to the in-sample predictive power of  $R^2$  that ranges from .48 to .68, which can be interpreted as having a highly medium to large predictive power (Hair et al., 2017). Additionally, the mediating effect of BI was investigated in the current study, which was overlooked in the academia to test its applicability with technology usage, acceptance, or adoption. The results show that PBC and ATT were mediated by BI; however, BI did not show any mediating effect between SN and AUSaaS. This investigation shed more light in theoretical contribution in this regard.

## **6.6.2 Practical Implications**

### **6.6.2.1 Collaboration between Universities and Government Sectors**

The multi-fold benefits of SaaS Cloud Computing in terms of educational, economical, and environmental issues makes the collaboration between different universities and government sectors more demanding than ever. Through the proper education of students at the universities, this will be reflected on improving their skills to deal with innovative technology of SaaS. This in turn will help the future generations to create new solutions when joining the government workforce as they are armed with the proper skills. Among those students, there will be the leaders of the future.

Also, the government should initiate more SaaS Cloud Computing projects' funds for the universities to enable them find solutions and create innovative ideas to market SaaS Cloud Computing in the business sector in Malaysia that will eventually create revenue for the country. Collaboration can be on the technical, economical, educational, and environmental sides as well as in the IT management side by providing solutions, innovative ideas, and surveys on the real business environments and people's tangible needs in their daily IT/IS usage.

For instance, if the government plans to extend the use of SaaS services in different departments and agencies, they could study the needs of these departments through the universities. The universities can provide the real needs, the proper scheduled plans, the migration process, the economic feasibility studies, and the recommendations based on academic, professional, and systematic ways that the universities' professional academicians possess. The expertise of the academicians in different areas such as the marketing, the technical consultancy, the economic feasibility, and the entrepreneurship can be utilized in projects supported financially by the government. The outcome can be with two-fold benefits, where the university can provide the expertise and the government can use the studies to develop projects that eventually will boost the economy.

#### **6.6.2.2 Connect Universities into a Central Educational Cloud Computing Hub**

As can be revealed from the extensive literature review in the area of cloud computing, the advantages are numerous. For example, connecting different public universities in a central cloud to provide e-library services for students and researchers, the universities could save a huge lump sum and overcome the financial issues regarding the upgrade of different facilities at their respective universities.

In this way, the Central Cloud Educational Hub infrastructure, not only a medium of connectivity among them, but also could provide a variety of services, such as E-library, collaboration among universities, sharing knowledge through a repository of shared research space, and other services with minimal cost. Thus, the Monterey that is supposed to build the datacenter inside the universities could be used in other areas inside the universities such as research.

In addition, instead of paying a huge lump sum on the subscription to international journals and niche publishers by each university, the Higher Education authorities could build a central library with single access with those publishers and give access to Malaysian universities through affordable amounts of yearly subscriptions. So, the government could play a vital role in the education process, as well as the business side in providing the services through their own SaaS Cloud Computing e-Library resources. This could save more spending and gain more educational and economic benefits.

#### **6.6.2.3 SaaS Cloud Computing to Safeguard Universities' Data**

In recent years, the floods in southern areas in Malaysia render many facilities at the universities unusable. A practical solution to solve returning the IT services inside the campus is to use the cloud computing services to backup and restore the data, as well as to operate the different IT services through using SaaS or other Cloud services. This is a practical and convenient way to resume the operations inside universities. Also, students, researchers, or lecturers can resume using the facilities offered in by SaaS services to restore their data, use online services, or do any of the research online. In that way, the time is saved, and the services are maintained by means of online Cloud

Services for all beneficiaries, i.e. students, researchers, academic staff, administration offices, etc.

#### **6.6.2.4 SaaS Cloud Computing as Learning and Research Environment**

As it was extensively highlighted in Chapter 2, SaaS applications and services are a useful means for a learning, teaching, and research environment inside universities. This must be taken under due consideration in the managerial level of those universities to create different and variety of applications and services for academic researchers, lecturers, and students and to further depend on Cloud more than ever.

Additionally, the results reveal that SaaS Cloud Computing is used in different ways by the respondents, so the focus on the administration of these universities is to focus on providing the educational materials for students online by means of SaaS services, and the programming tools for researchers as well. In addition, the lecturers could use the SaaS services to make an interactive environment with students and lecturers to produce better ways for the learning process. One way could be the usage of SaaS social media applications and services that reveal to be the prominent service among other SaaS services investigated in the study.

More importantly, the SaaS Cloud Computing is becoming a vital element in IT/IS in all aspects such as: Communication, entertainment, marketing, manufacturing, and business planning. Therefore, universities should implement new courses in this area and make it as an essential part of their IT/IS university curriculum.

#### **6.6.2.5 Co-operation between Service Providers of SaaS Cloud Computing and Universities**

The advantages of building a good co-operation between SaaS Cloud Computing providers and the universities could help to reduce the financial obstacles for the universities dramatically. This co-operation has many folds to both parties. For instance, the SaaS Provider can benefit to extend their services, and the universities to have facilities and services that are uninterrupted and cost-effective. In this way, both parties are benefiting from the implementation of Cloud services. Also, the SaaS providers can create a test-bed of their developed services and applications for students to test and improve its functionality or even the students can create their own applications and sell them to the providers. This bilateral, or even multi-fold, benefits can create a well-established Win-Win relationship between universities and SaaS providers.

#### **6.6.2.6 Salient Factors Influencing The Usage and Adoption Process Of SaaS Cloud Computing**

The findings of the current study shed more light on the importance of factors influencing the usage of SaaS Cloud Computing by individuals in higher education sector represented by students and lecturers. These factors can be identified as attitudinal factors (i.e., PEU, PU, and COM), control factors (i.e., PBCFC and PBCSE), and security perceptions factors (i.e., TRT and CRD). These factors found to have the main effect and influence in the current study with a significant effect on the final adoption process that give them special attention in any future study on cloud computing research, or SaaS as an element of it.

### 6.6.3 Methodological Implications

Majority of studies had used SPSS, AMOS, and Smart PLS analytical tools to study different relationships in the models estimated. Extending the research practice, the current study has firstly applied SPSS version 21, in the analysis process, and used Smart PLS as a second step to further investigate the different relationships. In addition, Microsoft Excel in some demographic analysis and illustrative results of the demographic analysis is used. Furthermore, there are paucity of studies in literature that overlook the heterogeneity analysis in many of studies implemented especially when it comes to the use of FIMIX and MICOM analysis as a recent analytical tool in Smart PLS 3 to investigate the heterogeneity of the samples before the actual implementation of the MGA (Multi-Group Analysis).

More importantly, MICOM, which is the most recent method used in the analysis in quantitative research, was used to probe if the questionnaire was understood by both groups equally and to know if it was understood by the respondents as intended by its design. The results confirm this measure statistically after it was pre-tested, pilot tested, and final implementation of the questionnaire survey.

In addition, the use of HTMT to affirm the measurement model discriminant validity is recently proposed to be included in the results of any study and proved to be more reliable in investigating the relationships in an estimated model (Hair et al., 2017). The usage of this procedure is not, yet, widely used in academia and not reached the popularity level. Therefore, the study included all the conventional techniques such as Fornell-Larker criterion, Cross-loadings, in addition to HTMT inferior for a triple fold of supporting the results with rigorous and contemporary analytical measurements to support the results obtained.



Furthermore, heterogeneity in the aggregate data has an impact on the data being interpreted and can lead to misinterpret the results and to affect the generalizability of the study (Matthews et al., 2016). Therefore, the researcher implemented the advanced methods (e.g., IPMA, MICOM, FIMIX, and MGA) in the current study to make a deeper investigation of the relationships proposed and give it more focus beyond the direct and basic analysis of the relationships proposed. The results revealed that there is a difference between the two groups of respondents in terms of some relationships highlighted in the above sections.

Moreover, the convergent validity, reliability, discriminant validity of the proposed new construct, namely: User Security Predisposition (USecP) was investigated and the outcome proved their reliability and validity in the measurement of the current study. Also, they show a relevance to be included in the current area of research to find out the perception of respondents in terms of usage, acceptance, and adoption of novel technologies such as SaaS Cloud Computing area of research as well.

Markedly, the instrument that was used in this study has proven its strength and applicability in the area of SaaS Cloud Computing by meeting more than the cut-off values of construct validity, internal consistency reliability, and discriminant validity. This instrument underwent different layers of testing, namely: face-to-face validity with expertise in the area, pre-test, pilot study that provide more applicability to the instrument, in addition to the final results obtained from the final questionnaire collected. Moreover, MICOM was one of the most important contemporary methods to assure the appropriateness, validity, reliability, and authenticity of the survey questionnaire.

The questionnaire has coined an innovative idea in terms of the design of the questionnaire. That is, the graphical presentation of SaaS Cloud Computing concept as presented in the questionnaire, in both versions, to facilitate the understanding of the SaaS Cloud Computing technology that majority of individuals do not know it specifically but use it frequently. The opinion of the respondents was considered, after submitting the responses, of the design and understanding of the questions. Majority of respondents confirmed the innovation of the design and easiness of understanding the questionnaire.

Finally, the distribution of the questionnaire has followed a new approach to meet the criteria proposed in the Chapter 3. That is, the systematic random sampling is chosen to be the approach to distribute the questionnaires. Unfortunately, the researcher faced many obstacles in applying the approach. Therefore, the researcher collected data as self-administered in some locations, created a list to select every second participant from the returned questionnaires, and hence, the systematic sampling is applied as a final approach from the total number of returned questionnaires.

### **6.7 Limitations and Future Studies**

Also, the results gained in the current study provides empirical support of the model hypothesized. However, there are number of limitations as any other empirical study that needs to further investigate the model in terms of the private universities to give the proper generalization of the applicability of the study in the higher education sector.

Further, the study focuses on the northern part of Malaysian Peninsula, and that is considered a limitation to generalize the results in the whole higher educational sector

represented by public universities. Hence, future studies could be conducted in other parts of Malaysia such as the south and middle part of Malaysia. Also, the study recommends including the private universities to obtain a complete picture of the attitude, intention, behavior, and finally, the security perceptions.

Another limitation resides in the nature of study in that it is a cross-sectional quantitative study in which data is collected just once. In fact, the behavior of individuals is changing over time and what applies now, may not be regarded in other times. Therefore, this limitation can be avoided by conducting a longitudinal study in the future, with other private or public universities to cope with changes of individual's behavior in using, accepting, and using SaaS Cloud Computing

Moreover, other factors were not included in the current study to leave space for future study, and not to have a very complex model that will be beyond the volume of the thesis. Hence, other factors could be included in future studies, such as: risk, cost of SaaS services, image that user perceives, cloud computing knowledge, Knowledge dissemination, knowledge sharing, and other control variables as moderators, namely: experience, gender, age, culture, religion, race, and occupation.

Additionally, the researcher suggests studying the relationship between SN and ATT and to investigate the mediating effect of ATT in the relationship between SN and BI. Moreover, other groups at universities could be included in future studies, such as: non-academic staff, management, administration and technical staff so group analysis could be conducted to investigate the different perception of different groups that may influence the intention and adoption of SaaS Cloud Computing. More importantly, the study highly recommends conducting a comparative study with some European or

Australian Public universities to investigate the difference between the Asian culture and European culture. Hence, the culture variable is an important element to be included in the future. This could pave the way for future studies in the area of cloud computing.

Extraneous variables such as gender, experience, income, level of education, race, language, religion, and age can be a wealthy area of research in future studies. Thus, the researcher feels it is necessary to give more space in studying SaaS Cloud Computing and shed more light on these variables. Of course, this will be of another cost of reducing other variables on the suggested model to accommodate the volume of research paper or theses.

Finally, replication studies on other organizations such as government agencies, private small-to-medium sized companies, and enterprises can shed more light on the suggested model of the current study and warrant the possibility to generalize the findings gained. Also, having conducted such studies, the results may bring new avenues and new dimensions for future studies on the area of SaaS Cloud Computing.

## **6.8 Conclusion**

The purpose of the current study was to investigate the salient factors influencing the usage, acceptance, or adoption of SaaS Cloud Computing. Additionally, the security perception positive inclination was also investigated as it is a crucial element of concern in adopting SaaS Cloud Computing. The results were analyzed, interpreted, and showed that almost all the factors possess influence in the final outcome of the study.

Besides, the moderating effect was discussed and explained further. The mediating role was one of the important findings that are explained in light with the results gained. The group-specific paths differences between the two groups of respondents were discussed and results highlighted.

The revised version of the model was presented showing different relationships that are significant and the two relationships that exerts weak and nonsignificant relationship, namely: TRI and SN. Besides, the revised model was deposited to give a clearer picture of the phenomenon under study and the findings revealed were reflected in this revised model. Also, the researcher recommends further usage of this current model in future studies.

Apparently, the questions raised in Chapter 1 and the objectives were answered in this study and the model empirically proven to find solution to the problem presented. Besides, the theoretical, the practical, and the methodological contribution were expressed clearly. Lastly, limitations and future direction were highlighted and explained thoroughly. In general, the model proposed achieved its relevance in the area of SaaS Cloud Computing and the discussion linked the results obtained with the hypotheses and the prior literature in previous chapters.

Moreover, the theoretical, practical, and methodological implications were discussed in the chapter and explained thoroughly in line with the objectives of the study. In the last part of this chapter, the limitations were highlighted and future directions for additional research in the area of cloud computing at Higher Education represented by universities is urged to provide the generalization for the results obtained.

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# APPENDICES

## Appendix A Questionnaire



### Exploring Personal Use of Software as a Service (SaaS) Cloud Computing Applications Perception

Dear respondent,

Our planet is facing an ecological disaster as a result of toxic unrecyclable waste, which is produced by technology industry. Some of these effects are: global warming, floods and drought in different areas, CO<sub>2</sub> high rates, high power and air conditioning consumption, and E-waste of technological devices (e.g. monitors, computers, smart phones etc.). However, Cloud Computing technology emerged to solve these problems generated by technology advancement by reducing CO<sub>2</sub> effects, power consumption, electronic waste, and prolong the life of electronic devices. IT has an influence in changing the trend of using technology to safeguard environment, while meeting the demand of modern life, high speed computing, and increase revenue. Software as a *Service Cloud Computing (SaaS CC)* is a **practice** to eliminate the side effects of technology. Therefore, kindly spend some of your valuable time (7-10min) to fill up this questionnaire, which is voluntarily & for research purpose only. Your feedback is highly appreciated and is ultimately confidential. Thanking you in advance for your valuable time.

Yours faithfully,

Taufiq Hail Ghilan

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Note: *SaaS CC services*



*SaaS Cloud Computing (SaaS CC) are Services accessed anytime from anywhere by connecting to the Internet (e.g., e-mail services, opening Pdf files online, storing/ sharing/ uploading/ downloading various files, using university Portal, watching YouTube, etc.).*

#### 1. Demographics

Kindly circle  the appropriate option that mostly suits you in the following:

CODE	Statement	Response	
GN	Gender	1. Male	2. Female
AG	Age	1. 18-26 3. 36-44 5. Above 53	2. 27-35 4. 45- 53
ED	Educational Level	1. Certificate 3. Bachelor 5. PhD.	2. Diploma 4. Master
ETH	Ethnicity	1. Malay	2. Indian

CODE	Statement	Response	
		3. Chinese	4. others
OC	Occupation	1. Student	2. Academic staff
UNI	University (Higher Educational Institute)	1. UUM 3. USM	2. UniMAP 4. UPSI
ST	What type of SaaS Cloud Computing Software (SaaS CC) do you use on daily bases? Select all that applies.	1. Collaborative SaaS CC applications (e.g., Google Docs, Microsoft office 365 applications, University portals). 2. Social media communication applications (e.g., Facebook, twitter, WhatsApp, telegram, Instagram, WhatsApp, Skype etc.). 3. E-mail (e.g., Google, Microsoft, or University e-mail, etc.)	4. SaaS cloud Storage (e.g., Dropbox, Google Drive, Microsoft OneDrive etc.). 5. Communication & calling services (e.g., Tango, imo, Viber, etc.) 6. Entertainment or educational videos/audios (e.g., YouTube, MP3 online streaming). 7. Other applications kindly specify in the following space _____ _____ _____ _____
AF	Which faculty/school/department you belong to _____		

## SaaS Cloud Computing Services (SaaS CC)



**Instructions:** The following statements are related to constructs of the study, kindly tick (✓) the **appropriated option** in the space provided according to your best evaluation of the statements.

### 2. Using, Accepting, or Using SaaS Cloud Computing Services

Code	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
AUSaaS1	I <b>prefer</b> online SaaS Cloud Computing services (e.g., store my data on the web, watching YouTube movies, listening to online music, calling friends using Tango or imo, etc.) <b>than using</b> conventional methods (e.g., using USB drive, watching movies on DVD, or normal telephone calls).					
AUSaaS2	I frequently use online SaaS Cloud Computing services for my work/academic studies (e.g., uploading my data/accessing e-mail, sharing files on Facebook, opening Pdf files online, watching YouTube, etc.).					

AUSaaS3	I believe that I could tell others the advantage of using SaaS Cloud Computing services in my academic study/work.					
AUSaaS4	I would have no difficulty explaining why SaaS Cloud Computing services may or may not be beneficial.					



