

AN ADOPTION MODEL FOR CLOUD-BASED COLLABORATIVE LEARNING
APPLICATIONS FROM TOP MALAYSIAN UNIVERSITIES' EXPERIENCE

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Specially Dedicated to...

My Parents

My Lovely Brother and Sister

*My love to you will always remain and thank you for your
Support, Guidance, Patience, Joyfulness to make this experience complete.*

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ABSTRACT

Cloud-based collaborative learning applications are new computing paradigms which facilitate collaborative activities in a centralized location. These applications offer various benefits to higher education. However, even though previous research have discussed cloud computing in general, there is still lack of studies considering students' intention to adopt cloud-based collaborative learning applications in university settings especially in the context of Malaysian universities. Therefore, this research aims to develop and test an adoption model for cloud-based collaborative learning applications for Malaysian universities by integrating Unified Theory of Acceptance and Use of Technology (UTAUT) and Task Technology Fit (TTF). A preliminary investigation using face-to-face interviews with directors of Information Technology centers and administrators of students email in four selected top Malaysian universities was conducted to understand the current adoption status of cloud-based collaborative learning applications. Next, using purposive sampling, a survey which involved 209 students was conducted to collect data from students who have had experience in using cloud-based collaborative learning applications such as Google Apps and/or Office 365. Partial Least Squares (PLS) method based on Structural Equation Modelling (SEM) was used for analyzing the survey data. Smart PLS 2.0M3 was applied to validate the research model. The overall analysis results showed that characteristics of cloud computing and collaborative task significantly predict the fit between these constructs. Furthermore, Task Technology Fit together with, Performance Expectancy, Social Influence, and Facilitating Conditions significantly influenced intention to adopt cloud-based collaborative learning applications. Findings confirmed that individual and group characteristics were significant drivers of Performance Expectancy and Effort Expectancy. Finally, this research develops a Cloud-Based Collaborative Learning Applications Adoption Model that can serve as a tool to assist the Ministry of Education, university administrators, and cloud service providers to plan their strategies and provide supportive adoption environment for cloud-based collaborative learning applications in universities.

ABSTRAK

Aplikasi pembelajaran kolaboratif berasaskan awan adalah satu paradigma komputeran baru yang memudahkan aktiviti kolaboratif di sesebuah lokasi berpusat. Aplikasi ini menawarkan pelbagai kelebihan kepada pengajian tinggi. Namun, walaupun kajian sebelum ini telah membincangkan tentang komputeran awan, masih terdapat kekurangan kajian terhadap penerimaan aplikasi pembelajaran kolaboratif berasaskan awan di kalangan pelajar universiti, terutamanya dalam konteks universiti di Malaysia. Maka, kajian ini bertujuan untuk membangunkan model adaptasi aplikasi pembelajaran kolaboratif berasaskan awan untuk universiti di Malaysia, dengan mengintergrasikan Teori Penyatuan Penerimaan dan Penggunaan Teknologi (UTAUT) dan Teori Kesesuaian Teknologi Tugas (TTF). Satu kajian awal menggunakan temubual bersemuka dengan Pengarah-pengarah Pusat Teknologi Maklumat dan pentadbir-pentadbir emel pelajar di empat universiti terkemuka di Malaysia yang terpilih telah dijalankan untuk memahami situasi semasa penggunaan aplikasi pembelajaran kolaboratif berasaskan awan. Seterusnya, menggunakan persampelan bertujuan, satu tinjauan melibatkan 209 pelajar telah dijalankan terhadap pelajar yang berpengalaman dalam menggunakan aplikasi pembelajaran kolaboratif berasaskan awan seperti aplikasi Google dan / atau Office 365. Kaedah Kuasa Dua Terkecil Separa (PLS) berasaskan Model Persamaan Berstruktur (SEM) digunakan untuk analisis data tinjauan. Smart PLS 2.0M3 digunapakai untuk validasi model kajian. Keseluruhan hasil analisis menunjukkan bahawa ciri-ciri komputeran awan dan tugas kolaboratif secara signifikan meramalkan kesesuaian antara konstruk tersebut. Seterusnya, teknologi tugas yang sesuai bersama jangkaan prestasi, pengaruh sosial, dan pemudahan syarat, secara signifikan mempengaruhi kemahuan untuk penerimaan aplikasi pembelajaran kolaboratif berasaskan awan. Dapatan mengesahkan bahawa ciri-ciri individu dan kumpulan menjadi pendorong bagi jangkaan prestasi dan jangkaan usaha jaya. Akhir sekali kajian ini membangunkan model Penerimaan Pembelajaran Kolaboratif Berasaskan Awan aplikasi yang boleh dijadikan satu alat dalam membantu pihak Kementerian Pendidikan, pentadbir universiti, penyedia perkhidmatan komputeran awan untuk merancang strategi mereka dan memberikan persekitaran yang menyokong adaptasi aplikasi pembelajaran kolaboratif berasaskan awan.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Innovations in technology continue to change the business and education environments. Cloud computing is a new computing paradigm that has quickly attracted a number of customers by providing pay per use computing infrastructure and different storage capabilities. The efficiency and effectiveness of cloud computing are very important in higher education. The capabilities of this technology can be used to support group collaborative learning in educational environments. It allows group members to complete collaborative tasks in less time and with increased satisfaction (White *et al.*, 2009). Therefore, this research aims to develop an adoption model for cloud-based collaborative learning applications in university settings. In addition, identifying the factors that influence this adoption is another significant contribution of the present research. Figure 1.1 illustrates the organization of this chapter:

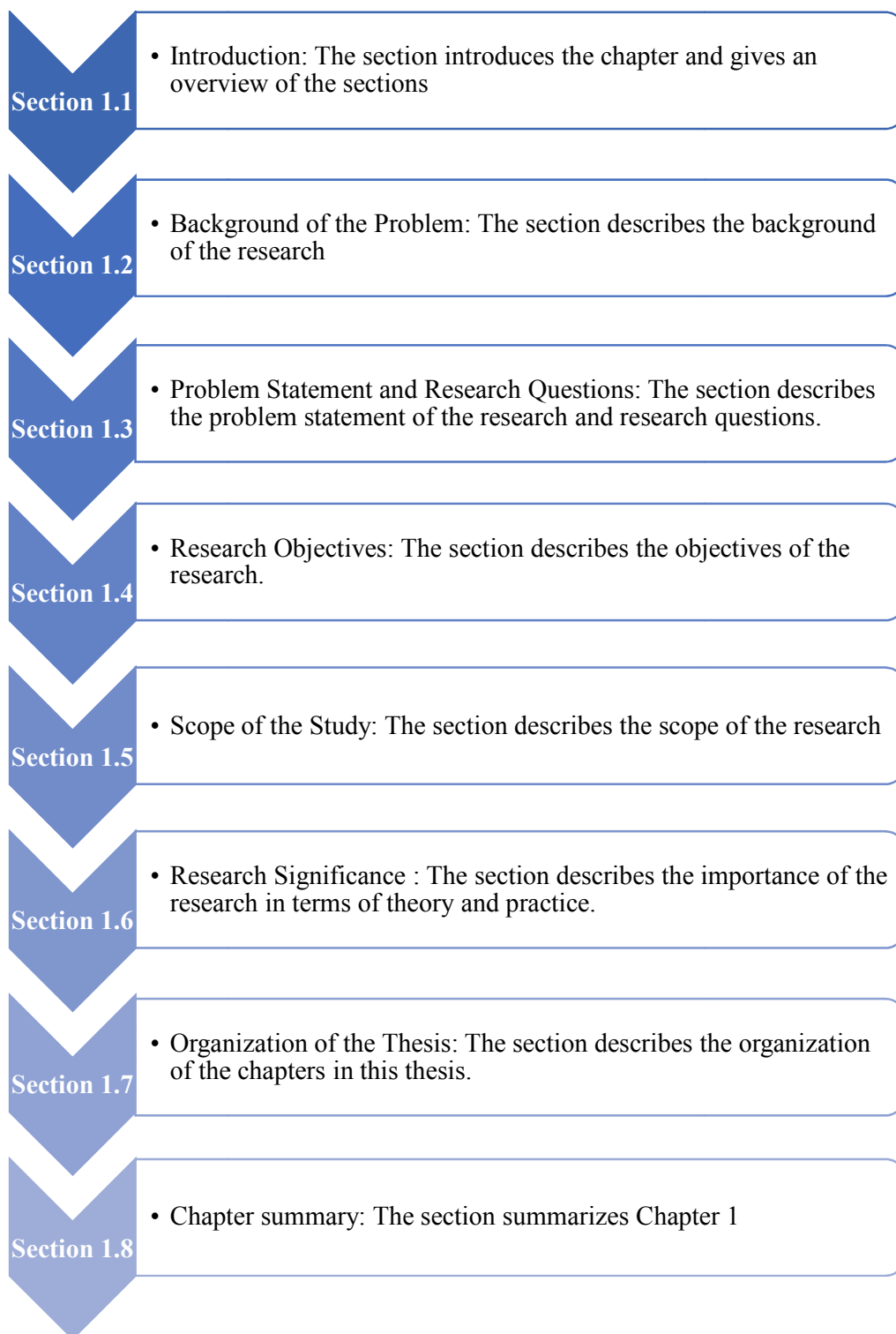


Figure 1.1 Organization of the Chapter1

1.2 Background of the Problem

Flux and evolution are constantly influencing the higher education landscape around the world (Pardeshi, 2014). It is increasingly highlighted that incorporating technology effectively in higher education is important to support high quality education and to prepare students for the 21st century (Thomas, 2011). Currently, educational institutions have become increasingly reliant on information technology to provide new skills to the students (Miseviciene *et al.*, 2011). Furthermore, students need to develop quite different kinds of skills and knowledge in comparison with the past in order to be better prepared for their future life. The traditional teaching-learning methods are not sufficient to support the expectations of academics and students in universities (Thomas, 2011; Razak, 2009). Therefore, universities require a basic change in knowledge and communication-based society in order to achieve higher order learning experience and outcomes (Thomas, 2011). There are various new teaching-learning methods using Information and Communication Technologies (ICT) that can be appropriate to enable students to develop the needed intellectual and practical skills and positive perceptions (Razak, 2009).

Cloud computing is one of the new trends in technology which has significant impact on teaching and learning environments (Ercana, 2010). According to Jain and Pandey (2013), although cloud computing has some constraints and challenges, its potential benefits outweigh the risks. The push with IT industry and significant advantages of cloud computing leads Cisco to the expectation that cloud computing will be widely used in higher education. They believed that cloud computing and its abilities should be considered as an enabler for academic organizations in response to calls for transformation with efficiency and confidence. (Cisco, 2014). Cloud computing is a good response to the growing trend towards distance learning among students (Jain and Pandey, 2013). Furthermore, it offers significant opportunities to educators and enhances engagement among them to understand and improve practices, and therefore, increase productivity (Thomas, 2011). Since cloud computing aims to provide low cost or free applications, this technology is a critical solution for educational institutions faced with budget restrictions and mobile students and makes learning tools accessible for a larger

number of students (Behrend *et al.*, 2011). It is expected that using cloud computing by students is not only useful for their education and in helping them to obtain new skills, it is also economical for academic institutions and can save resources as well (Bansal *et al.*, 2012). Therefore, the preference in higher education sector is the move towards adoption of cloud computing (Pardeshi, 2014).

