

## CHAPTER ONE

### INTRODUCTION

#### 1.0. Introduction

This research studies the users' information privacy of cloud based e-learning. There is a lack of clarity in educational institutions as what users' information privacy issues are when using cloud based e-learning. Such ambiguity has also resulted in an uncertainty of information privacy implantation of educational institutions when adopting cloud computing in their e-learning system. In this respect, the aim of this research is to study and develop information privacy framework of cloud based e-learning users in order to improve the information privacy implementation. It also aims to increase the level of users' trust. This framework provides the researchers, educational institutions, and users with deep understanding of information privacy within the cloud computing. This study makes a contribution towards reducing the information privacy concerns of cloud based e-learning system. Such contributions allow educational institutions to be more confident with their information privacy practice than before.

This chapter is organized under different sub-headings. Section 1.2 states the research problem. Section 1.3 outlines the research motivation. Section 1.4 identifies the research aim and objectives. Section 1.5 introduces the research questions. Section 1.6 explains the research scope and limitation. Section 1.7 briefly details the general aspects of the research methodology. The research contribution is highlighted in section 1.8. And section 1.9 introduces the organization of the thesis.

## 1.1. Background of The Research

Cloud computing has received a great attention by individuals and societies. The demand for Cloud computing has been increasing for the last decade (Khadijah M. Alzhrani, 2016). There are three types of cloud computing service models: Software as a service (SaaS), platform as a service (PaaS), and infrastructure as a service (IaaS). In the case of SaaS, the application is hosted and delivered as a service to users who can access it via the internet (Babu, Kulkarni, & Sekaran, 2014). PaaS provides a computing platform to allow users, mostly developers, to build applications and services over the internet (Mell & Grance, 2011). While IaaS, is the delivery of computing services (hardware, storage, and networking) through cloud infrastructure (Babu et al., 2014).

Regarding the deployment models, four types can be distinguished: A private cloud which is operated solely for a single institution, accessible only within a private network and managed by the institution. Public cloud the infrastructure is made available to the general public. In hybrid cloud, the cloud infrastructure is a composition of two or more deployment models that remain unique entities. A community cloud is exclusively used by a community of users from institutions that have the same interest. A hybrid cloud is a composition of two or more cloud infrastructures (Mell & Grance, 2011).

The cloud computing has become a widely used term in the academia industry. Educational institutions have not remained unaware of this trend. Several e-learning systems based on cloud technologies are already in place, especially for software as a service in public cloud (Meske, Stieglitz, Vogl, Rudolph, & Öksüz, 2014; Vaquero, 2011). E-Learning in the public cloud can be viewed as Education Software-as-a-Service. Its deployment can be performed very quickly since the hardware requirements of the user are very low (Fernandez, Peralta, Herrera, & Benítez, 2012).

The primary reason for using public cloud computing in education is to gain benefits in terms of economic advantage (e.g. pay per usage, maintenance) (Ibrahim, Salleh, & Misra, 2015). The public cloud can help in reducing educational institutions' IT

complexity and costs by using SaaS to replace the software installation on campus computers with applications delivered via the Internet (Sasikala & Prema, 2011). Public clouds provide access to an almost infinite amount of infrastructure resources without any upfront investment required, and the ability to use cutting-edge technology available from public cloud provider (Butler, 2016). Students, lecturers, administrative staff members and other cloud users in the institutions can access educational tools or files saved in the public cloud from almost any internet-capable device (Meske et al., 2014).

Moreover, students can have access to course content, video tutorials, educational e-books, online-exams, and podcasts, workshop / conference videos. Also lecturers/instructors are able to upload course content, video tutorials and other educational materials (Olokunde & Misra, 2015). The educational institutions have adopted SaaS e-learning system because of its promises such as cost reduction, scalability, flexibility, pay per use model, accessibility. Softwares and applications available through SaaS are being used by students and lecturers in educational insitioations mainly for collaboration, content delivery, communication and accessing learning materials (Erturk & Iles, 2015). The economic advantages, speed, agility, flexibility as well as infinite elasticity of SaaS leads to improved e-learning services as argued by (Alsaeed & Saleh, 2015).