**3. Behavior Intention to Use SaaS CC Services:** Your future plans that you may take to use SaaS applications

Code	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
BI1	Intend to continue using SaaS Cloud Computing online services in my work /academic studies.					
BI2	I will strongly recommend online services from SaaS Cloud Computing providers to others.					
BI3	I plan to continue using SaaS Cloud Computing services frequently this term and onward.					
BI4	Assuming that I have access to Internet, I intend to continue using SaaS Cloud Computing services.					

**4. Attitude:** Your positive belief towards the use of SaaS services

Code	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
ATT1	Using SaaS CC services is a good idea.					
ATT2	Using SaaS CC services is a wise idea.					
ATT3	I like the idea of using SaaS CC services.					
ATT4	Using SaaS CC online services is beneficial to my academic studies/work.					



**1. Compatibility:** The sense of positive feeling that you get while or after using SaaS services and applications.

Code	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
COM1	Using SaaS CC services will fit well with the way I work and my lifestyle.					
COM2	Using SaaS CC services fits well with my academic needs and values.					
COM3	SaaS CC services and applications are compatible with my preferred work practices.					
COM4	SaaS CC services are compatible with our culture and values in protecting nature, decrease power consumption, and reduce CO <sub>2</sub> .					

**2. Perceived Ease of Use:** The positive feeling that you have while using SaaS services

Code	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
PEU1	It would be easy for me to become skilled at using online SaaS CC services (e.g., access webmail, share files in WhatsApp or Facebook, open Pdf file online on web browser, etc.).					
PEU2	Learning to use online SaaS CC services is easy for me.					
PEU3	I would find the online SaaS CC services easy to use.					
PEU4	Using SaaS CC online services is clear & understandable.					



**3. Perceived Usefulness:** The positive feeling that you have towards using SaaS services

Code	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
PU1	Using online SaaS CC services would facilitate in achieving my duties in work/academic studies.					
PU2	Using online SaaS CC services would provide access to useful academic information.					
PU3	Using online SaaS CC services would save my time when working with electronic information (e.g., reading online, downloading articles).					
PU4	Using SaaS CC online services increases productivity by accessing my data anytime and anywhere.					

**4. Trialability:** Time given to try the services before you believe it is beneficial, essential, or practical for you to use.

Code	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
TRI1	Before deciding on whether or not to accept the various SaaS CC applications, I would need to use it on a trial basis.					
TRI2	Before deciding on whether or not to use or adopt any SaaS CC applications (e.g., Dropbox), I would need to properly try it out.					
TRI3	SaaS CC online services were adequately available to me to test or try various applications.					
TRI4	There are enough people in my university to help me try the various uses of SaaS CC services (e.g. Google Drive)					



**5. User Security Predisposition**



**1. Trust:** The positive feeling towards your SaaS services providers.

Code	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
TRT1	I would trust SaaS CC provider to offer secure transaction to access my data (e.g., access my e-mail, my files on Microsoft OneDrive).					
TRT2	I would trust SaaS CC provider to provide me online services to help in conducting my work/academic studies on the web.					
TRT3	I would trust my SaaS CC provider to provide secure data connections using strong security codes to conduct my transactions over the Internet.					
TRT4	I feel confident that legal & technological aspects of SaaS CC provider are adequate to protect my data.					



SaaS Cloud Save Energy Save Green



**2. Credibility:** The positive feeling that you have towards the SaaS providers in terms of security of the transactions, providers security measures, privacy feeling that your personal information are not exposed.

Code	Statement	Strongly Agree	Disagree	Neutral	Agree	Strongly Disagree
CRD1	Using SaaS CC applications & services would not expose my personal information.					
CRD2	I would find SaaS CC services secure in conducting my transactions & working with online applications provided from SaaS CC providers.					
CRD3	I trust in the ability of SaaS CC services provider (e.g., Google) to protect my privacy.					
CRD4	SaaS CC services are really secure to use in my work/academic research.					

**6. Subjective Norms: The social environment that has influence on you.**

Code	Statement	Strongly Agree	Disagree	Neutral	Agree	Strongly Disagree
SN1	People who influence my behavior would think that I should use SaaS CC services.					
SN2	People who are important to me would think that I should use SaaS CC services.					
SN3	People who are important to me would recommend using SaaS CC online services.					
SN4	People who are important to me would find using SaaS CC online services beneficial & practical.					

**1. Peer Influence:** Your colleagues and friends around you who advise you to do certain things that they feel its beneficial to you.

Code	Statement	Strongly Agree	Disagree	Neutral	Agree	Strongly Disagree
SNPI1	My friends would think that I should use the SaaS CC services.					
SNPI2	I want to do what my classmates/colleagues think I should do.					
SNPI3	My classmates/colleagues recommend that I should use SaaS CC services.					
SNPI4	Colleagues/Classmates who are important to me would think that I should use SaaS CC services in my academic studies/work.					



**2. Superior Influence:** Your colleague, friend in a higher level of education, or your supervisor that urges, requests, or recommends you do certain thing that (s)he believe it is a requirement or important to facilitate your work.

Code	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
SNSI1	I will have to use SaaS CC services and applications because my professors/supervisors require it.					
SNSI2	I want to do what my professors/supervisors think I should do.					
SNSI3	My professors/supervisors would think that I should use SaaS CC services & applications.					
SNSI4	I will have to use SaaS CC services and applications because my professors/supervisors require it.					

**7. Perceived Behavior Control:** Your personal capabilities, the resources such as internet, time, and money, which can facilitate your use of SaaS technology

Code.	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
PBC1	I would be able to use SaaS CC services & applications.					
PBC2	Using SaaS CC services (e.g., storing files on the web) is entirely within my control and capability.					
PBC3	I have the resources and the ability to make use of SaaS CC facilities and services.					
PBC4	I have the knowledge to use SaaS CC services.					



**1. Self-efficacy:** Your skills, capabilities, knowledge, and feeling of comfort that you believe you possess to use SaaS applications and services.

<i>Code</i>	<i>Statement</i>	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
PBC-SE1	I would feel comfortable using SaaS CC services.					
PBC-SE2	I could easily use SaaS CC services on my own.					
PBC-SE3	I know enough to use SaaS CC services.					
PBC-SE4	It is important to me to use SaaS CC services, even if there is no one around to show me how to use it.					



**2. Facilitating Conditions:** Resources such as internet equipment, Smart devices, money, time, or availability of internet connectivity to use SaaS services

<i>Code</i>	<i>Statement</i>	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
PBC-FC1	I have the Internet equipment (modems, ADSL, Wi-Fi accessibility etc.) required to use online SaaS CC services.					
PBC-FC2	I have the time to use online SaaS CC services.					
PBC-FC3	I have enough money to buy the hardware (e.g., Tablet, Smartphone, Laptop) to access and use online SaaS CC applications & services.					
PBC-FC4	It is important for me to be able to use SaaS CC services when I need it.					



**Appendix B**  
**Discriminant Validity Results**



Table B. 1

*Discriminant Validity With Cross-Loadings Criteria for The Latent Variables*

	<b>ATT</b>	<b>AUSaaS</b>	<b>BI</b>	<b>COM</b>	<b>PBC</b>	<b>PBCFC</b>	<b>PBCSE</b>	<b>PEU</b>	<b>PU</b>	<b>SN</b>	<b>SNPI</b>	<b>SNSI</b>	<b>USecP</b>	<b>TRI</b>
ATT1	<b>0.88</b>	0.55	0.67	0.66	0.52	0.54	0.52	0.59	0.67	0.42	0.39	0.29	0.43	0.44
ATT2	<b>0.77</b>	0.35	0.54	0.54	0.39	0.4	0.38	0.45	0.51	0.27	0.25	0.21	0.31	0.34
ATT3	<b>0.90</b>	0.52	0.69	0.68	0.53	0.54	0.54	0.6	0.67	0.42	0.4	0.33	0.44	0.46
ATT4	<b>0.85</b>	0.51	0.69	0.7	0.54	0.52	0.52	0.6	0.69	0.41	0.41	0.31	0.4	0.47
AUSaaS1	0.42	<b>0.71</b>	0.43	0.41	0.35	0.41	0.41	0.44	0.36	0.29	0.28	0.1	0.35	0.31
AUSaaS2	0.42	<b>0.77</b>	0.51	0.46	0.44	0.36	0.38	0.45	0.46	0.26	0.29	0.19	0.28	0.31
AUSaaS3	0.51	<b>0.81</b>	0.56	0.53	0.45	0.4	0.49	0.5	0.5	0.4	0.37	0.21	0.4	0.37
AUSaaS4	0.35	<b>0.70</b>	0.41	0.38	0.39	0.4	0.42	0.4	0.37	0.32	0.28	0.16	0.32	0.31
BI1	0.66	0.59	<b>0.87</b>	0.63	0.54	0.5	0.5	0.55	0.65	0.37	0.38	0.26	0.38	0.4
BI2	0.67	0.58	<b>0.88</b>	0.63	0.54	0.49	0.53	0.57	0.59	0.43	0.41	0.29	0.42	0.42
BI3	0.72	0.59	<b>0.94</b>	0.68	0.56	0.55	0.53	0.64	0.66	0.4	0.39	0.27	0.41	0.43
BI4	0.72	0.56	<b>0.9</b>	0.66	0.54	0.55	0.53	0.6	0.67	0.39	0.39	0.3	0.37	0.44
COM1	0.69	0.53	0.63	<b>0.9</b>	0.59	0.55	0.57	0.63	0.67	0.47	0.41	0.27	0.47	0.47
COM2	0.7	0.56	0.69	<b>0.9</b>	0.58	0.59	0.59	0.62	0.7	0.49	0.47	0.34	0.49	0.51
COM3	0.69	0.54	0.65	<b>0.92</b>	0.56	0.54	0.58	0.66	0.72	0.47	0.42	0.31	0.48	0.47
PBC1	0.52	0.47	0.53	0.56	<b>0.82</b>	0.58	0.6	0.58	0.59	0.45	0.45	0.39	0.45	0.45
PBC2	0.51	0.46	0.51	0.52	<b>0.85</b>	0.59	0.64	0.56	0.55	0.46	0.46	0.34	0.5	0.42
PBC3	0.51	0.49	0.55	0.56	<b>0.89</b>	0.64	0.72	0.6	0.59	0.49	0.42	0.32	0.48	0.43
PBC4	0.44	0.44	0.44	0.51	<b>0.81</b>	0.61	0.75	0.56	0.48	0.41	0.39	0.33	0.42	0.44
PBCFC1	0.5	0.46	0.49	0.51	0.59	<b>0.85</b>	0.6	0.5	0.54	0.39	0.42	0.29	0.4	0.35
PBCFC2	0.48	0.43	0.45	0.5	0.58	<b>0.86</b>	0.62	0.57	0.54	0.42	0.45	0.32	0.42	0.37
PBCFC3	0.37	0.32	0.37	0.41	0.46	<b>0.7</b>	0.49	0.4	0.37	0.35	0.34	0.22	0.33	0.32
PBCFC4	0.57	0.49	0.59	0.59	0.69	<b>0.87</b>	0.7	0.61	0.62	0.46	0.46	0.35	0.46	0.45
PBCSE1	0.53	0.54	0.56	0.58	0.74	0.65	<b>0.86</b>	0.63	0.59	0.49	0.46	0.33	0.54	0.44
PBCSE2	0.54	0.54	0.55	0.59	0.73	0.67	<b>0.91</b>	0.65	0.59	0.46	0.42	0.33	0.48	0.44

Table B.1 continued

PBCSE3	0.46	0.44	0.42	0.51	0.64	0.6	<b>0.84</b>	0.56	0.49	0.41	0.37	0.3	0.41	0.36
PBCSE4	0.48	0.45	0.47	0.53	0.67	0.64	<b>0.86</b>	0.55	0.53	0.45	0.4	0.31	0.45	0.36
PEU1	0.6	0.5	0.57	0.59	0.55	0.51	0.53	<b>0.81</b>	0.62	0.37	0.34	0.29	0.39	0.45
PEU2	0.56	0.53	0.58	0.61	0.6	0.55	0.63	<b>0.89</b>	0.61	0.39	0.35	0.25	0.41	0.43
PEU3	0.59	0.53	0.59	0.62	0.62	0.59	0.63	<b>0.92</b>	0.64	0.41	0.39	0.3	0.43	0.49
PEU4	0.57	0.54	0.56	0.64	0.63	0.57	0.63	<b>0.87</b>	0.65	0.45	0.43	0.29	0.52	0.46
PU1	0.65	0.5	0.62	0.69	0.62	0.58	0.58	0.64	<b>0.86</b>	0.45	0.44	0.36	0.44	0.47
PU2	0.67	0.49	0.61	0.67	0.55	0.54	0.55	0.62	<b>0.87</b>	0.44	0.46	0.33	0.41	0.46
PU3	0.65	0.49	0.62	0.64	0.57	0.55	0.55	0.61	<b>0.87</b>	0.44	0.4	0.35	0.41	0.43
PU4	0.64	0.5	0.62	0.66	0.53	0.54	0.52	0.62	<b>0.86</b>	0.39	0.4	0.29	0.39	0.45
SN1	0.39	0.41	0.39	0.45	0.48	0.41	0.45	0.43	0.42	<b>0.86</b>	0.61	0.46	0.55	0.44
SN2	0.41	0.37	0.37	0.46	0.46	0.42	0.46	0.38	0.43	<b>0.91</b>	0.64	0.45	0.5	0.42
SN3	0.39	0.35	0.38	0.47	0.48	0.45	0.46	0.38	0.44	<b>0.91</b>	0.65	0.46	0.51	0.38
SN4	0.44	0.4	0.43	0.49	0.51	0.48	0.5	0.47	0.49	<b>0.89</b>	0.69	0.48	0.54	0.47
SNPI1	0.4	0.39	0.42	0.45	0.47	0.48	0.47	0.42	0.47	0.7	<b>0.9</b>	0.51	0.45	0.4
SNPI2	0.3	0.28	0.27	0.32	0.32	0.31	0.29	0.28	0.33	0.55	<b>0.8</b>	0.47	0.37	0.31
SNPI3	0.41	0.38	0.42	0.45	0.49	0.49	0.44	0.4	0.46	0.66	<b>0.92</b>	0.54	0.46	0.37
SNPI4	0.41	0.39	0.42	0.46	0.5	0.5	0.47	0.41	0.47	0.67	<b>0.92</b>	0.55	0.48	0.41
SNSI1	0.29	0.21	0.29	0.29	0.34	0.32	0.3	0.28	0.34	0.44	0.53	<b>0.89</b>	0.29	0.31
SNSI2	0.31	0.21	0.27	0.3	0.36	0.31	0.33	0.29	0.33	0.46	0.51	<b>0.86</b>	0.3	0.34
SNSI3	0.33	0.21	0.29	0.33	0.41	0.38	0.37	0.3	0.38	0.52	0.56	<b>0.91</b>	0.35	0.35
SNSI4	0.27	0.17	0.27	0.28	0.33	0.29	0.29	0.27	0.3	0.42	0.49	<b>0.9</b>	0.27	0.35
TRT1	0.44	0.44	0.41	0.49	0.5	0.46	0.51	0.43	0.43	0.43	0.41	0.29	<b>0.82</b>	0.43
TRT2	0.45	0.41	0.44	0.52	0.51	0.46	0.5	0.46	0.5	0.45	0.39	0.32	<b>0.78</b>	0.46
TRT3	0.45	0.4	0.41	0.49	0.49	0.46	0.49	0.41	0.45	0.48	0.42	0.3	<b>0.85</b>	0.42
TRT4	0.39	0.39	0.37	0.43	0.45	0.39	0.43	0.41	0.39	0.49	0.43	0.29	<b>0.88</b>	0.44
CDR1	0.33	0.3	0.28	0.35	0.4	0.36	0.4	0.38	0.3	0.49	0.41	0.27	<b>0.81</b>	0.4
CDR2	0.37	0.37	0.34	0.41	0.48	0.4	0.47	0.44	0.38	0.53	0.42	0.29	<b>0.85</b>	0.43
CDR3	0.29	0.3	0.27	0.35	0.39	0.35	0.39	0.34	0.29	0.49	0.42	0.24	<b>0.81</b>	0.34
CDR4	0.38	0.37	0.37	0.43	0.42	0.38	0.41	0.45	0.41	0.52	0.41	0.29	<b>0.81</b>	0.45

Table B.1 continued

TRI1	0.37	0.26	0.31	0.35	0.33	0.28	0.26	0.36	0.35	0.32	0.28	0.27	0.37	
TRI2	0.35	0.3	0.32	0.34	0.34	0.31	0.3	0.38	0.37	0.32	0.28	0.28	0.35	<b>0.83</b>
TRI3	0.44	0.4	0.41	0.51	0.48	0.43	0.46	0.45	0.47	0.44	0.33	0.31	0.45	<b>0.82</b>
TRI4	0.44	0.42	0.45	0.48	0.47	0.42	0.43	0.48	0.48	0.43	0.44	0.35	0.45	<b>0.75</b>

Table B. 2

*Discriminant Validity With Fornell and Larker Criterion for The Latent Variables*