Presently, a new generation of learners, also known as Millennial or Generation Y who depend on technology and their support system, has immersed themselves in the college classrooms. The learning needs of this genre are quite different from their predecessors (Thomas, 2011). They want to spend less time on tasks and be successful with little effort (Monaco and Martin, 2007). They prefer to receive information really fast and are interested in parallel processes, multi-tasking, random access, and games. They function best when networked (Prensky, 2001). This generation is the generation of “Web 2.0”: interactivity, community, communication, collaboration (Cornu, 2011). Furthermore, team orientation and less interest in working independently have been highlighted by previous related research (Cornu, 2011; Monaco and Martin, 2007; Oblinger, 2003; Howe and Strauss, 1993) as significant characteristics of this generation of students. Therefore, it is clear that the method of teaching and learning ten years ago is not a good method to achieve learning with this generation (Monaco and Martin, 2007). Understanding expectations of learners is an important factor to facilitate learning and to make colleges competitive (Oblinger, 2003). Thus, universities and colleges are trying to find new ways to meet students’ expectations for services, immediacy, interactivity, and group activities (Oblinger, 2003). Pedagogy has to be rethought taking into account the constructivist approach, collaborative learning, and networking for learning (Cornu, 2011). Creative content delivery must be integrated and group dynamic learning should be designed to keep the students engaged and to develop their independent and critical thinking.

To succeed in today’s competitive world, institutions of higher education play a significant role in preparing students for living in international and multicultural society. Similar to other universities, universities in Malaysia face challenges teaching factual skills and encouraging students to be inquiring and to develop in

them a sense of professionalism (Razak, 2009). Graduates lack critical thinking and communication skills, the links between academia and industry is insufficient, and systemic issues hamper the efficiency and financial sustainability of the system (Malaysia Education Blueprint 2015-2025 (Higher Education)). Malaysian universities require the application of different teaching, learning and assessment methods in order to help students learn a range of competencies (Razak, 2009). Furthermore, the focus in higher education is to develop learned, value-driven talent professionals, researchers, educators, entrepreneurs, and innovators who have an international outlook and can propel Malaysia's development forward.

To that end, the Ministry has developed the Malaysia Education Blueprint 2015-2025 (Higher Education), here known as MEB (HE), to chart the next horizon of growth for the Malaysian education system. The objectives of the development of the MEB (HE) are; assess current performance and challenges in order to improve access to education, raise standards (quality), close achievement gaps (equity), promote unity amongst students, and maximize student efficiency. Leadership skills and thinking skills are two important student aspirations in MEB (HE). To achieve these objectives and aspirations, MEB (HE) is committed to produce holistic, entrepreneurial and balanced graduates in the first shift. In accordance with this shift, higher education institutions aim to train graduates with practical skills, critical and creative thinking skills, communication skills, social skills, teamwork and responsibility, problem solving skills to deal with present and future demands. Moreover, they focus on making students lifelong learners who are motivated to continuously develop their knowledge and skills, to think critically, and be open to change, new ideas and new ways of doing things.

Interestingly, previous research has recognized the highly significant importance of collaboration learning in training creative and innovative learners (Nayan *et al.*, 2010; Chu *et al.*, 2009; Maesin *et al.*, 2009), improving team work skills (Nayan *et al.*, 2010; Maesin *et al.*, 2009; Monaco and Martin, 2007), training critical thinker (Suwantarathip and Wichadee, 2014; Nayan *et al.*, 2010; Maesin *et al.*, 2009). Further, results of studies (Nayan *et al.*, 2010; Maesin *et al.*, 2009; Jedin and Saad, 2006; Maesin, 2006; Abas and Kaur, 2004) conducted in Malaysian

universities highlighted the preference of students and educators towards collaborative learning as an essential part of learning process in these universities. Collaborative learning (CL) is an educational method to teaching and learning that involves group of learners working together to solve a problem, complete a task, or create a product (Laal and Laal, 2012). Therefore, in order to follow MEB (HE) as well as fulfill the preference of students towards collaborative learning, Malaysian educational institutions need to adopt technologies that will enable students to collaborate in an effective manner.