The new features of cloud computing have an impact on IT budgeting, but they also affect trust and traditional information privacy mechanisms. Not all types of cloud computing raise the same information privacy risks (Gellman, 2012). The perceived lack of control is more rising in public cloud than other cloud models since data is stored and transmitted over the cloud and even across borders (Butler, 2016). However, many of information privacy mechanisms are no longer adequate and need to be reconsidered to fit this new paradigm of cloud computing (Pearson & Benameur, 2010). This new features of cloud computing make it hard and sometimes not possible at all to reuse traditional trust and information privacy mechanisms in the cloud (Pearson & Benameur, 2010). They raise issues and concerns that need to be fully understood and addressed because, these issues are exacerbated by the cloud computing.

## 1.2. Research Problem

Cloud computing is a model for moving the processing from the local devices to the data center facilities. It has the ability to provide a platform, software, and infrastructure that can be accessed anytime and anywhere via the internet (Ghazizadeh, 2012). By adopting cloud services, the restrictions of sharing, compatibility, low storage size, backup, and recovery have been exceedingly resolved (Arpaci, Kilicler, & Bardakci, 2015). Cloud computing can also reduce the costs of implementation and maintenance. It can be used without being installed on individual computers.

Like other organizations, education institutes need to use Information Technology (IT) services such as email, sharing space, web base services, and the Internet (Badie, Che Hussin, & Yadegaridehkordi, 2013). The traditional methods are insufficient to address the needs of universities especially academics and students. Education institutions find it difficult to meet the growing technology requirements as a result of limited resources (Razak, 2009). Due to the growing needs for information technology and the current dwindling global financial stability, education institutes including universities, are facing problems in providing the essentials of IT supports for administrative, educational, and research activities (Badie et al., 2013). Universities have been forced to slash their teaching budgets in order to protect research funds. Salleh (2008) states that universities have to work with a limited budget and the universities have a large number of students and there are some issues such as software constant licensing, infrastructure, teaching materials, training of lecturers and the renovation is very slow.

Many educational institutions do not have proper resources and infrastructure needed to run the e-learning systems (Begum, Sheeba, & Rani, 2013). It is important for universities to adopt new approach and technology that will better prepare students and equip them to be ready for current and future job market needs (Badie et al., 2013). E-learning systems usually require many hardware and software resources. There are many educational institutions that cannot afford such investments to support their learning needs. Cloud computing, then, is the best solution for them (Pocatilu, Alecu, & Vetrici,

2010). The educational institutions can take benefit from economies of scale of public cloud, because their infrastructure costs are spread across all public cloud clients. There is several public cloud computing services providers that offer support for educational systems. Among them are Amazon, Google, Yahoo, and Microsoft. While other profit services such as banking use private cloud infrastructure that are dedicated to a particular organization not shared with other organizations.

Adopting cloud computing technology gives all the needs of educational institutions to improve teaching and learning methodology (Kassim, Salleh, & Zainal, 2015). Educational institutions can take benefit of ready-made applications that hosted on a dynamic, robust cloud to enable the end users completing their tasks without obtaining software licensing, setting up, and maintaining of software packages.