	ATT	AUSaaS	BI	COM	PBC	PBCFC	PBCSE	PEU	PU	SN	SNPI	SNSI	USecP	TRI
ATT	0.85													
AUSaaS	0.57	<b>0.75</b>												
BI	0.77	0.65	<b>0.9</b>											
COM	0.77	0.6	0.72	<b>0.91</b>										
PBC	0.59	0.55	0.61	0.64	<b>0.84</b>									
PBCFC	0.59	0.52	0.58	0.62	0.72	<b>0.82</b>								
PBCSE	0.58	0.57	0.58	0.64	0.81	0.74	<b>0.87</b>							
PEU	0.66	0.6	0.66	0.7	0.69	0.64	0.69	<b>0.87</b>						
PU	0.75	0.57	0.71	0.77	0.66	0.64	0.64	0.72	<b>0.87</b>					
SN	0.45	0.43	0.44	0.53	0.54	0.49	0.52	0.46	0.5	<b>0.89</b>				
SNPI	0.43	0.41	0.44	0.48	0.51	0.51	0.48	0.43	0.49	0.73	<b>0.89</b>			
SNSI	0.34	0.23	0.31	0.34	0.41	0.37	0.37	0.32	0.38	0.52	0.59	<b>0.89</b>		
USecP	0.47	0.45	0.44	0.53	0.55	0.49	0.54	0.5	0.48	0.59	0.5	0.34	<b>0.83</b>	
TRI	0.51	0.44	0.47	0.53	0.51	0.46	0.46	0.52	0.52	0.48	0.42	0.38	0.51	<b>0.8</b>

Table B. 3

*Discriminant Validity HTMT Inference Ratio With 95% Confidence Interval for All Latent Variable*

	Original Sample (O)	Sample Mean (M)	T Statistics ( $ O/STDEV $ )	P Values	2.5%	97.5%	Significant? Yes/No
AUSaaS -> ATT	0.7	0.7	14.81	0	0.59	0.78	Yes
BI -> ATT	0.86	0.86	37.12	0	0.81	0.9	Yes
BI -> AUSaaS	0.78	0.78	21.13	0	0.69	0.84	Yes
COM -> ATT	0.86	0.86	36.06	0	0.81	0.9	Yes
COM -> AUSaaS	0.73	0.73	16.18	0	0.63	0.81	Yes
COM -> BI	0.8	0.79	27.54	0	0.74	0.85	Yes
PBC -> ATT	0.67	0.67	15.84	0	0.58	0.75	Yes
PBC -> AUSaaS	0.69	0.69	15.01	0	0.59	0.77	Yes
PBC -> BI	0.68	0.68	18.04	0	0.6	0.75	Yes
PBC -> COM	0.73	0.73	17.96	0	0.64	0.8	Yes
PBCFC -> ATT	0.68	0.68	15.84	0	0.59	0.76	Yes
PBCFC -> AUSaaS	0.66	0.66	13.71	0	0.56	0.75	Yes
PBCFC -> BI	0.65	0.65	15.6	0	0.57	0.73	Yes
PBCFC -> PBC	0.83	0.83	25.79	0	0.75	0.88	Yes
PBCSE -> ATT	0.66	0.65	16.17	0	0.57	0.73	Yes
PBCSE -> AUSaaS	0.7	0.7	16.48	0	0.6	0.77	Yes
PBCSE -> BI	0.64	0.64	16.22	0	0.56	0.71	Yes
PBCSE -> COM	0.71	0.71	18.8	0	0.63	0.78	Yes
PBCSE -> PBC	0.91	0.91	40.7	0	0.87	0.96	Yes
PBCSE -> PBCFC	0.85	0.85	32.14	0	0.79	0.9	Yes
PEU -> ATT	0.75	0.75	21.14	0	0.67	0.81	Yes
PEU -> AUSaaS	0.73	0.73	19.33	0	0.66	0.8	Yes
PEU -> BI	0.73	0.72	20.88	0	0.66	0.8	Yes
PEU -> COM	0.79	0.79	22.46	0	0.71	0.85	Yes
PEU -> PBC	0.78	0.78	27.64	0	0.72	0.83	Yes
PEU -> PBCFC	0.73	0.73	21.04	0	0.66	0.79	Yes

Table B.3 continued

PEU -> PBCSE	0.77	0.77	27.32	0	0.71	0.82	Yes
PU -> ATT	0.85	0.85	32.7	0	0.8	0.9	Yes
PU -> AUSaaS	0.7	0.7	14.57	0	0.59	0.78	Yes
PU -> BI	0.79	0.79	26.29	0	0.73	0.84	Yes
PU -> COM	0.86	0.86	37.53	0	0.82	0.91	Yes
PU -> PBC	0.75	0.75	23.68	0	0.69	0.81	Yes
PU -> PBCFC	0.73	0.73	19.98	0	0.66	0.8	Yes
PU -> PBCSE	0.71	0.71	21.44	0	0.65	0.77	Yes
PU -> PEU	0.81	0.81	25.66	0	0.74	0.86	Yes
SN -> ATT	0.5	0.5	10.18	0	0.4	0.59	Yes
SN -> AUSaaS	0.52	0.52	8.91	0	0.4	0.62	Yes
SN -> BI	0.48	0.48	9.91	0	0.39	0.57	Yes
SN -> COM	0.58	0.58	13.06	0	0.49	0.66	Yes
SN -> PBC	0.61	0.6	12.68	0	0.51	0.7	Yes
SN -> PBCFC	0.56	0.56	11.51	0	0.46	0.65	Yes
SN -> PBCSE	0.58	0.57	12.5	0	0.48	0.67	Yes
SN -> PEU	0.51	0.51	11.27	0	0.42	0.6	Yes
SN -> PU	0.55	0.55	12.83	0	0.46	0.63	Yes
SNPI -> ATT	0.48	0.48	9.61	0	0.38	0.57	Yes
SNPI -> AUSaaS	0.49	0.49	8.73	0	0.37	0.6	Yes
SNPI -> BI	0.47	0.47	9.98	0	0.38	0.56	Yes
SNPI -> COM	0.53	0.53	11.11	0	0.43	0.62	Yes
SNPI -> PBC	0.57	0.57	11.74	0	0.47	0.66	Yes
SNPI -> PBCFC	0.58	0.57	12	0	0.47	0.66	Yes
SNPI -> PBCSE	0.52	0.52	10.42	0	0.42	0.62	Yes
SNPI -> PEU	0.48	0.48	9.79	0	0.38	0.57	Yes
SNPI -> PU	0.54	0.54	12.87	0	0.46	0.63	Yes
SNPI -> SN	0.79	0.79	28.09	0	0.74	0.85	Yes
SNSI -> ATT	0.38	0.37	6.48	0	0.26	0.49	Yes
SNSI -> AUSaaS	0.27	0.27	3.82	0	0.14	0.41	Yes

Table B.3 continued

SNSI -> BI	0.34	0.34	5.96	0	0.23	0.45	Yes
SNSI -> COM	0.37	0.37	6.05	0	0.25	0.5	Yes
SNSI -> PBC	0.46	0.46	7.01	0	0.33	0.59	Yes
SNSI -> PBCSE	0.4	0.4	6.56	0	0.28	0.52	Yes
SNSI -> PEU	0.35	0.35	5.87	0	0.24	0.48	Yes
SNSI -> PU	0.42	0.42	7.59	0	0.32	0.53	Yes
SNSI -> SN	0.56	0.56	9.94	0	0.44	0.66	Yes
SNSI -> SNPI	0.64	0.64	13.08	0	0.53	0.73	Yes
USecP -> ATT	0.52	0.51	11.2	0	0.43	0.61	Yes
USecP -> AUSaaS	0.54	0.54	11.78	0	0.45	0.63	Yes
USecP -> BI	0.47	0.47	10.57	0	0.38	0.56	Yes
USecP -> COM	0.58	0.57	14.27	0	0.5	0.66	Yes
USecP -> PBC	0.61	0.61	14.74	0	0.53	0.69	Yes
USecP -> PBCFC	0.55	0.55	11.38	0	0.46	0.65	Yes
USecP -> PBCSE	0.59	0.59	14.42	0	0.51	0.67	Yes
USecP -> PEU	0.55	0.55	13.38	0	0.47	0.63	Yes
USecP -> PU	0.52	0.52	11.58	0	0.43	0.61	Yes
USecP -> SN	0.64	0.63	15.96	0	0.55	0.71	Yes
USecP -> SNPI	0.54	0.54	12.61	0	0.46	0.62	Yes
USecP -> SNSI	0.37	0.37	6.19	0	0.24	0.48	Yes
TRI -> ATT	0.59	0.58	12.56	0	0.49	0.67	Yes
TRI -> AUSaaS	0.55	0.55	9.98	0	0.44	0.66	Yes
TRI -> BI	0.54	0.53	10.74	0	0.44	0.63	Yes
TRI -> COM	0.61	0.61	12.89	0	0.51	0.69	Yes
TRI -> PBC	0.6	0.6	11.88	0	0.5	0.7	Yes
TRI -> PBCFC	0.53	0.53	9.54	0	0.42	0.64	Yes
TRI -> PBCSE	0.53	0.52	10.03	0	0.43	0.63	Yes
TRI -> PEU	0.6	0.6	12.66	0	0.51	0.7	Yes
TRI -> SN	0.54	0.54	11.16	0	0.45	0.64	Yes
TRI -> SNPI	0.48	0.48	9.21	0	0.38	0.58	Yes

Table B.3 continued

TRI -> SNSI	0.44	0.43	6.92	0	0.31	0.55	Yes
TRI -> USecP	0.58	0.57	12.45	0	0.48	0.66	Yes