Rapid spread of web-based collaboration tools leads educational intuitions across the disciplines to incorporate learning activities that integrate their use. Common Web 2.0 collaborative tools such as Blogs, wikis, and podcasts were the first tools that have found their way into college classrooms (Davi *et al.*, 2007). Reviewing the previous studies (Wang, 2014; Caple and Bogle, 2013; Li and Zhu, 2013; Avci and Askar1, 2012; Hadjerrouit, 2012; Bruen *et al.*, 2011; Hughes, 2011; Mavridis *et al.*, 2011; Giesbers *et al.*, 2009; Leung and Chu, 2009; Chou and Chen, 2008; Ioannou and Artino, 2008; Loch and Reushle, 2008; Wheeler *et al.*, 2008; Minocha and Thomas, 2007) shows that wikis and web conferencing are two main common collaborative learning tools examined and discussed by previous researchers for the purposes of collaborative writing, creating knowledge, and improving communication. However, constraints associated with these tools such as lack of accuracy and veracity, limited capacity, weakness of discussion pages ownership and intellectual property problems, limitation in number of participants, rely on specific equipment are also worth consideration.

Consequently, cloud computing can be considered an appropriate solution in this situation. Cloud computing provides communication and collaboration applications in an effective way on the internet. Individual users can arrange their meetings and share messages or email by using cloud-based applications anytime and anywhere (Brohi and Bamiah, 2011). Cloud computing improves individual collaboration on documents across the internet (Siegle, 2010). It creates innovative environments for education by offering ubiquity, advanced online tools and collaboration altogether (González-Martínez *et al.*, 2015). Cloud computing helps

individuals to work on a project simultaneously – regardless of their location. In this case the creator of a document can share a document with others and invite them to view or edit it. Each version of the document is saved and a list of previous versions of the document can be retrieved by users (Siegle, 2010).

Cloud-based collaborative learning applications are relatively new paradigms. Although a broad definition may consider anything from e-mail on one extreme to very complex systems on the other, this research considers those cloud-based applications that have achieved widespread popularity in educational settings. The mechanism for specifying this group is to view the domain to be considered in terms of services. Cloud-based collaborative learning applications are considered as those providing the seamless platform for collaboration, file management and sharing, instant messaging, video conferencing, project management, task management and reporting, etc. The applications to be considered are those that cloud-based and facilitate these attributes in one centralized location.

Google and Microsoft are two main providers of cloud-based collaborative learning applications. They provide communication and collaboration opportunities for educational institutions like mail, messaging and collaboration tools (e-mail, contact management, and calendars), office applications (document storage, creation and sharing documents) and platform applications (the ability to create websites or learning management systems) (Miseviciene *et al.*, 2011).

1.3 Problem Statement and Research Questions

As Web 2.0 technologies are providing more group collaborative experience and benefits for students, educators are also trying to adopt group collaborative learning as an approach to achieve their educational objectives (Zurita and Nussbaum, 2004). Therefore, understanding the adoption behaviors of collaborative technologies is essential because acceptance is a prerequisite for participation (White *et al.*, 2009). However, White *et al.* (2009) argued that despite the growing preference in Web 2.0 applications and Internet-based collaborative learning

technologies, there is a lack of studies examining the adoption behaviors of these technologies.

Further, cloud computing is still relatively young in terms of maturity and adoption (Park and Ryoo, 2013; Gital and Zambuk, 2011). Kim *et al.* (2009) believed that an inevitable adoption of cloud computing is predicted for the future, and its adoption will change the world of software and hardware. As reported by Bittman (2009) cloud computing is being used in the areas of finance and business while it is comparatively rarely used at educational institutions. However, Katz *et al.* (2009) believed that cloud computing will achieve mainstream adoption in a two- to five-year time frame and higher education is early in the “early adopters” stage of diffusion. In a recent attempt, González-Martínez *et al.* (2015) reviewed literature related to the cloud computing in education domain from 2007 to 2012. They concluded that the main advantages of cloud computing in education are strongly supported, however, the research in this topic may still be immature and many of the contributions are introductory.