However, many e-learning institutions are rushing into adopting ICT without carefully planning and understanding any related security concerns (Alwi & Fan, 2010). Information privacy represents an aspect that may not suggest itself as a high priority in an educational environment, but evidence indicates that it is definitely required (Furnell & Karweni, 2001). E-learning providers and practitioners have not considered information privacy as a top priority (Chen & He, 2013). While cloud computing is expanding rapidly as a service used by many individuals and organizations. Information privacy issues related to cloud computing are not being widely considered (Badie et al., 2013). Information privacy is a very big concern in the public cloud since both the software and the data are located on remote servers. Several studies and surveys such as (Chuang, Li, Huang, & Kuo, 2011; Lar, Liao, & Abbas, 2011; Shankarwar & Pawar, 2015; Waqar, Raza, Abbas, & Khan, 2013; Zhao, Li, Li, Zhang, & Tang, 2012; Zhou, Zhang, Xie, Qian, & Zhou, 2010). Show that information privacy is the main reason for slow adoption of cloud computing. Moreover, the information privacy imposes a strong obstacle to the adoption of cloud technologies (Chuang et al., 2011; Lar et al., 2011; Shankarwar & Pawar, 2015; Waqar et al., 2013; Zhao et al., 2012; Zhou et al., 2010).

Cloud computing has raised many information privacy concerns such as, the impact of existing information privacy compliance requirements, cloud data location, retention period, data destruction, and the notification management when an information privacy breach occurs. The information privacy threats for cloud computing also affect educational institutions which have adopted cloud based e-learning system. In fact, all the information privacy threats of cloud computing are also in cloud based e-learning. Due to the openness and multi-tenant characteristics of the cloud, cloud computing is bringing tremendous impact on information privacy field (Chen & Zhao, 2012). As the system boundaries have been extended to the cloud, traditional security and information privacy mechanisms are no longer suitable for applications and data in the cloud (Chen & Zhao, 2012).

Moreover, there is a lack of clarity in educational institutions as to what information users' information privacy issues are, while using cloud based e-learning solution. This confusion, with respect to user's information privacy concerns in the cloud, has also resulted in an unspecified information privacy implementation by educational institutions which have adopted cloud computing technology. In order to adopt cloud technology in educational institutions efficiently, there is necessity of an obvious understanding of all possible information privacy issues; otherwise, the potential benefits of the cloud based e-learning will not be achieved. Consequently, there is a need to develop an information privacy cloud based e-learning framework to ensure that information privacy requirements of educational institutions are met. Adopting an information privacy framework is one approach to set up and build trusting relations among cloud service providers, educational institutions, and their users.

The adoption of cloud based e-learning is also motivated by the issue of security and privacy of e-learning systems including users' information. In many cases, the information privacy is compromised, simply because of the act of theft and vandalism. Vast numbers of educational institutions are destroyed by military operations and subsequent looting. This has been witnessed in the recent uprising in many countries like Iraq, Kuwait, Egypt and Libya (Harb, 2008; Yahia & Butler, 2015). According (Harb,

2008) many universities are looted in the chaos that accompanied the invasion of 2003. In one particular case, 15,000 computers are looted from a university system composed of 30,000 computers. This includes all e-learning systems installed. This same is looting experienced in Syria (Yahia & Butler, 2015) and Kuwait (Al-Jaber, 1996).

Reviewing literature, several issues are identified which suggest different factors in information privacy of the cloud based e-learning. Although there are previous studies exploring the information privacy concerns. There is a lack in the literature when it comes to relating cloud computing and e-learning system in terms of information privacy. Furthermore, there is a gap in research investigating the information privacy issues of cloud based e-learning. This study aims to fill in this gap by identifying the factors that affect on users' information privacy of cloud based e-learning, and propose an information privacy framework of cloud based e-learning users.

### 1.3. The Motivation

The motives behind this research are the interest and the need of identifying and understanding the users' information privacy concern for cloud based e-learning. Therefore, exploring the information privacy issue and developing an information privacy framework of cloud based e-learning as an essential step to reduce the users' concern in order to increase the trust and minimize the risk of adoption cloud based e-learning.

### 1.4. Research Questions

The main research question is how to improve the users' information privacy of cloud based e-learning. This question is divided into three sub questions. The relevant questions are as follows

1. Why cloud based e-learning users are concerns about the information privacy?

2. How significant are these factors (i.e. Collection, Control, Awareness, Access, Storage, Retention, Destruction, Compliance, privacy Breaches and, Audit and Monitoring) in influencing information privacy of cloud based e-learning users?
3. How to validate the information privacy framework of cloud based e-learning users?