## Appendix C

### Normality Tests, Measurement & Structural Model Diagrams

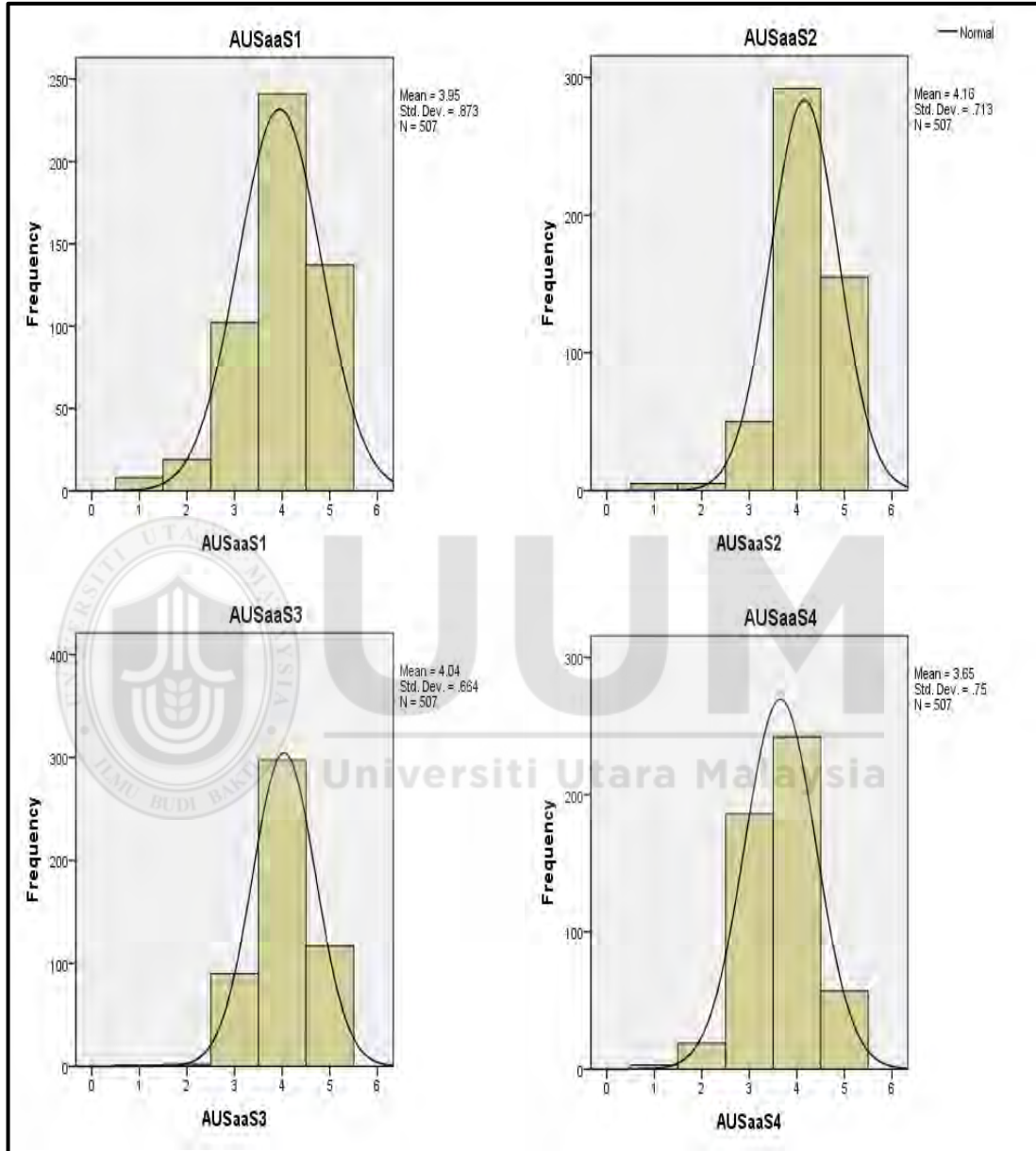


Figure C. 1. Normality histogram for AUSaaS

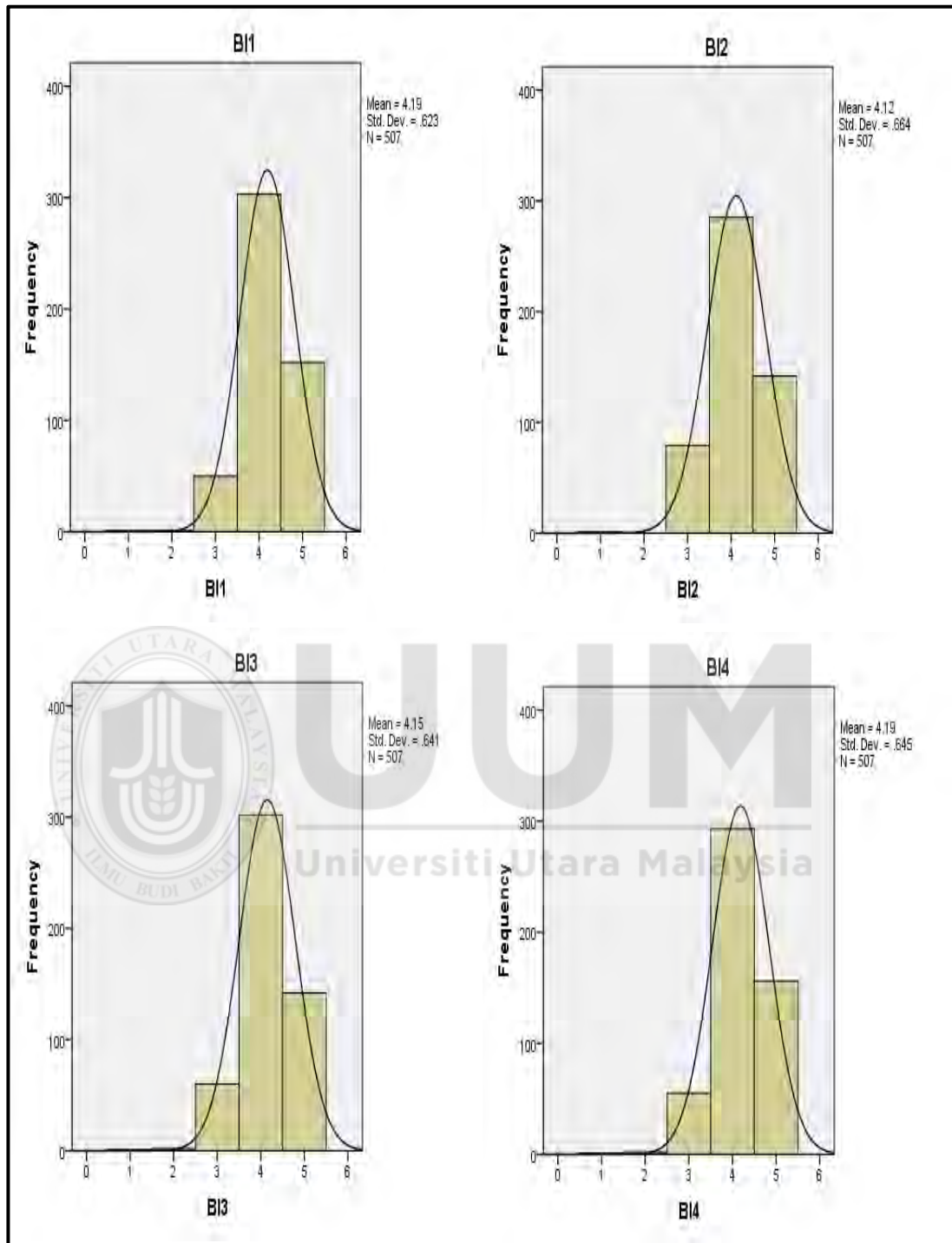


Figure C. 2. Normality histogram for BI

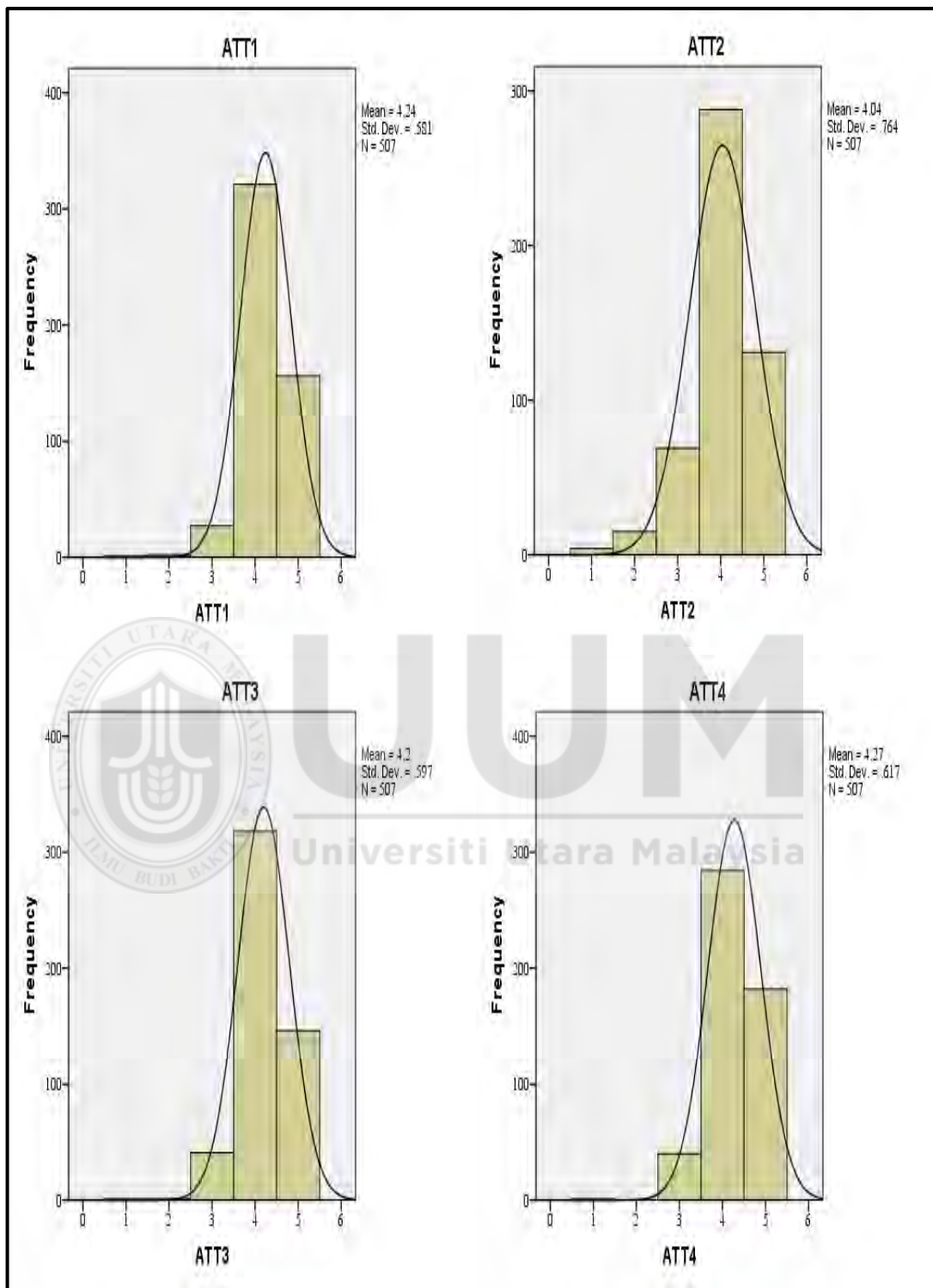


Figure C. 3. Normality histogram for AUSaaS

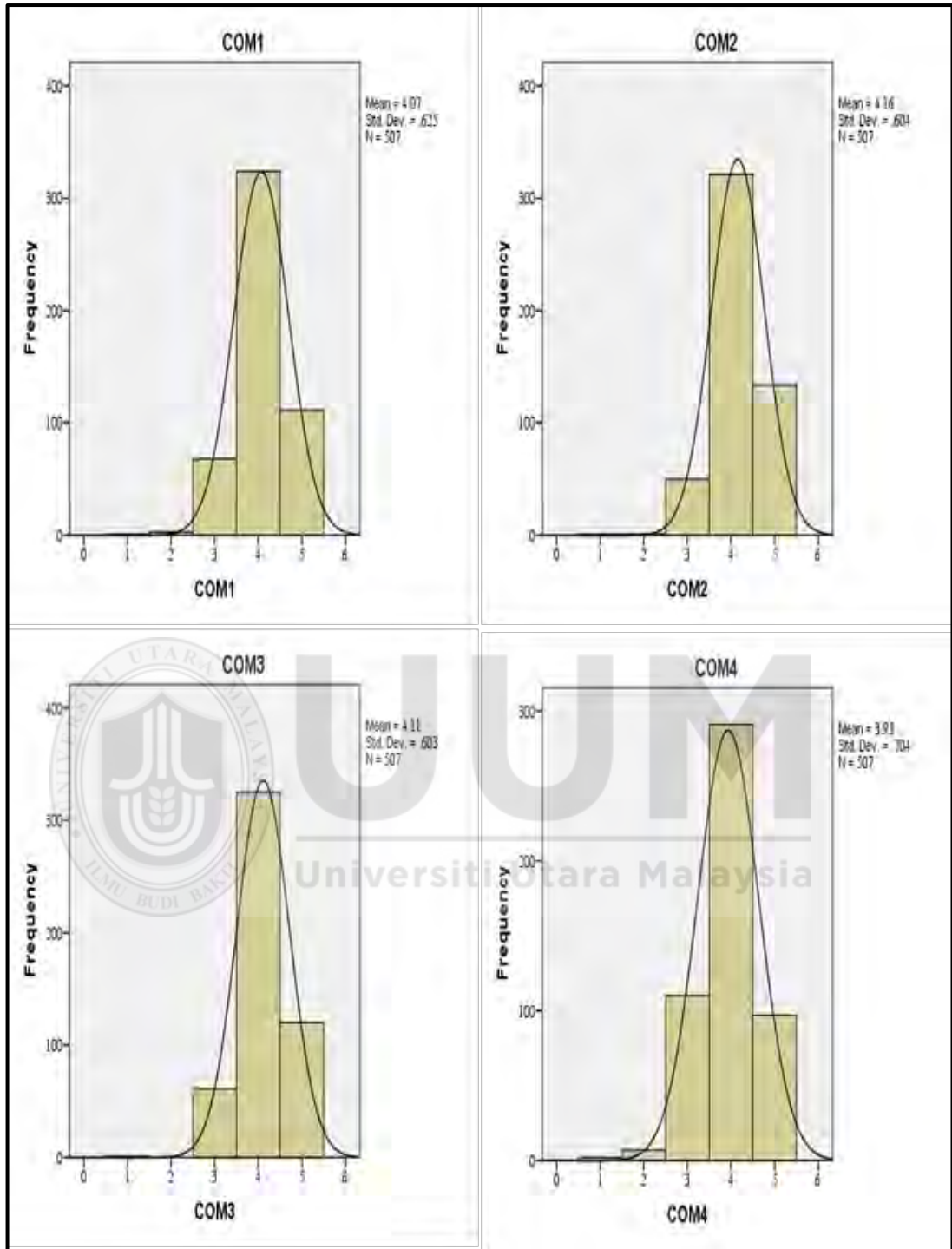


Figure C. 4. Normality histogram for COM

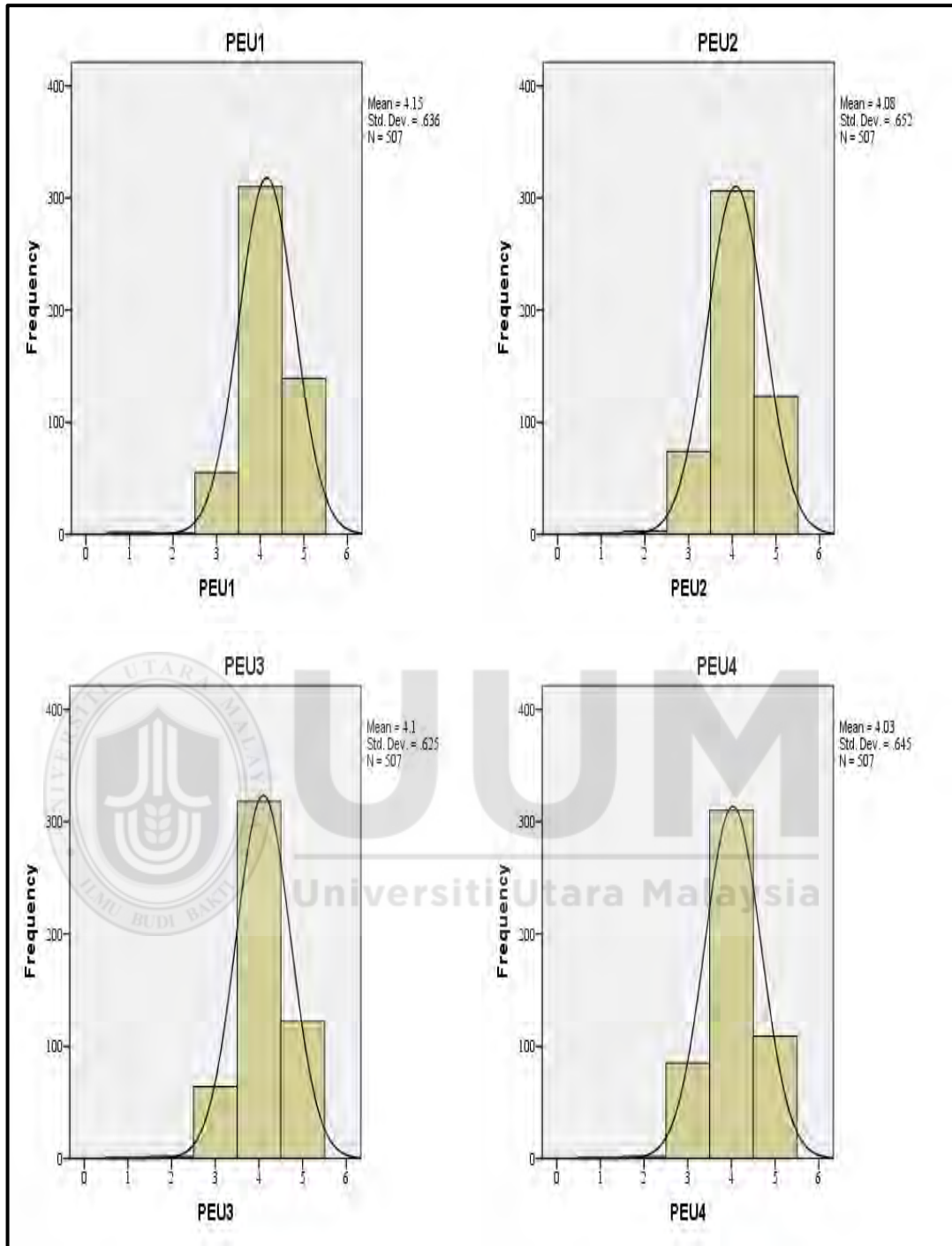