Looking at the research literature considering cloud-based collaborative learning applications in educational environments by (Cheung and Vogel, 2014; Orehovački and Babić, 2014; Suwantarathip and Wichadee, 2014; Cheung and Vogel, 2013; Dominguez *et al.*, 2012; Brodahl *et al.*, 2011; Calvo *et al.*, 2011; Edwards, 2011; Miseviciene *et al.*, 2011; Taylor and Hunsinger, 2011; Edwards and Baker, 2010; Blau and Caspi, 2009; Chu *et al.*, 2009; Rienzo and Han, 2009; White *et al.*, 2009), it can be concluded that most of the previous researches on collaborative learning using cloud-based applications (mainly Google Apps and Microsoft Office) have focused on collaborative writing. It appears that published materials are categorized into: positive elements of use, advantages of using cloud-based applications in collaborative learning, technical issue of cloud computing, comparing students’ perceptions using Google Docs with those working in groups in a face-to-face classroom, comparing outcomes of collaboration using cloud-based applications with traditional collaboration systems, and critical role of teacher in using these applications. Moreover, although learning theories have been used in a few prior related research, the use of IS theories, especially individual technology

adoption theories remains largely unexplored in the literature. This is in accordance with the claim of Taylor and Hunsinger (2011) that even though the previous research have considered the overall notion of cloud computing, there is a lack of studies regarding students' usage and acceptance of this technology in university settings. Therefore, understanding the individual behaviour related to cloud computing is worth consideration.

Meanwhile, the movement to cloud computing is a technology and cultural shift which takes time and involves more than just the technology; it involves people, process, and organization. As such, they should be well-considered before jumping in too quickly (Cooke and Kirby, 2008). Yang *et al.* (2015) believed that in order to examine the adoption of cloud computing (Software as a Service), the behavioural perceptions of users in acquiring and using them should be carefully taken into account. Successful implementation of cloud computing in educational settings requires careful attention to a number of factors from both the student and school's perspective (Behrend *et al.*, 2011). However, Park and Ryoo (2013) stated that there are few studies which have examined adopting/switching behavior from previous IS services to cloud computing from the perspective of users. Cloud computing allows team members to work collaboratively. However, successful completion of the collaborative tasks depends on whether the individual team members accept the new methods and use them. Team members who use the new technology are more important than the technology itself. Individual perceptions, attitudes, and reactions regarding new technology provide an important area of interest. The successful acceptance of the new collaboration tools may result in higher level of satisfaction among team members and outcome will be more valuable (White *et al.*, 2009). Therefore, the decision of students to adopt cloud-based applications and use them for collaborative learning is a very long-term and complicated process and there are many factors that influence this adoption. In order to have successful adoption, determining these factors, eliminating problems, and highlighting the profits of these applications for users is very essential.

As stated previously, Malaysian educational institutions need to adopt technologies that will enable students to collaborate in an effective manner.

However, little is known about user adoption of cloud-based collaborative learning applications in educational settings. Integration of cloud-based applications into educational processes requires specific consideration of students' behavioural intention to adopt. Few studies (Orehovački and Babić, 2014; Cheung and Vogel, 2013; Taylor and Hunsinger, 2011) have examined the factors influencing user adoption of these kind of applications. Specifically, there have been few theoretical models developed to understand adoption of cloud-based collaborative learning applications by students in educational settings. Therefore, the main purpose of this research is to develop and test an adoption model for cloud-based collaborative learning applications in Malaysian universities. In order to address key issues as mentioned before, the main research question for this research is:

” How can cloud-based collaborative learning applications be adopted by students in Malaysian Universities?” Three sub questions have been formulated:

1. What is the current adoption status of cloud-based collaborative learning applications in selected top Malaysian universities?
2. What are the factors that influence the adoption of cloud-based collaborative learning applications by students?
3. What is the adoption model for cloud-based collaborative learning applications?