### 1.5. Research Aim and Objectives

#### 1.5.1. Research Aim

The main aim of the research is developing users' information privacy framework for cloud based e-learning to improve the information privacy of cloud based e-learning. Developing such a framework reduces the users' concern, increase the users' trust and minimize the risk of adoption cloud based e-learning.

#### 1.5.2. Research Objectives

- a) To identify the possible factors that cloud based e-learning users concern about.
- b) To examine the factors that influence on information privacy of cloud based e-learning users.
- c) To develop and validate the information privacy framework of cloud based e-learning users.

### 1.6. Research Scope and Limitation

While cloud computing is still growing like other computing fields, there are large amount of research opportunities and issues that can be explored. This research focuses on information privacy of public cloud computing using Software as a service in e-learning field. In addition, this research explores the information privacy issues which are

faced by educational institutions in adopting public cloud computing. Figure 1.1 outlines the scope of the research.

The limitation of this study lies in the fact that currently there is one university in Malaysia adopting the cloud based e-learning in the whole learning system process which is Universiti Pendidikan Sultan Idris (UPSI). In addition, due to the large size of the cloud based e-learning users, which include the clerical staff, lectures, and students, this research assumes that the lectures of computer and science department and the staff member of the center for information technology and communication (ICT) which have been selected in this study, have more experience than others and the result would be more accurate.

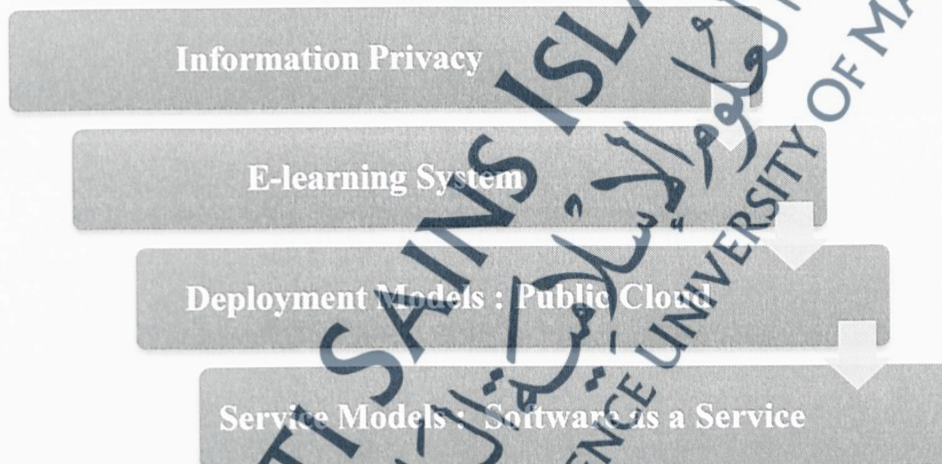


FIGURE 1.1: The Research Scope

### 1.7. Research Methodology

The main aim of this research is to develop users' information privacy framework of cloud based e-learning. To accomplish the aim of the research, deductive research approaches, along with quantitative research method are adopted. The research

methodology is divided into to three main phases: a) problem identification phase, b) data collection and analysis phase, and c) framework development, and conclusion phase. Figure 1.2 outlines the overall of three main research methodology phases.