Figure C. 5. Normality histogram for PEU

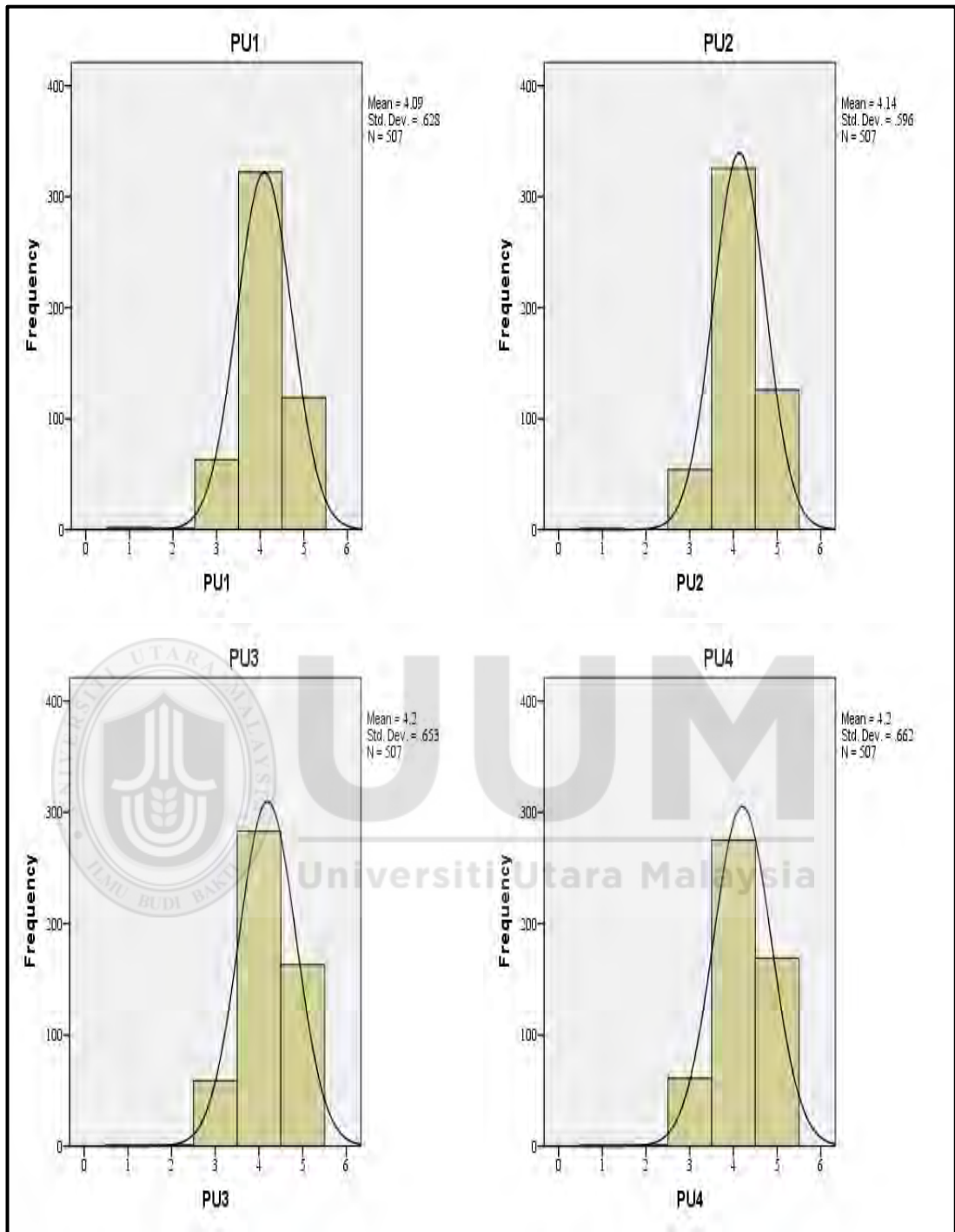


Figure C. 6. Normality histogram for PU

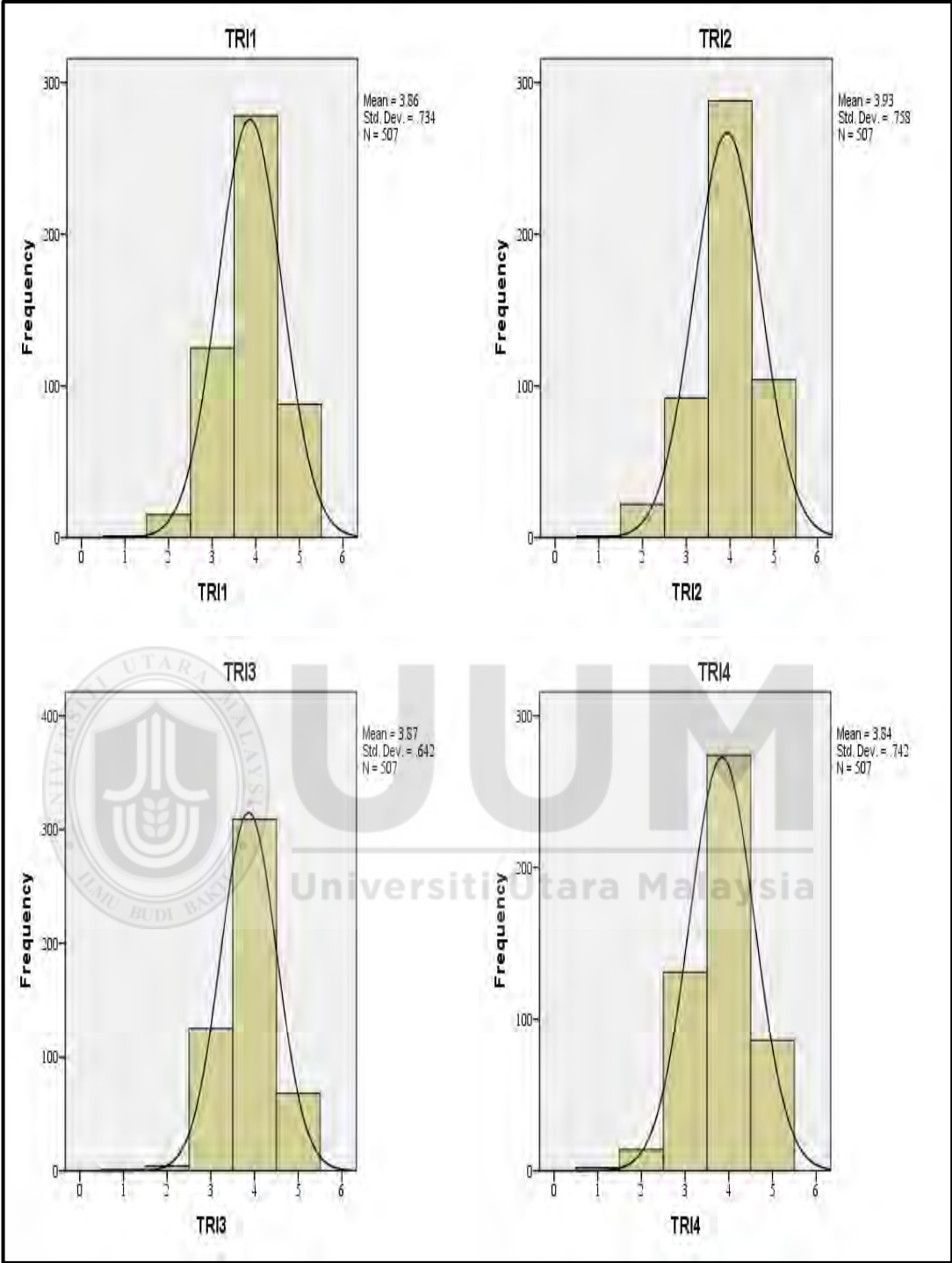


Figure C. 7. Normality histogram for TRI

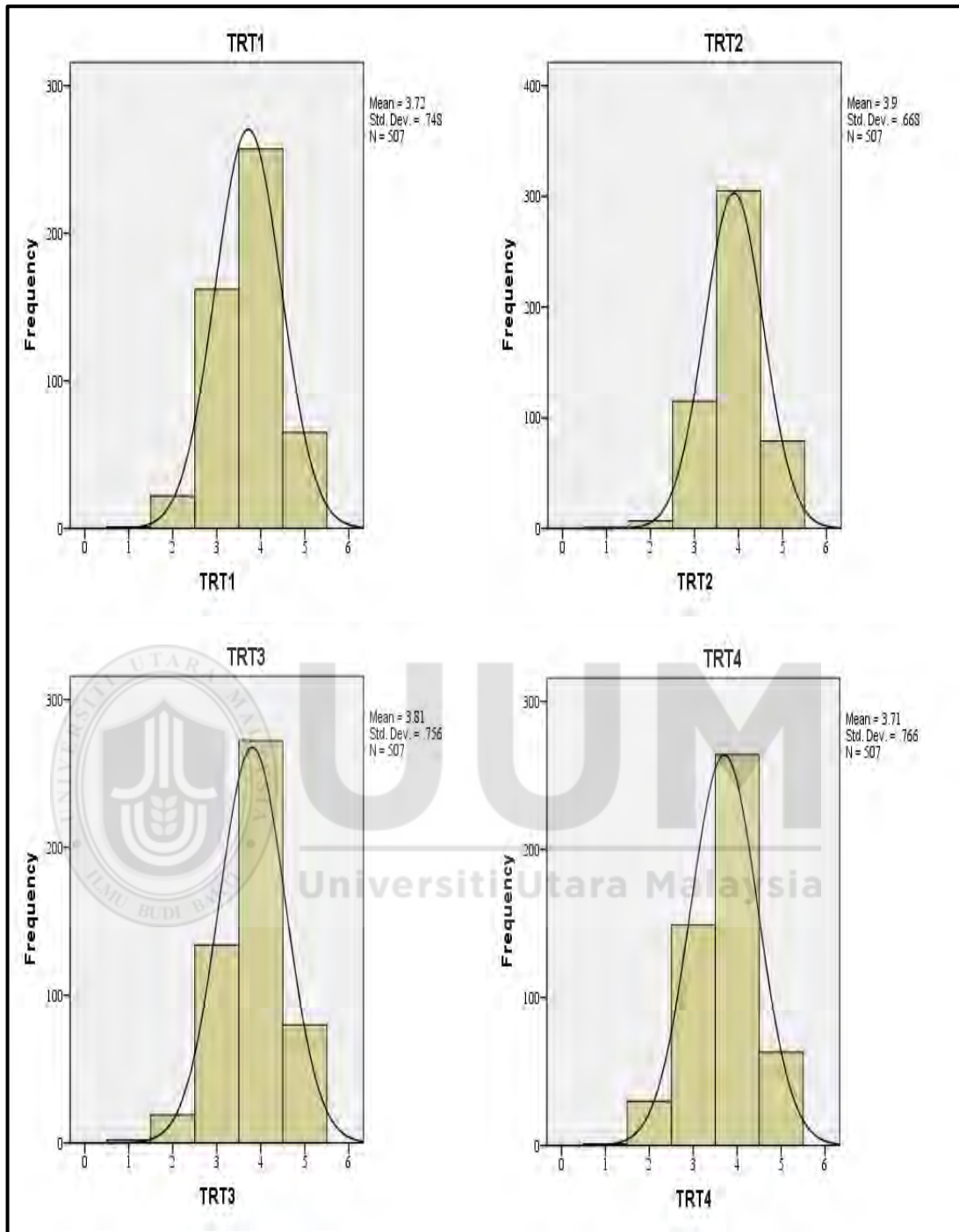


Figure C. 8. Normality histogram for TRT



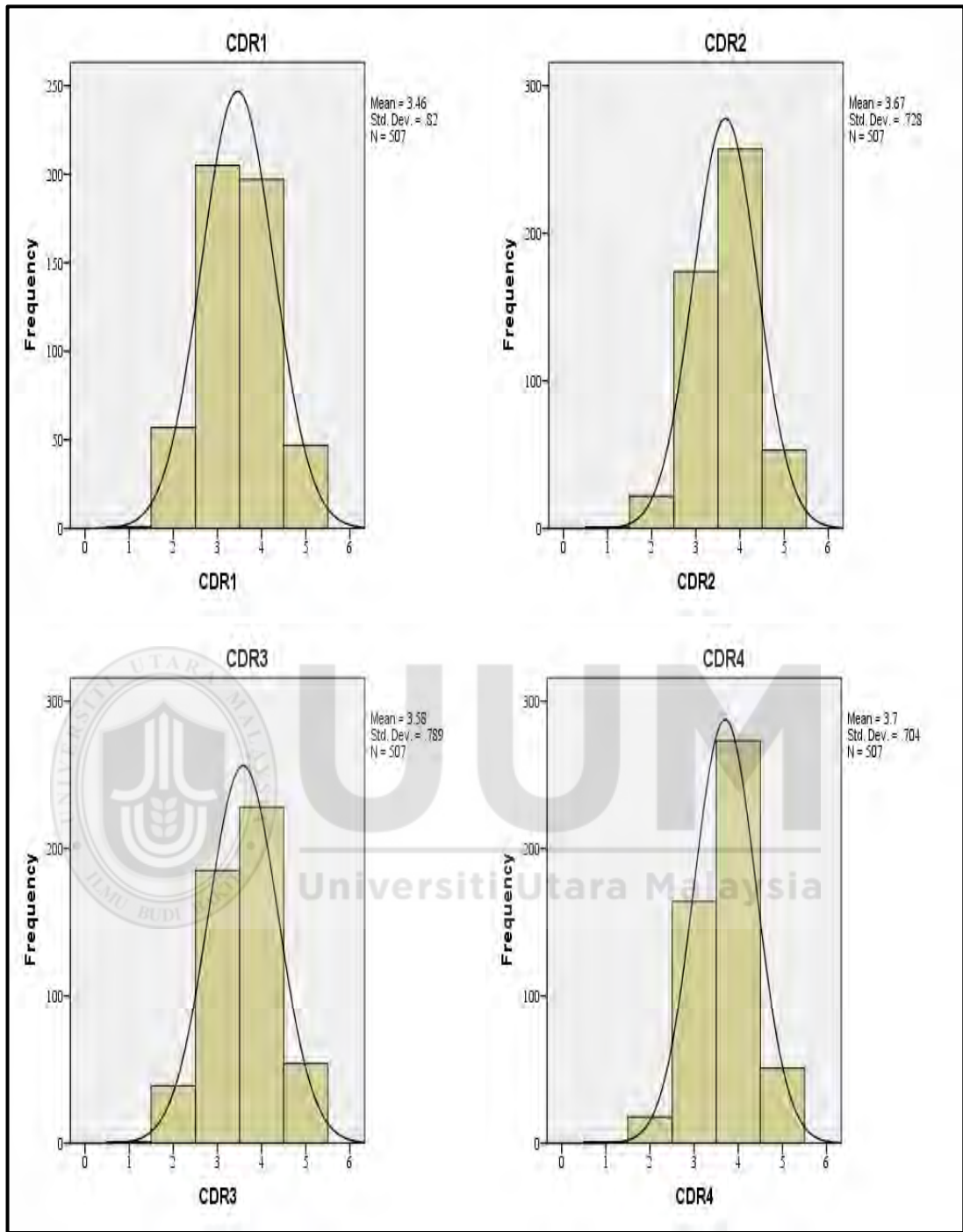


Figure C. 9. Normality histogram for CRD

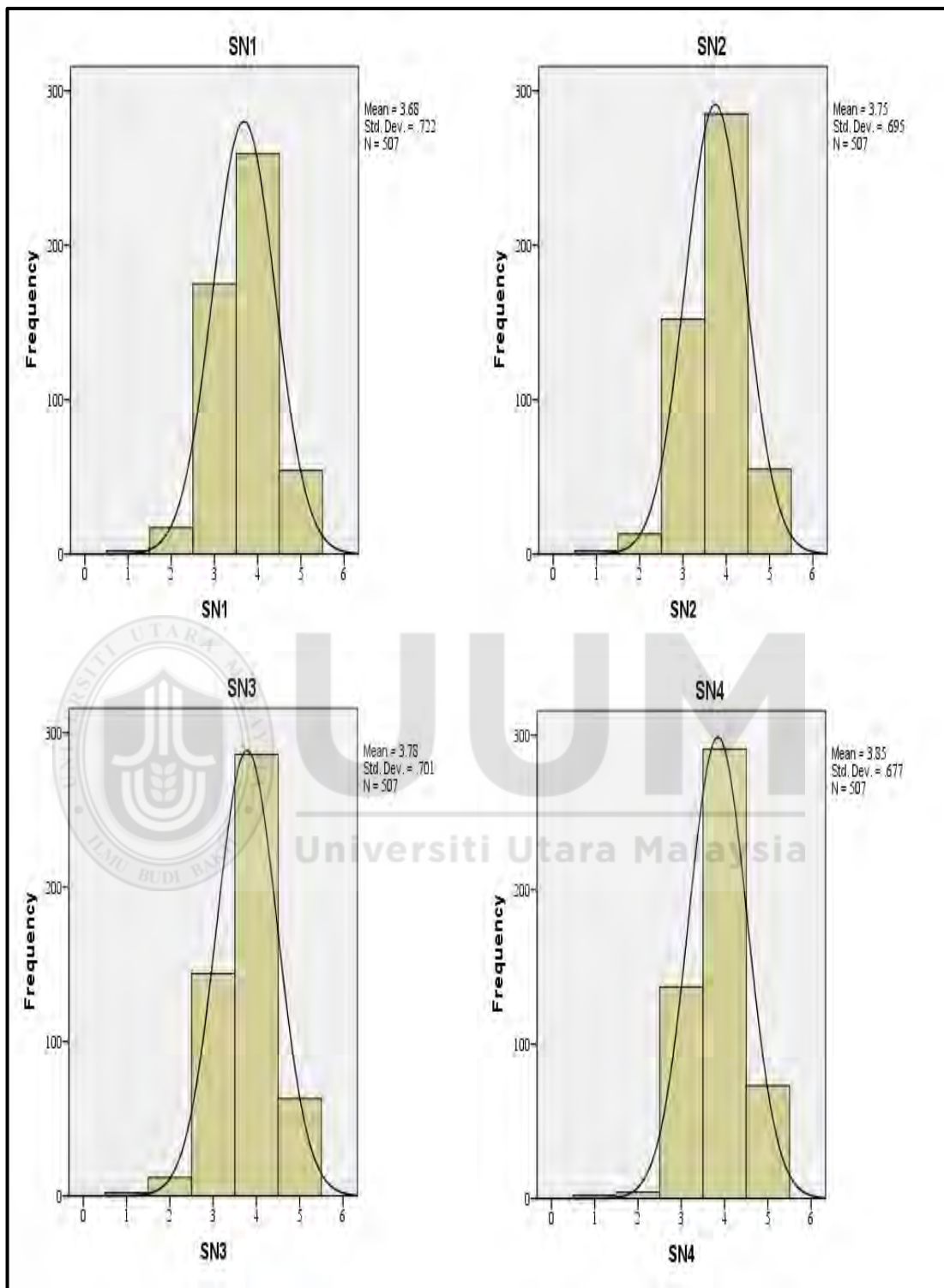


Figure C. 10. Normality histogram for SN