1.4 Research Objectives

Objectives of this research are:

1. To understand the current adoption status of cloud-based collaborative learning applications in selected top Malaysian universities
2. To identify the factors that influence the adoption of cloud-based collaborative learning applications by students.
3. To develop and test an adoption model for cloud-based collaborative learning applications.

1.5 Research Scope

The focus of this research is mainly on the individual adoption of cloud-based applications to support collaborative learning. Therefore, the unit of analysis is the individuals as user of cloud applications. This research targeted undergraduate and postgraduate students from different educational backgrounds in Malaysian universities, specifically on those universities that have already adopted cloud-based collaborative learning applications. The process of data collection is done within the selected top Malaysian universities. An investigation on the current adoption status of cloud-based collaborative learning applications was done in selected universities through interviews. This is followed by a survey method using online and paper based questionnaire. The collected data was tested by Structural Equation Modelling (SEM) using the Partial Least Squares (PLS) approach. The SmartPLS 2.0 software was utilized as data analysis tool.

1.6 Research Significance

Currently, in the age of technology and innovation the preference of new generation of students in collaborative learning is increasing with high speed and they need new services in less time. On the other hand, universities confront some limitations such as budget constraints and limited number of technical staff. Cloud computing is increasingly becoming widespread as a way to offer low-cost collaborative learning solutions. Therefore, the benefits of integrating cloud-based applications into collaborative learning activities of students are worth consideration.

This research contributes to a more comprehensive understanding of cloud-based collaborative learning applications adoption in university settings by: 1) describing the benefits of cloud computing for educational institutions and highlighting the importance of collaborative learning for students; 2) extending the current understanding of cloud computing adoption to support collaborative learning in university contexts; 3) synthesizing and integrating two theoretical lenses (TTF and UTAUT) as the basis of the research model and incorporating collaboration-

related constructs to this model; 4) identifying the factors that influence the adoption of cloud-based collaborative learning applications and developing an instrument and theoretical model for this adoption; and 5) becoming a starting point for future studies associated with adoption of cloud-based collaborative learning applications.

This research has a contribution to the growing body of literature on collaborative learning and technology acceptance and usage. Developing and testing an adoption model which integrates two adoption theories (UTAUT and TTF) and even incorporates collaboration-related constructs will advance the body of knowledge on the antecedents of technology adoption in university settings.

The findings of this research will contribute to the body of ideas and knowledge about better strategic ways of adopting cloud-based collaborative learning applications in universities. Since students are the largest group of cloud-based collaborative learning applications' users, this work has crucial implications for cloud service providers, Ministry of Education, and university administrators because it can help them to better understand students' behavior and identify the factors that facilitate their adoption. Understanding the key factors that influence the adoption of cloud computing for collaborative learning helps Ministry of Education and university administrators to plan their strategies for supporting and encouraging students to integrate these technologies to their collaborative learning and achieve high quality of educational outcomes. Furthermore, it helps cloud service providers to keep close contact with universities and to establish standard cloud-based applications based on user preferences.

This research provides a mechanism to better understand the moderating effects of age and gender on the adoption of cloud-based collaborative learning applications. The moderating relationships are conceptualized based on UTAUT. This research is the first to demonstrate these moderating effects for cloud-based collaborative learning applications and helps university administrative and cloud service providers to know whether or not they need to develop different policies and services based on age and gender differences.