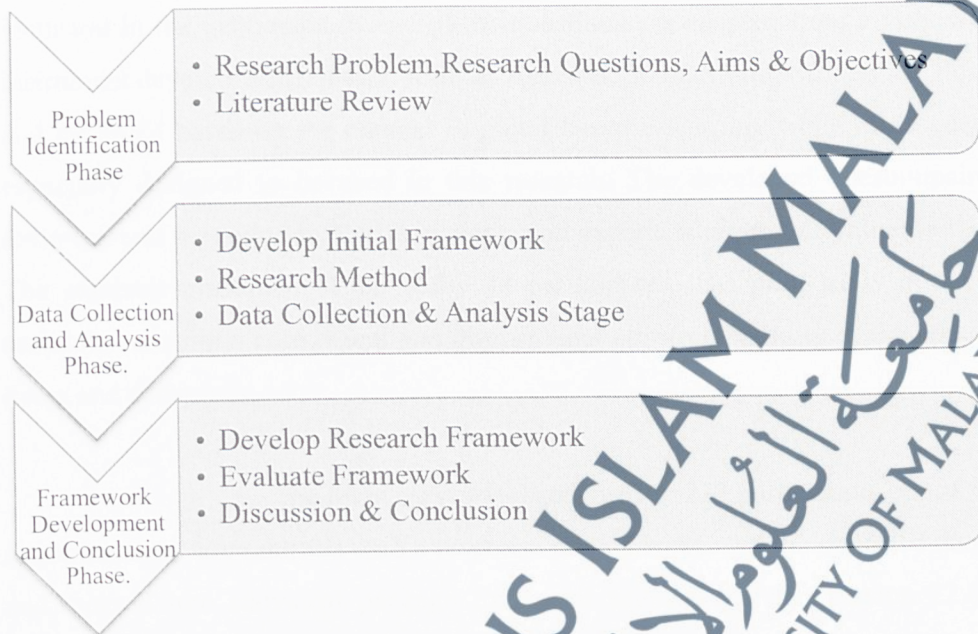


FIGURE 1.2: The Research Methodology

### 1.7.1. Problem Identification Phase

The research begins with identifying of the research gap and research problem. The first phase involves identifying the research problem and formulating the research aim, objectives, and research questions. In addition, for the purpose of better understanding of the research domain, a systematic literature search is utilized with a wide range of secondary data sources from academic databases.

### 1.7.2. Data Collection and Analysis Phase

After reviewing the relevant literature, the conceptual framework is developed, associated constructs (factors) and related items (questions) are determined for inclusion in the instrument. Some of the questions are adapted from a very well-known instrument developed (Malhotra, Kim, & Agarwal, 2004; Smith, Milberg, & Burke, 1996) and modified based on the context of cloud based e-learning while other questions are especially designed to be used in this research. The developed questionnaire is then reviewed and pre-tested by the supervisors and experts who provide valuable suggestions. The resultant instrument is piloted by 24 participants. The pilot study is conducted to ascertain reliability, convergent and discriminant construct validity of the contextualized items and constructs.

The main survey is distributed to 223 participants out of which 216 questionnaires are returned with a response rate of 96.86. All the collected data is coded and entered into statistical package for social sciences (SPSS) version 22.0. First, a descriptive analysis, data preparation, screening, normality and the reliability tests are carried out. Then, all items are clarified by exploratory factor analysis and measured again by confirmatory factor analysis. The structural equation modeling is used to hypothesize relationships among latent variables.

### 1.7.3. Framework Development and Conclusion Phase

In the final phase, the research framework is developed based on the result of testing the conceptual framework. The guide to using the framework is suggested to give the users, educational institution, and cloud service provider significant instruction to ensure the information privacy in the cloud based e-learning environment. Also, in this phase, the research framework is validated by panel of experts.

## 1.8. The Contribution of This Research

This research has contributed to the knowledge and practical domain as discussed below.

### 1.8.1. Theoretical Contribution

Theoretical contribution is divided into three parts such as Users' Information Privacy of Cloud Based E-Learning Framework, Assessment Tool (Instrument) and Methodology.

- Users' Information Privacy of Cloud Based E-Learning Framework

The proposed framework will serve as a useful guide for exploring user' concerns to various information privacy issues on the cloud based e-learning system.

- Assessment Tool (Instrument)

This research makes a contribution to the information privacy domain by providing assessment tool (Instrument) to assess information privacy in the cloud based e-learning system which could be used for further researches. The instrument is designed based on the findings from the extended literature review with a particular focus on information privacy concerns of cloud computing.