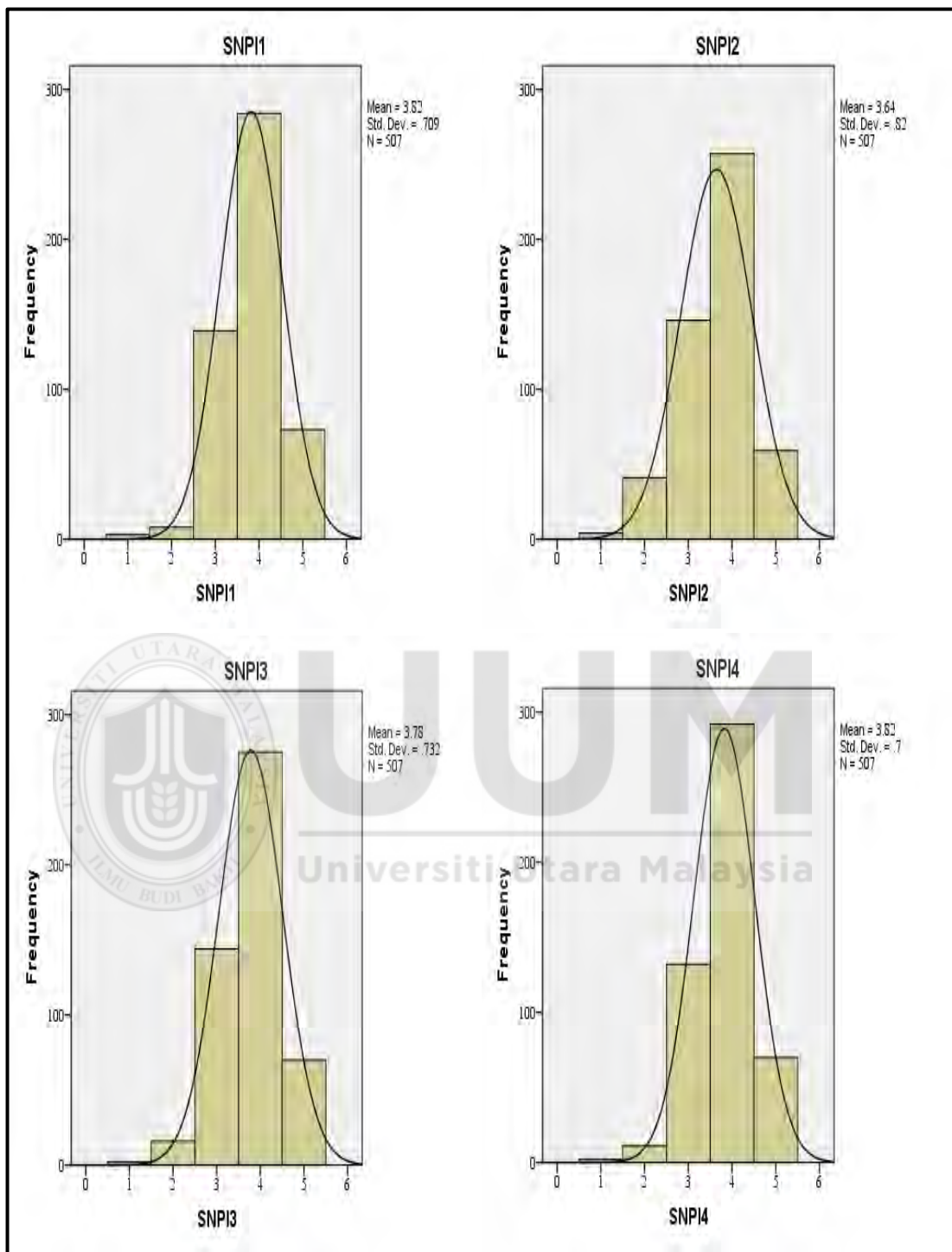


Figure C. 11. Normality histogram for SNSI

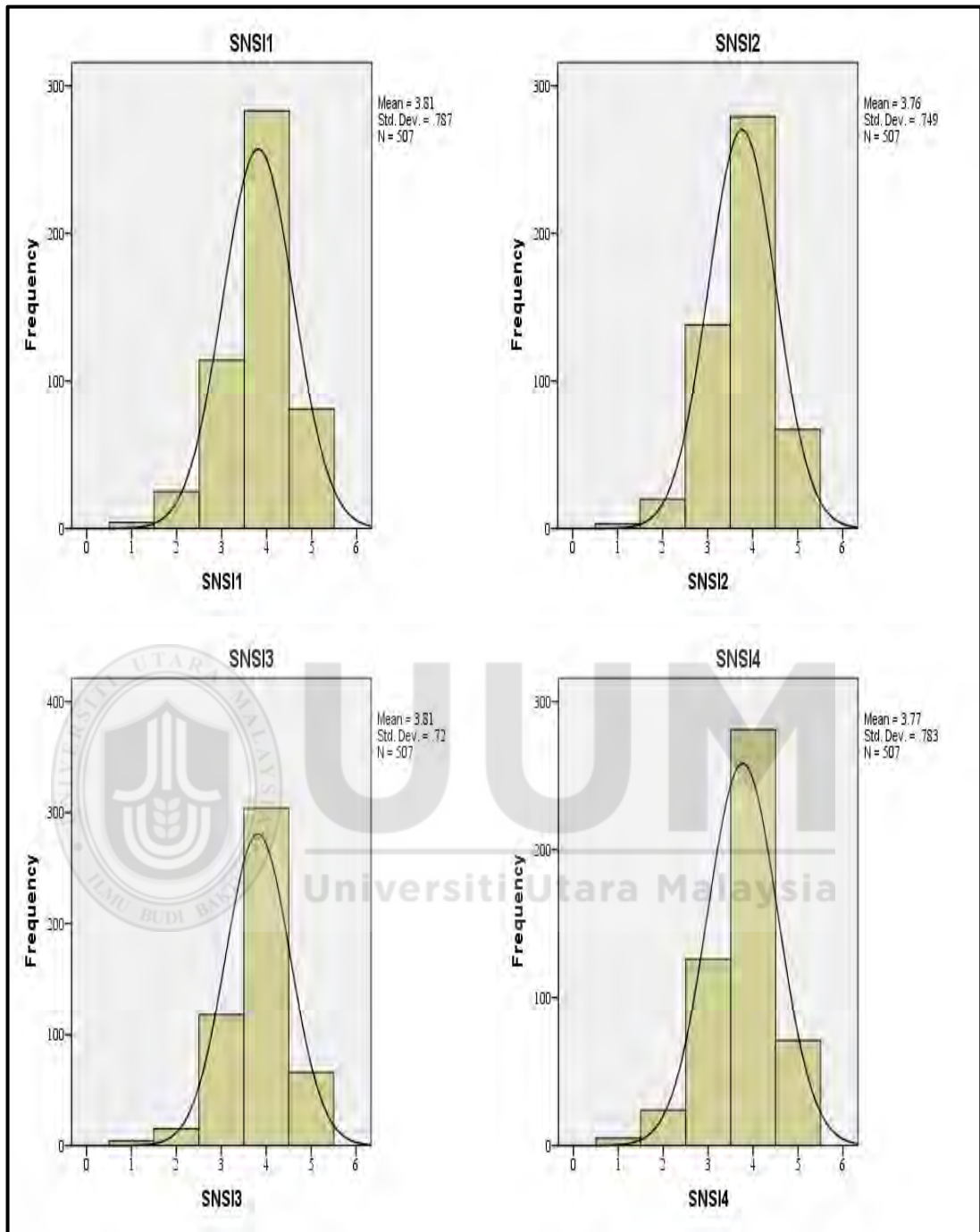


Figure C. 12. Normality histogram for SNSI

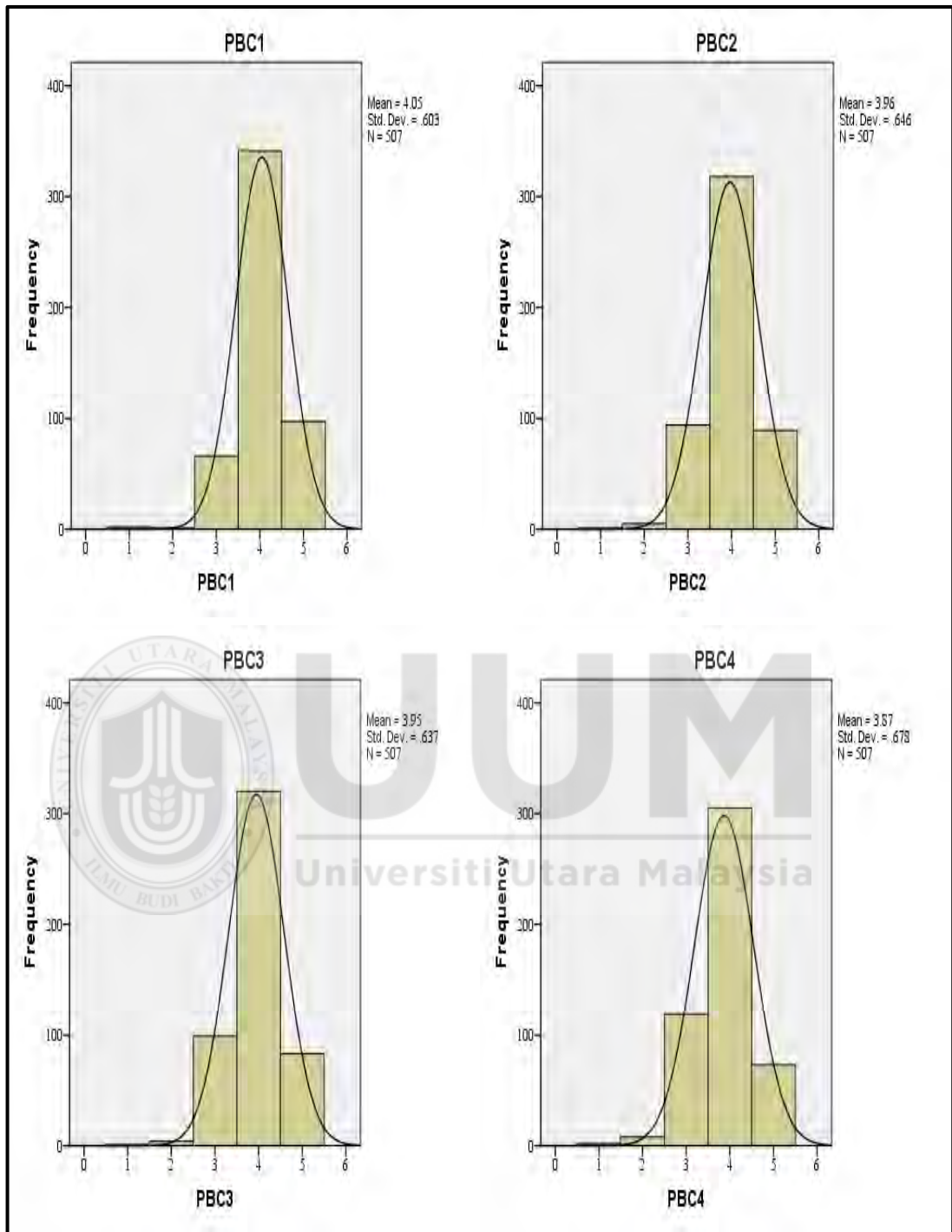


Figure C. 13. Normality histogram for PBC

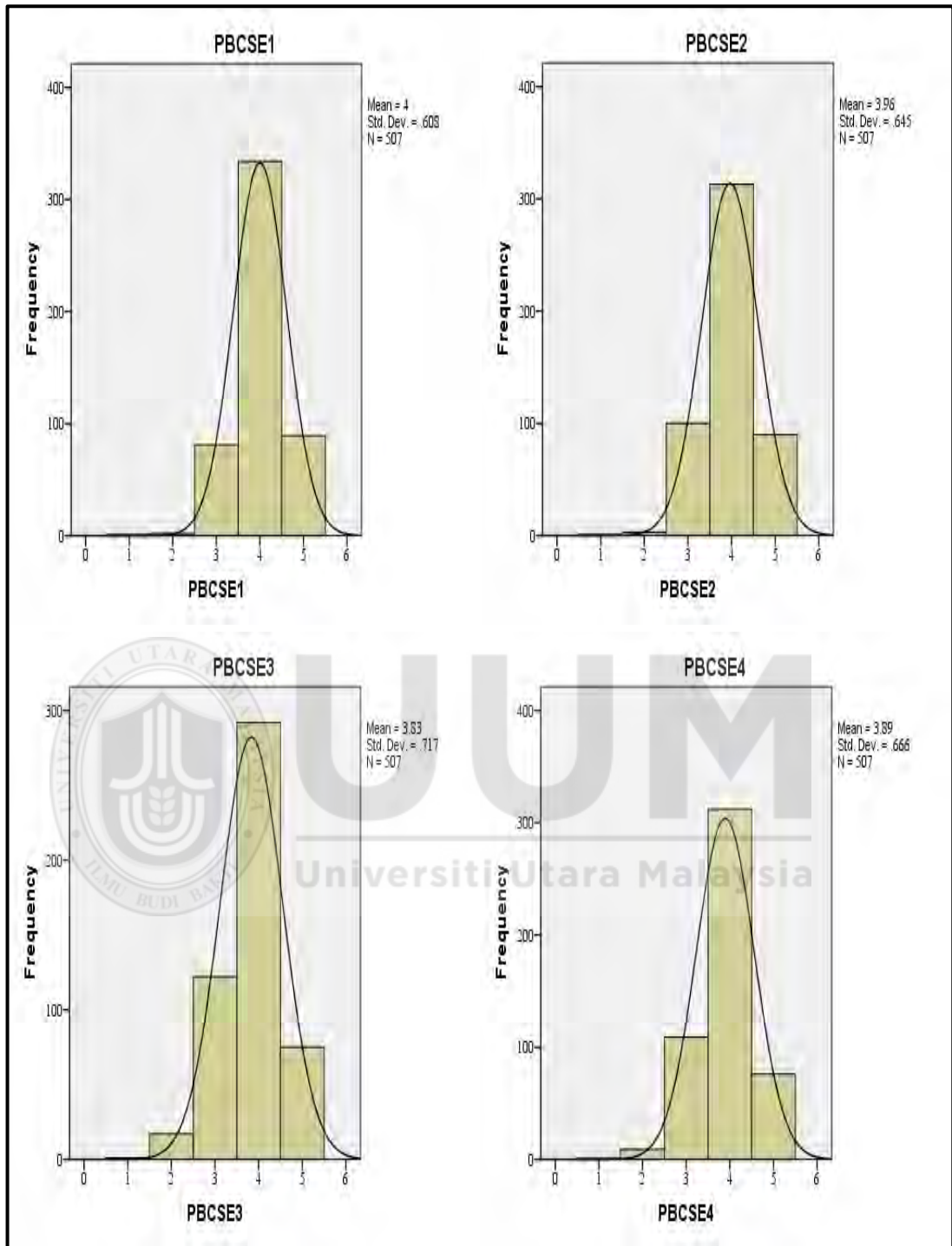


Figure C. 14. Normality histogram for PBCSE

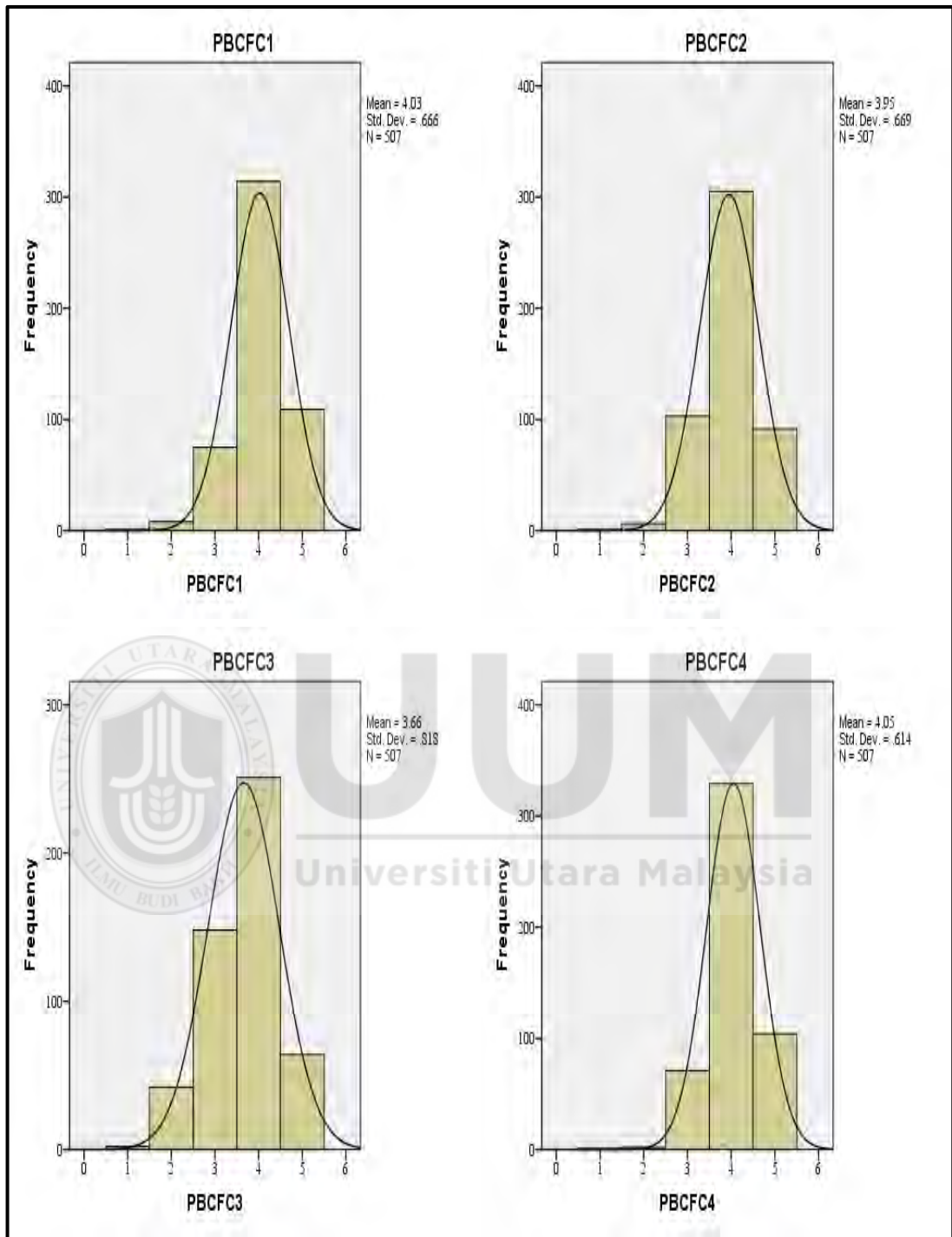


Figure C. 15. Normality histogram for PBCFC