1.7 Organization of the Thesis

As visualized in Figure 1.2, this thesis is divided into six chapters which are organized into three main sections:

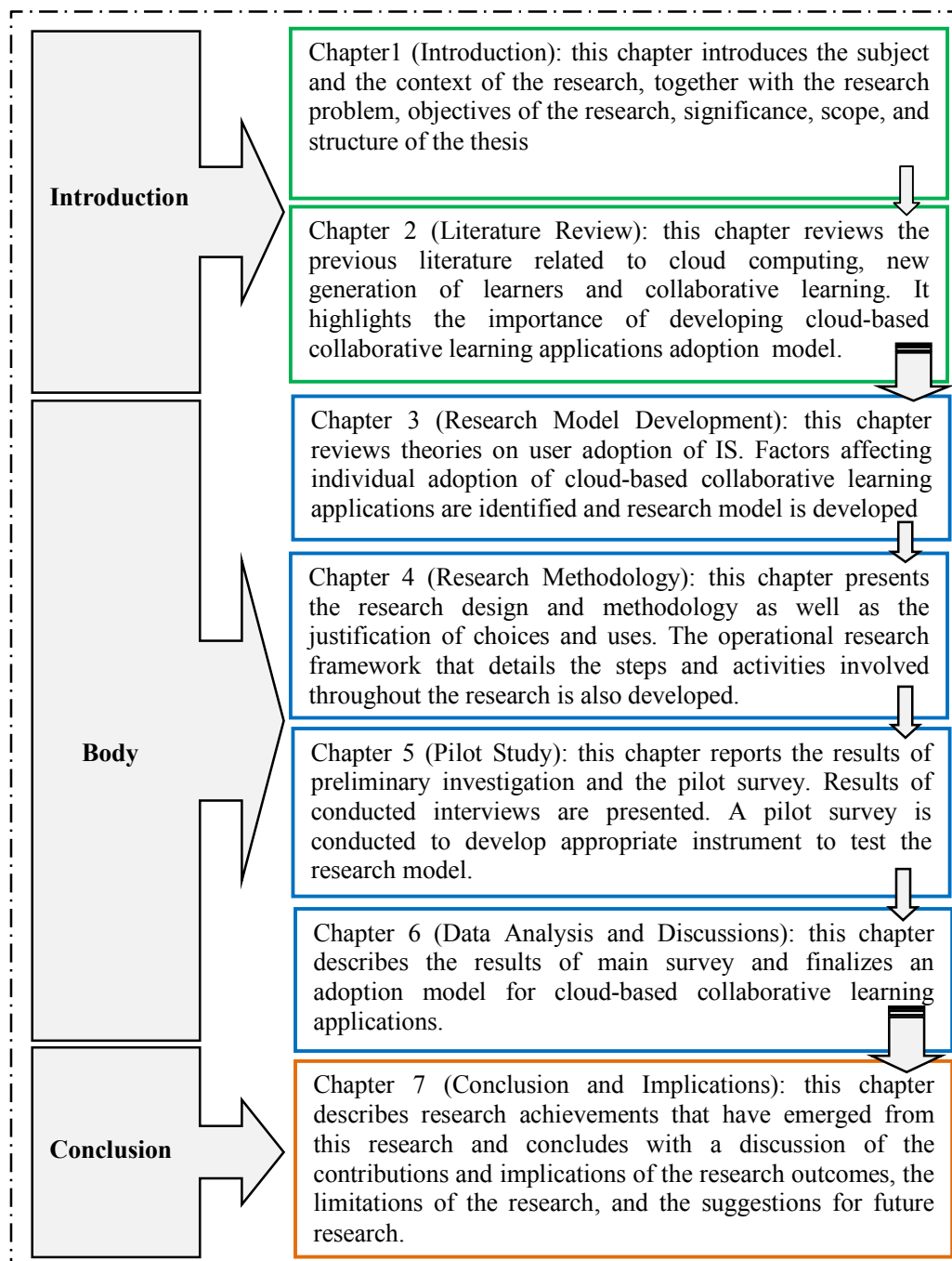


Figure 1.2 Organization of the thesis

1.8 Chapter Summary

This chapter provides an overview of the thesis. It begins by introducing the background and research problems. This is followed by research statement, development of research questions, and research objectives. The scope and significance of the research are subsequently discussed. Finally, the organization of the thesis is described in three main sections, namely, introduction, body, and conclusion.

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