- Methodology

This methodology explains how the instrument and the framework are developed to assess the information privacy of the cloud based e-learning. The measurement items of the study constructs are identified by rigorous statistical testing to check validity and

reliability along with satisfactory fit indices and significant pathways in the hypothesized direction between the theorized constructs.

### 1.8.2. Industry Contribution

The Industry contribution is divided into two parts such as Education Industry and Cloud Computing Industry.

- Education Industry

This research provides an overview of the information privacy issues pertinent to cloud based e-learning system and points out considerations to educational institutions that they should take when outsourcing data, applications, and infrastructure to a cloud computing environment. This research highlights all possible information privacy issues and gives a good base which leads to improving educational institutions' information privacy. Furthermore, the proposed framework and instrument allow the educational institution to overcome the urgent need of ensuring the information privacy. The findings of this study also assist educational institution with more practical guidance on considering particular information privacy factors. Besides, this study provides direction to educational institutions that are plane to adopt cloud based e-learning to evaluate possible user information privacy issues and increase their awareness.

- Cloud Computing Industry

Despite the fact that the users' information privacy is a central part of creating the trust that supports adoption of cloud computing, this research identifies the key information privacy issues of cloud computing which can be used by CSP to increase the level of trust between users of CSPs. The CSPs would be able to design cloud based e-learning system with more respect of users' information privacy.

### 1.8.3. Policy Contribution

This study is in parallel with the growing importance of effective policies and regulation that govern the data in the cloud computing. Thus, it provides an important base for policy-makers in order to improve the legal rights and liabilities of cloud computing services and their users.

## 1.9. Organization of The Thesis

This section presents a concise review of the chapters and their contents.

### 1.9.1. Chapter 1: Introduction

This chapter presents the introduction of the research, the identification of the gap that needs to be bridged by this study, the motivation, research aim and objectives, the research questions, research assumptions, research methodology, research contribution and organization of the thesis.

### 1.9.2. Chapter 2: Literature Review

This chapter reviews the relevant literature on three key domains of research: information privacy e-learning and cloud computing. This chapter also reviews the previous cloud computing information privacy frameworks, the theoretical background of information privacy concerns. It also highlights the information gap found in the literature.

### 1.9.3. Chapter 3: Methodology

This chapter discusses the strategy of this research in order to achieve its objectives and answer its questions. It also gives the explanation for the research

approach and process. Also, this chapter highlights the data analysis strategy and data resources. Finally; this chapter presents the ethical considerations that are applied in this research.

#### 1.9.4. Chapter 4: Data Analysis

This chapter presents the population and sample, research instruments, pre-test, pilot study and data collection procedure. It shows the data analysis process by using various data analysis techniques and tools. The analysis techniques consist of data management, data screening, demographic characteristics, factor loading, exploratory factor analysis, confirmatory factor analysis, structural equation modelling and assessment of model fit.

#### 1.9.5. Chapter 5: Finding and Discussion

Chapter five discusses the results. The findings of all hypothesis testing are reviewed and compared with past research. The findings indicate that the control, awareness, access, storage, retention, destruction, compliance, audit and monitoring and, information privacy breaches have a positive significant influence on information privacy concerns of cloud based e-learning while information privacy concern of cloud based e-learning has a positive significant influence on risk beliefs and a negative significant influence on trust beliefs. The chapter five presents the proposed information privacy framework of cloud based e-learning users and also point out the guide of using this framework. At the end of the chapter, the validation of proposed framework by a panel of experts is explained.

#### 1.9.6. Chapter 6: Conclusion

This chapter provides an overview of this research followed by the research contribution of the thesis. Then, the limitations of the research and future research recommendations are presented.

## 1.10. Chapter Summary

This chapter provides an introduction to this research, the research problem, the research questions as well as the research aims and objectives. The research motivation is addressed before introducing the assumptions of the research. This chapter also included a brief explanation of research methodology and the contribution of the research. Finally, this chapter outlined the organization of the thesis.