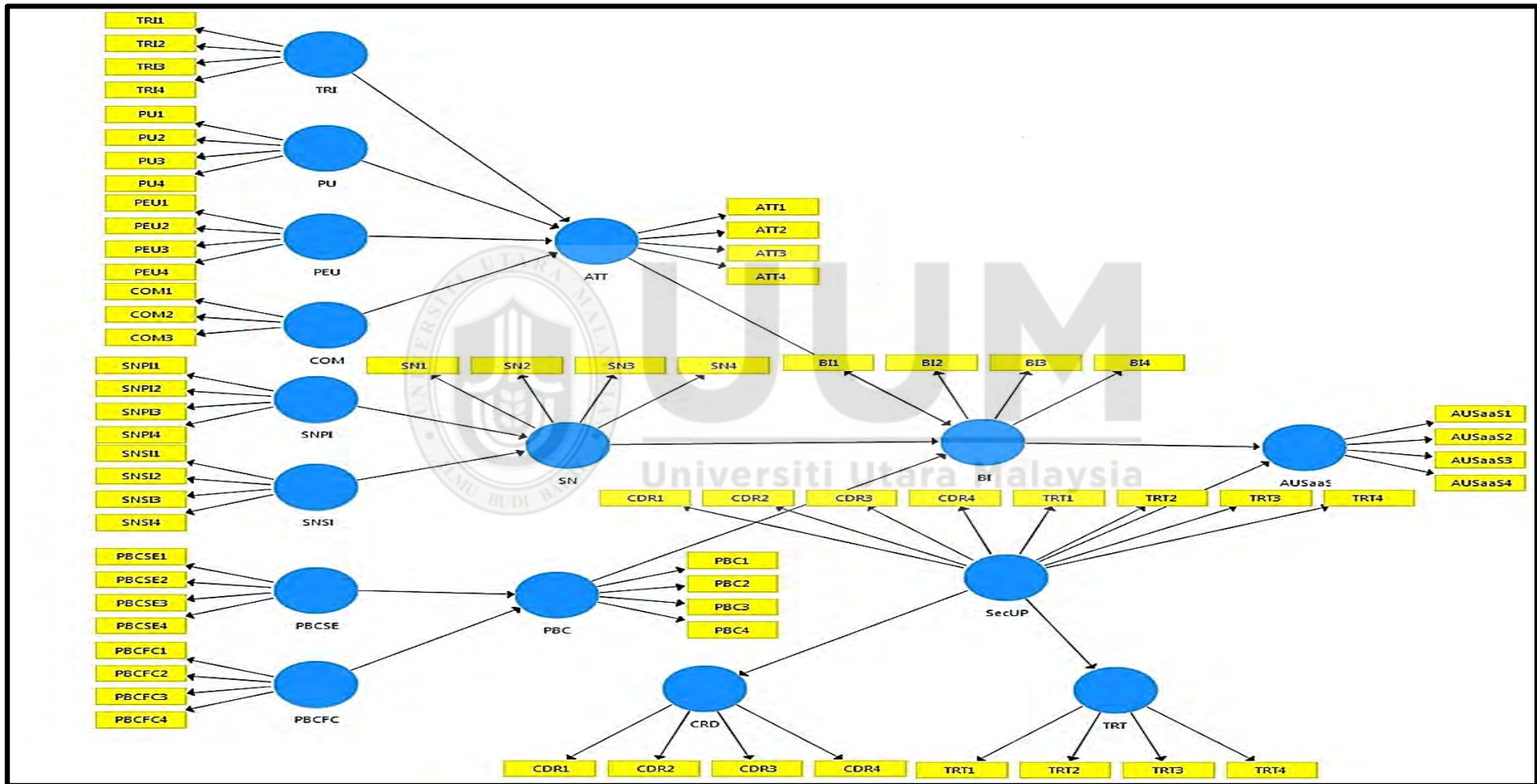


Figure C. 16. Model of the study



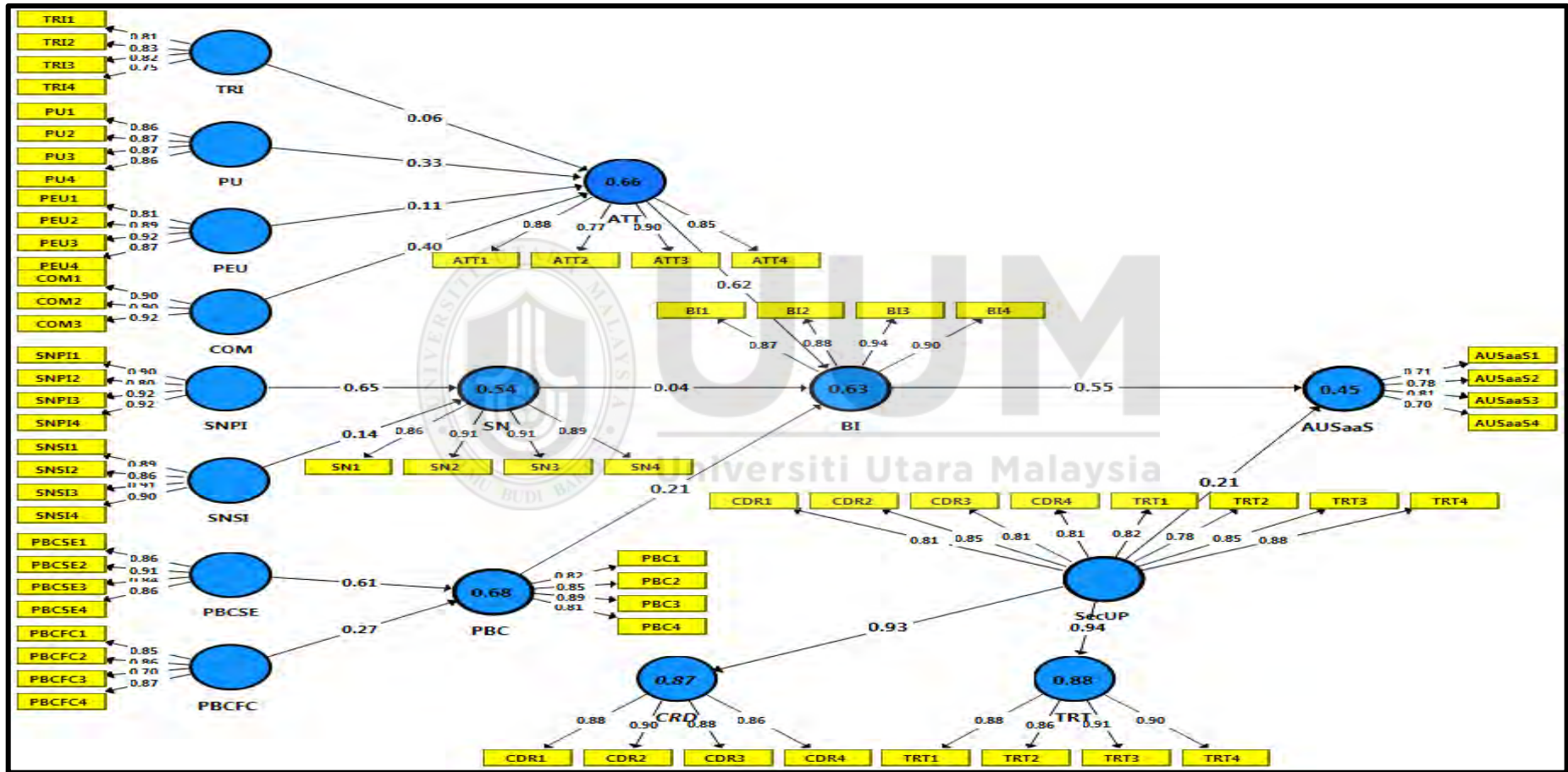


Figure C. 17. Measurement model estimation

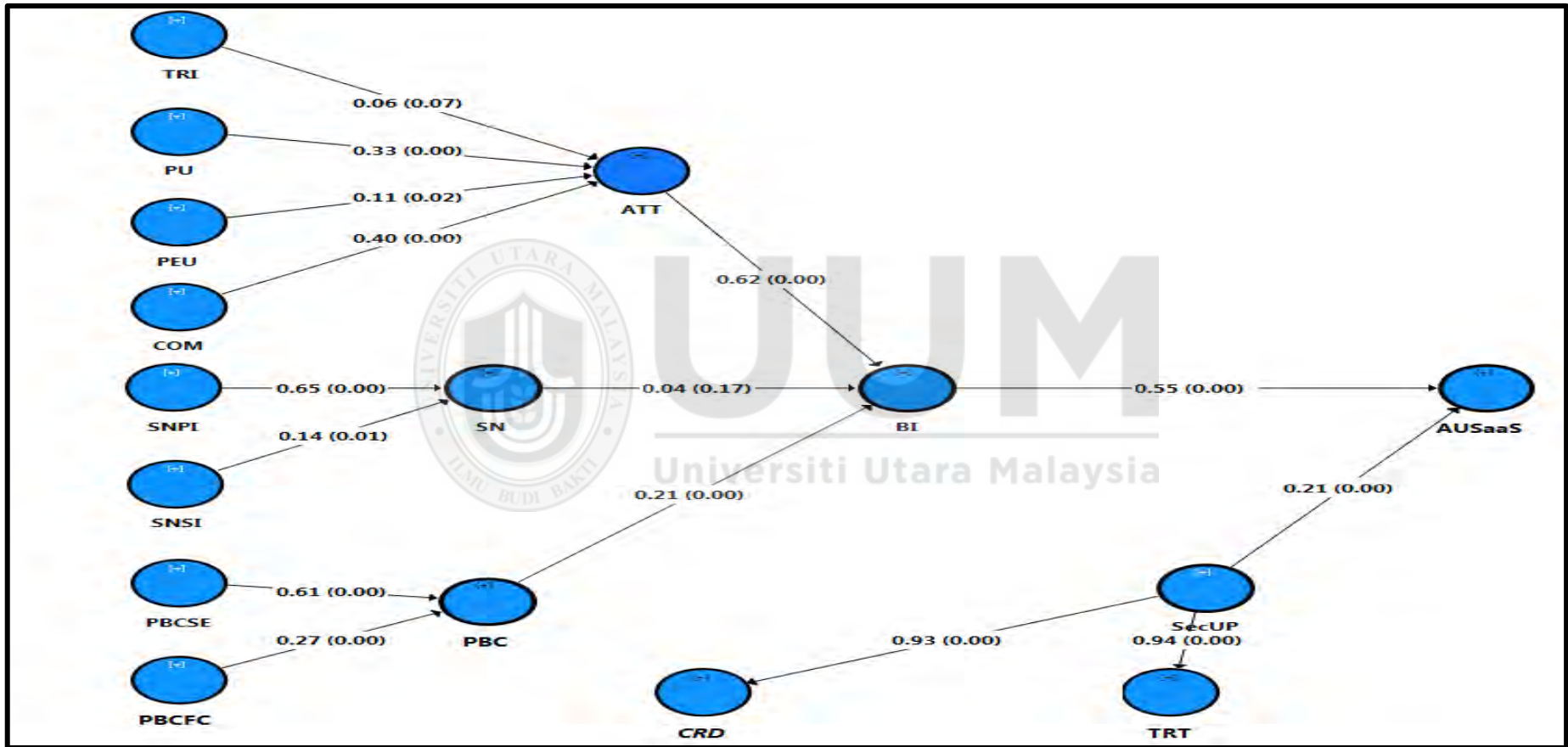


Figure C. 18. Structural modeling analysis

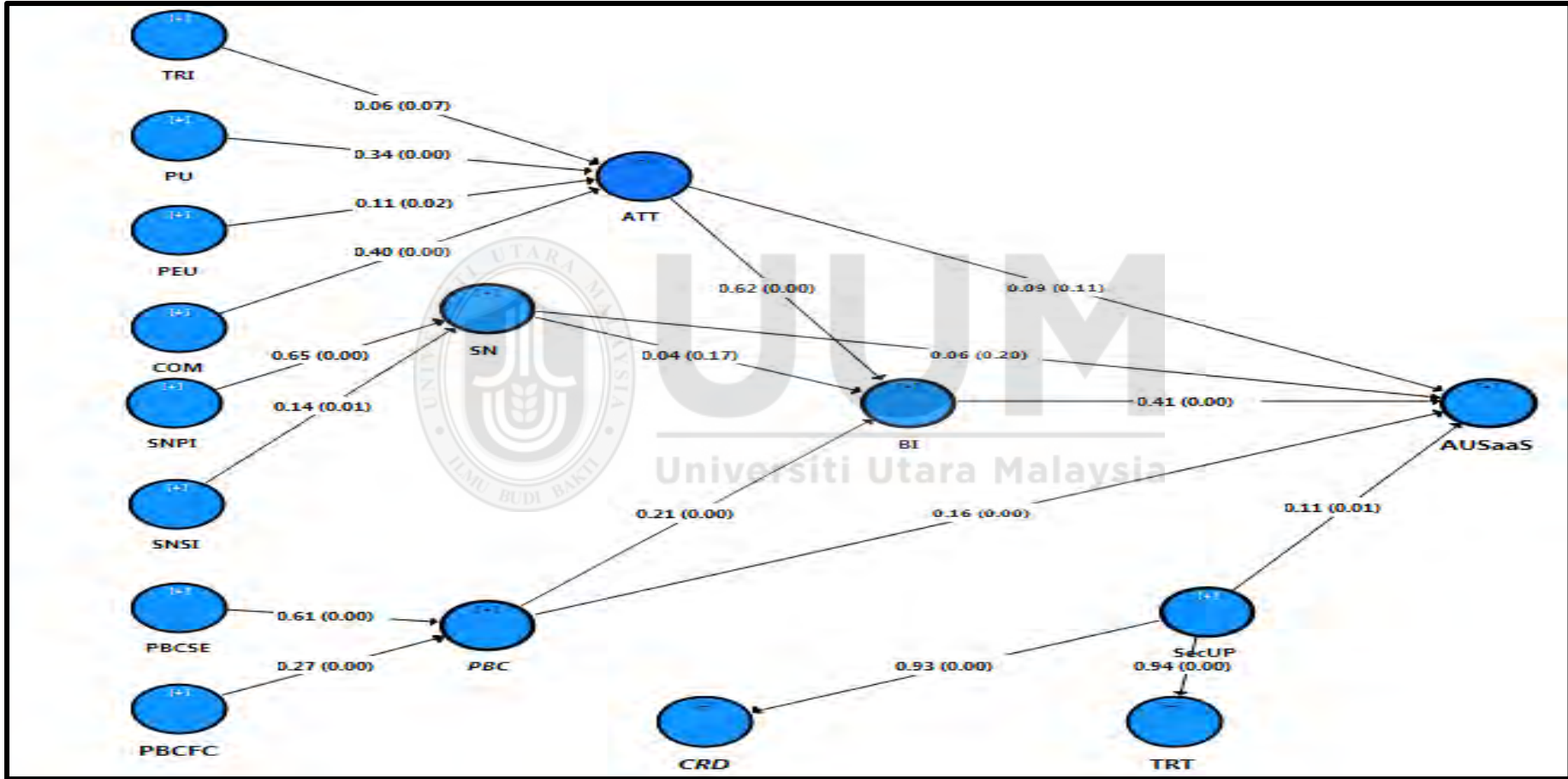


Figure C. 19. Mediating effect analysis

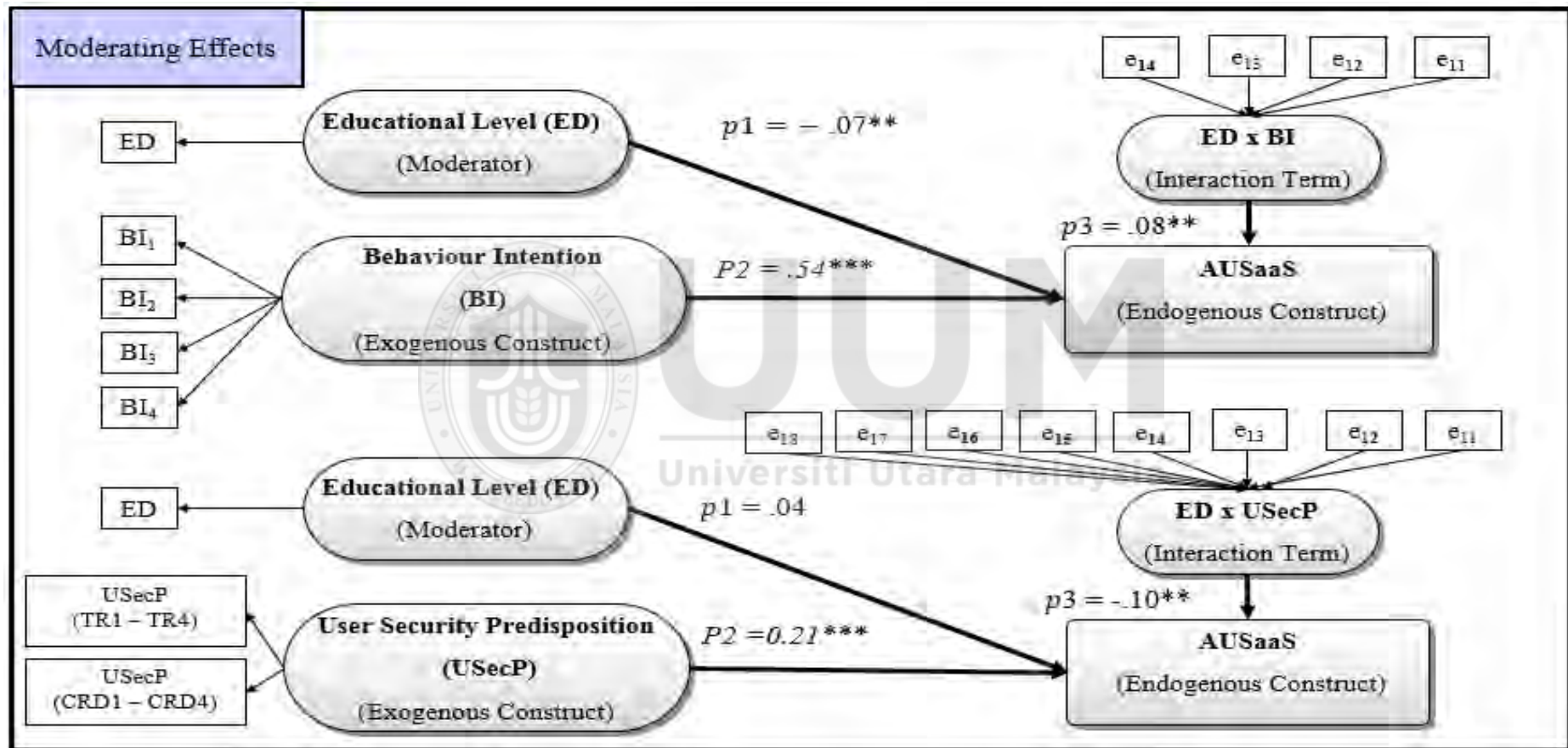


Figure C. 20. Moderating effect analysis ED x BI -> AUSaaS and ED x UsecP -> AUSaaS

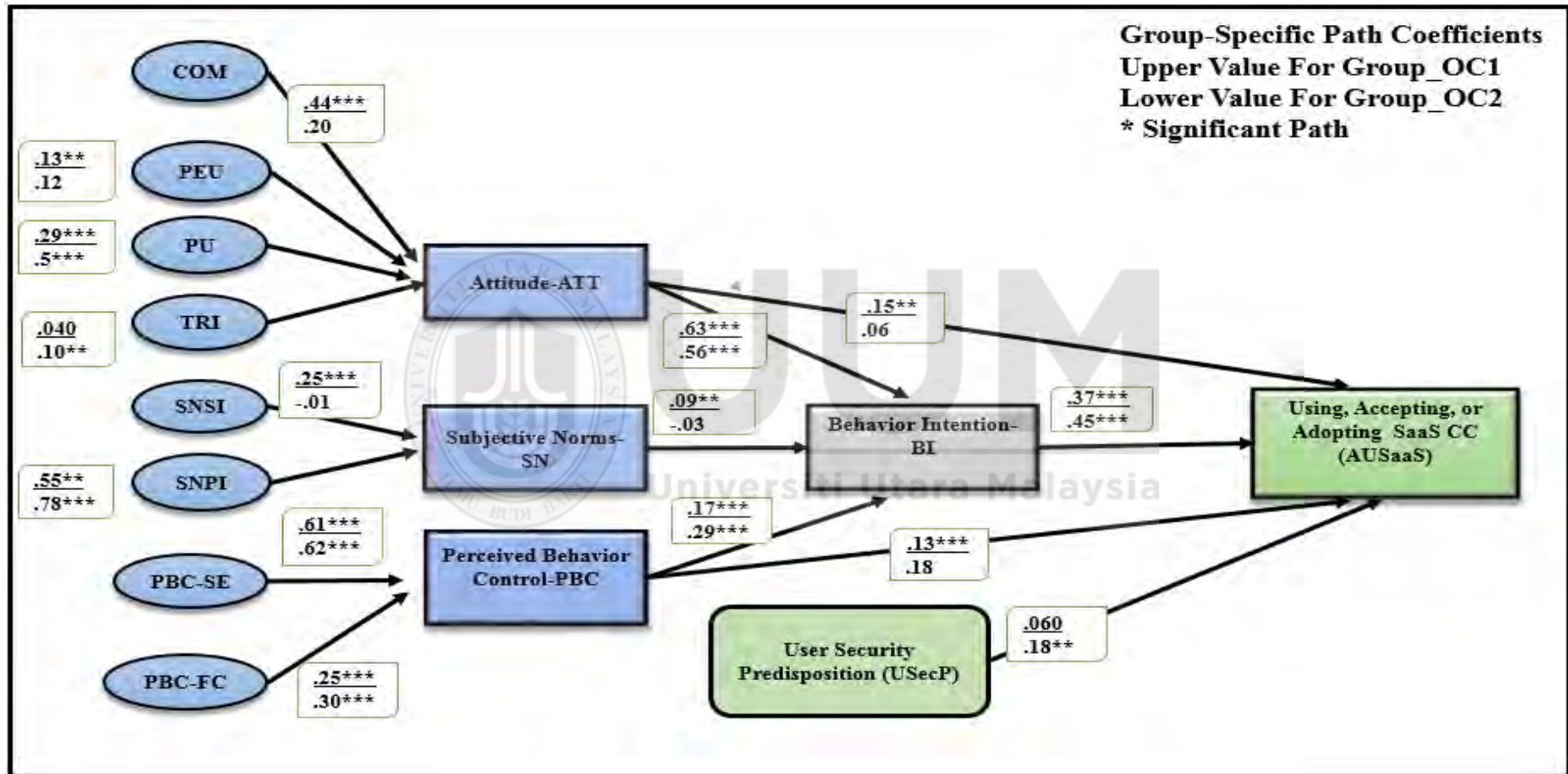


Figure C. 21. Group specific path coefficients of student group OC1 (upper value) and academic staff group OC2 (lower value)

## Appendix D Pilot Study Results

Table D. 1

*Convergent Validity & Internal Consistency and Reliability Assessment-Pilot Study*

Latent Variable	Loadings	AVE ≥0.5	Composite Reliability ≥0.7	Cronbach's Alpha ≥0.7
ATT		0.67	0.89	0.83
ATT1	0.85			
ATT2	0.76			
ATT3	0.85			
ATT4	0.80			
AUSaaS		0.61	0.86	0.79
AUSaaS1	0.80			
AUSaaS2	0.81			
AUSaaS3	0.81			
AUSaaS4	0.71			
BI		0.677	0.89	0.84
BI1	0.82			
BI2	0.84			
BI3	0.84			
BI4	0.78			
COM		0.66	0.88	0.82
COM1	0.81			

Table D.1 continued

COM2	0.86			
COM3	0.83			
COM4	0.73			
CRD		0.70	0.90	0.86
CRD1	0.84			
CRD2	0.85			
CRD3	0.84			
CRD4	0.81			
PBCFC		0.65	0.88	0.82
PBCFC1	0.83			
PBCFC2	0.84			
PBCFC3	0.71			
PBCFC4	0.84			
PBC		0.66	0.89	0.83
PBC1	0.82			
PBC2	0.82			
PBC3	0.84			
PBC4	0.78			
PEU		0.64	0.88	0.82
PEU1	0.76			
PEU2	0.80			
PEU3	0.83			
PEU4	0.82			
PU		0.68	0.89	0.84

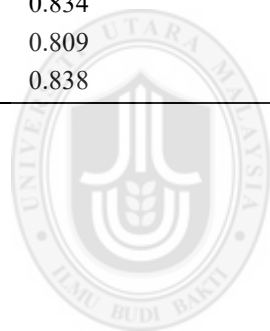
Table D.1 continued

PU1	0.801			
PU2	0.846			
PU3	0.82			
PU4	0.821			
PBCSE		0.682	0.896	0.845
SE1	0.825			
SE2	0.844			
SE3	0.816			
SE4	0.819			
SN		0.716	0.91	0.867
SN1	0.84			
SN2	0.899			
SN3	0.806			
SN4	0.837			
SNPI		0.689	0.899	0.849
SNPI1	0.834			
SNPI2	0.811			
SNPI3	0.85			
SNPI4	0.824			
SNSI		0.685	0.897	0.847
SNSI1	0.79			
SNSI2	0.851			
SNSI3	0.853			
SNSI4	0.815			



Table D.1 continued

TRI		0.556	0.831	0.73
TRI1	0.802			
TRI2	0.797			
TRI3	0.788			
TRI4	0.568			
TRT		0.68	0.895	0.843
TRT1	0.817			
TRT2	0.834			
TRT3	0.809			
TRT4	0.838			



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Table D. 2

*Discriminant Validity Assessment\_ Fornell-Larker Criterion -Pilot Study*

	ATT	AUSaaS	BI	COM	CRD	PBCFC	PBC	PEU	PU	PBCSE	SN	SNPI	SNSI	TRI	TRT
ATT	0.82														
AUSaaS	0.543	0.78													
BI	0.68	0.65	0.82												
COM	0.69	0.54	0.69	0.81											
CRD	0.45	0.39	0.49	0.54	0.84										
PBCFC	0.50	0.46	0.53	0.55	0.53	0.804									
PBC	0.55	0.45	0.54	0.50	0.52	0.665	0.814								
PEU	0.69	0.55	0.63	0.65	0.47	0.526	0.553	0.80							
PU	0.67	0.52	0.66	0.69	0.53	0.55	0.566	0.69	0.82						
PBCSE	0.46	0.47	0.48	0.51	0.51	0.679	0.775	0.48	0.51	0.83					
SN	0.49	0.43	0.58	0.52	0.57	0.537	0.588	0.50	0.51	0.59	0.846				
SNPI	0.56	0.42	0.55	0.55	0.61	0.456	0.544	0.51	0.52	0.49	0.675	0.830			
SNSI	0.45	0.37	0.49	0.47	0.54	0.484	0.467	0.48	0.53	0.43	0.61	0.605	0.83		
TRI	0.55	0.39	0.51	0.61	0.48	0.475	0.445	0.54	0.65	0.43	0.388	0.343	0.45	0.75	
TRT	0.51	0.40	0.53	0.56	0.69	0.535	0.561	0.56	0.54	0.49	0.566	0.555	0.53	0.46	0.83

Table D. 3

*Discriminant Validity Assessment-Cross-Loadings -Pilot Study*

	ATT	AUSaaS	BI	COM	CRD	PBCFC	PBC	PEU	PU	PBCSE	SN	SNPI	SNSI	TRI	TRT
ATT1	0.85	0.459	0.56	0.601	0.342	0.394	0.422	0.6	0.583	0.383	0.402	0.442	0.396	0.535	0.411
ATT2	0.761	0.344	0.477	0.468	0.292	0.351	0.441	0.459	0.474	0.34	0.342	0.372	0.298	0.383	0.406
ATT3	0.854	0.49	0.568	0.545	0.429	0.479	0.509	0.639	0.558	0.384	0.407	0.528	0.438	0.461	0.474
ATT4	0.798	0.464	0.617	0.611	0.406	0.41	0.436	0.545	0.564	0.397	0.449	0.47	0.332	0.395	0.386
AUSaaS1	0.427	0.795	0.479	0.445	0.3	0.319	0.33	0.438	0.382	0.383	0.349	0.364	0.224	0.265	0.36
AUSaaS2	0.361	0.807	0.54	0.437	0.286	0.326	0.324	0.371	0.394	0.34	0.3	0.27	0.242	0.256	0.265
AUSaaS3	0.539	0.813	0.592	0.449	0.335	0.407	0.422	0.487	0.501	0.401	0.392	0.405	0.391	0.397	0.37
AUSaaS4	0.347	0.705	0.406	0.327	0.304	0.368	0.3	0.425	0.324	0.352	0.309	0.292	0.273	0.295	0.229
BI1	0.605	0.57	0.821	0.637	0.404	0.418	0.415	0.556	0.551	0.394	0.415	0.429	0.391	0.476	0.438
BI2	0.544	0.544	0.84	0.504	0.412	0.41	0.461	0.517	0.525	0.382	0.493	0.495	0.407	0.39	0.408
BI3	0.553	0.546	0.844	0.576	0.467	0.43	0.43	0.512	0.541	0.408	0.507	0.49	0.417	0.441	0.475
BI4	0.546	0.485	0.783	0.544	0.339	0.482	0.461	0.498	0.539	0.388	0.489	0.398	0.381	0.356	0.43
COM1	0.545	0.485	0.582	0.81	0.502	0.474	0.416	0.502	0.595	0.44	0.481	0.481	0.402	0.517	0.491
COM2	0.612	0.459	0.565	0.861	0.374	0.451	0.438	0.533	0.59	0.378	0.409	0.454	0.351	0.475	0.447
COM3	0.582	0.454	0.606	0.833	0.479	0.425	0.389	0.562	0.535	0.418	0.442	0.499	0.38	0.538	0.455
COM4	0.47	0.32	0.471	0.729	0.416	0.42	0.383	0.497	0.517	0.416	0.346	0.346	0.408	0.446	0.437
CRD1	0.348	0.271	0.409	0.44	0.839	0.417	0.364	0.396	0.411	0.342	0.45	0.433	0.406	0.419	0.597
CRD2	0.399	0.413	0.46	0.485	0.851	0.502	0.46	0.399	0.47	0.489	0.497	0.526	0.482	0.405	0.586

Table D.3 continued

CRD3	0.319	0.268	0.354	0.446	0.839	0.412	0.43	0.376	0.425	0.422	0.464	0.514	0.436	0.385	0.536
CRD4	0.448	0.355	0.426	0.445	0.812	0.436	0.497	0.408	0.457	0.465	0.509	0.57	0.486	0.4	0.584
PBCFC1	0.407	0.379	0.414	0.466	0.413	0.83	0.523	0.384	0.411	0.554	0.414	0.364	0.343	0.432	0.386
PBCFC2	0.408	0.344	0.417	0.398	0.379	0.835	0.552	0.448	0.442	0.524	0.379	0.304	0.336	0.351	0.404
PBCFC3	0.305	0.371	0.387	0.406	0.423	0.705	0.39	0.401	0.373	0.477	0.404	0.342	0.372	0.31	0.414
PBCFC4	0.47	0.381	0.476	0.483	0.49	0.84	0.634	0.459	0.523	0.618	0.522	0.45	0.495	0.423	0.513
PBC1	0.428	0.449	0.486	0.444	0.443	0.524	0.82	0.472	0.52	0.596	0.458	0.425	0.398	0.425	0.467
PBC2	0.531	0.354	0.472	0.462	0.483	0.532	0.817	0.496	0.478	0.609	0.506	0.517	0.39	0.35	0.446
PBC3	0.5	0.376	0.489	0.453	0.391	0.554	0.839	0.503	0.503	0.632	0.455	0.434	0.35	0.409	0.498
PBC4	0.331	0.265	0.289	0.265	0.388	0.556	0.777	0.322	0.332	0.691	0.497	0.394	0.384	0.258	0.414
PEU1	0.567	0.448	0.458	0.511	0.353	0.373	0.412	0.76	0.567	0.373	0.318	0.375	0.418	0.476	0.44
PEU2	0.473	0.415	0.491	0.484	0.351	0.431	0.484	0.801	0.524	0.445	0.389	0.341	0.369	0.405	0.414
PEU3	0.59	0.444	0.528	0.555	0.398	0.473	0.42	0.825	0.557	0.334	0.416	0.422	0.375	0.435	0.467
PEU4	0.572	0.454	0.553	0.515	0.408	0.41	0.467	0.822	0.545	0.414	0.464	0.479	0.361	0.407	0.467
PU1	0.54	0.398	0.507	0.567	0.396	0.421	0.425	0.559	0.801	0.395	0.356	0.373	0.376	0.503	0.393
PU2	0.598	0.451	0.553	0.581	0.448	0.435	0.468	0.58	0.846	0.389	0.443	0.518	0.451	0.567	0.424
PU3	0.512	0.383	0.537	0.528	0.441	0.459	0.435	0.579	0.82	0.401	0.403	0.39	0.481	0.527	0.47
PU4	0.549	0.473	0.559	0.591	0.449	0.496	0.531	0.535	0.821	0.501	0.474	0.418	0.438	0.526	0.496
PBCSE1	0.457	0.374	0.413	0.45	0.452	0.58	0.688	0.465	0.492	0.825	0.482	0.447	0.392	0.446	0.441
PBCSE2	0.335	0.426	0.352	0.421	0.414	0.554	0.622	0.419	0.37	0.844	0.476	0.369	0.364	0.325	0.35
PBCSE3	0.352	0.33	0.374	0.37	0.389	0.486	0.608	0.33	0.383	0.816	0.461	0.359	0.274	0.295	0.342
PBCSE4	0.373	0.429	0.437	0.428	0.439	0.619	0.638	0.379	0.436	0.819	0.522	0.427	0.379	0.337	0.476

Table D.3 continued

SN1	0.392	0.415	0.506	0.469	0.48	0.446	0.451	0.424	0.426	0.479	0.84	0.56	0.479	0.349	0.486
SN2	0.421	0.349	0.51	0.429	0.516	0.478	0.497	0.408	0.46	0.485	0.899	0.56	0.588	0.35	0.514
SN3	0.38	0.348	0.429	0.376	0.45	0.428	0.484	0.397	0.414	0.486	0.806	0.506	0.461	0.273	0.426
SN4	0.467	0.358	0.505	0.476	0.493	0.463	0.554	0.445	0.428	0.537	0.837	0.649	0.529	0.334	0.484
SNPI1	0.539	0.371	0.469	0.453	0.525	0.45	0.536	0.509	0.498	0.456	0.557	0.834	0.542	0.328	0.518
SNPI2	0.377	0.302	0.402	0.433	0.466	0.315	0.334	0.334	0.34	0.309	0.551	0.811	0.479	0.247	0.367
SNPI3	0.507	0.368	0.476	0.5	0.529	0.393	0.454	0.43	0.483	0.459	0.542	0.85	0.482	0.307	0.466
SNPI4	0.431	0.38	0.482	0.45	0.508	0.358	0.479	0.412	0.406	0.392	0.588	0.824	0.504	0.257	0.489
SNSI1	0.448	0.334	0.431	0.41	0.375	0.378	0.38	0.475	0.466	0.328	0.461	0.51	0.79	0.42	0.43
SNSI2	0.337	0.316	0.393	0.309	0.453	0.406	0.395	0.38	0.46	0.361	0.499	0.476	0.851	0.312	0.44
SNSI3	0.403	0.355	0.424	0.429	0.512	0.409	0.431	0.418	0.453	0.422	0.561	0.572	0.853	0.382	0.444
SNSI4	0.31	0.206	0.36	0.411	0.441	0.408	0.335	0.306	0.38	0.298	0.493	0.438	0.815	0.381	0.429
TRI1	0.484	0.347	0.406	0.472	0.301	0.29	0.274	0.436	0.486	0.231	0.213	0.27	0.283	0.802	0.32
TRI2	0.343	0.197	0.321	0.359	0.311	0.342	0.31	0.353	0.506	0.272	0.189	0.151	0.344	0.797	0.294
TRI3	0.464	0.346	0.477	0.566	0.464	0.443	0.426	0.47	0.533	0.431	0.447	0.314	0.435	0.788	0.419
TRI4	0.284	0.247	0.262	0.39	0.37	0.358	0.326	0.314	0.395	0.365	0.301	0.28	0.275	0.568	0.35
TRT1	0.398	0.343	0.455	0.498	0.579	0.42	0.44	0.411	0.422	0.416	0.533	0.453	0.45	0.45	0.817
TRT2	0.384	0.358	0.457	0.449	0.528	0.503	0.462	0.451	0.467	0.426	0.407	0.396	0.425	0.373	0.834
TRT3	0.437	0.305	0.423	0.469	0.548	0.4	0.443	0.485	0.442	0.348	0.454	0.48	0.439	0.354	0.809
TRT4	0.469	0.301	0.421	0.441	0.618	0.443	0.504	0.496	0.454	0.423	0.471	0.499	0.422	0.348	0.838