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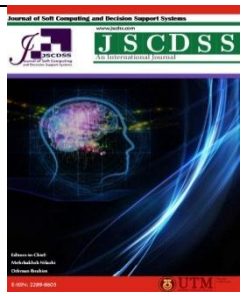

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Cloud Computing Adoption Behaviour: an Application of the Technology Acceptance Model

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Abstract

Cloud computing is considered as a new technology which significantly affects teaching and learning processes in educational environments. Utilizing this technology not only enhances the quality of teaching and learning, but also reduces overhead expenditures of educational institutions. Despite the worthwhile advantages of cloud computing, however, its adoption is still far from full potential, particularly in university settings. Thus, this research is aimed to develop a theoretical research model for the adoption of cloud computing in university settings. For this purpose, Technology Acceptance Model is chosen as theoretical foundation and collaboration, mobility, and personalization are added to it as antecedents of perceived usefulness and perceived ease of use.

Keywords: Cloud computing, Adoption, Technology Acceptance Model, University settings

1. Introduction

Nowadays, cloud computing is increasingly becoming a ubiquitous computing tool and a powerful platform in every aspect of the society. Grid computing, utility computing and virtualization technologies can be considered as precursors to cloud computing (Sourya 2011). Fig. 1 demonstrates the evolutionary steps of cloud computing from 1990 to 2008. Grid computing is the use of distributed parallel computing devices which are connected to each other and worked on a single problem (Craig et al. 2009). Grid computing leads to utility computing which is a model of renting computer capacity such as storage, hardware, CPU, network bandwidth, pay based on demand and consumption (Sourya 2011). Software as a Service (SaaS) provides users commercially available software through the internet, charging for used services instead of offering licensed applications (Craig et al. 2009). Cloud computing is considered as a broader form of utility computing and grid computing. Column (2008) argued that it is very difficult to explain cloud computing in a unique definition, the fundamental features of this technology are that applications run somewhere on the "cloud", Scalability, performance, reliability, all without any concern as where the applications actually run. Cloud computing helps organizations by offering high degree of returns on investments.

The National Institute of Standards and Technology (NIST) defined cloud computing as:" a model for enabling ubiquitous, convenient, on-demand network access to a shared computing resources that can be rapidly provisioned and released with minimal management effort or service provider interaction. This cloud model is composed of three service models, and four deployment models" (Mell and Grance 2011). Private cloud, public cloud, community cloud, and hybrid cloud are four main deployment models of cloud computing. Furtheremore, cloud services are categorized into Infrastructure As a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), (Cooke and Kirby 2008; Mell and Grance 2011).

Higher education is one of the basic foundations which has strong interrelationship with government and other business organizations (Jain and Pandey 2013; Pardeshi 2014). Therefore, educational institutions are constantly looking for the new technologies for their software and IT hardware in order to make students more satisfy and to follow the rapid developments in digital technologies (Sultan 2010). Nowadays, cloud computing has considerable importance in higher education (Thomas 2011). Cloud computing is the latest technology which can significantly improve the quality of teaching and learning in educational environments. This technology improves the accessibility of education, especially in remote and underserved communities. Furtheremore, it offers variety of internet-based application platforms and solutions according to the demand of users (Miseviciene et al. 2011) and learning needs of student and lecturers (González-Martínez et al. 2015). On the other hand, since universities face some limitations such as budget constraints, limitedon-campus computing resources, and lack of unified storage

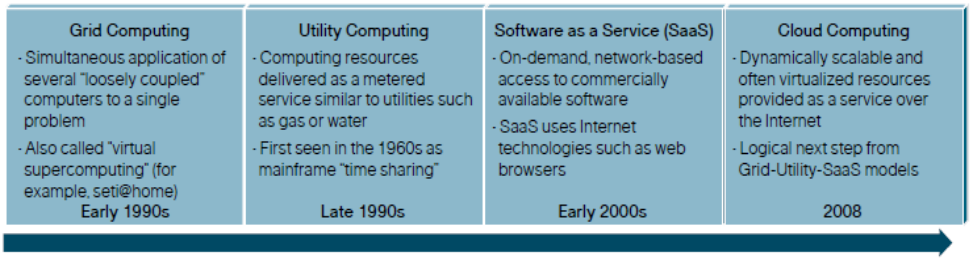

Fig.1. Evolution of cloud computing (Craig et al. 2009).

media, they can make use of cloud computing resources to reduce the overhead expenditures (Tout et al. 2009).

Despite the worthwhile advantages of clud computing, however, its adoption is still far from full potential (Gital and Zambuk 2011; Park and Ryoo 2013), especially in educational context (Bittman 2009). Furtheremore, Yang et al. (2015) believed that when organizations decide to implement and adopt cloud technology, the readiness of personnel should be clearly taken into account. Therefore, in order to have a successful implementation and adoption of cloud technology, both students and schools perceptions need to be considered (Behrend et al. 2011). Since, few studies have discussed about the user adoption behavior of cloud computing by applying IS adoption theories in university settings (Cheung and Vogel 2013; Orehovački and Babić 2014; Taylor and Hunsinger 2011), the main objective of this study is to develop a theoretical research model for user adoption of cloud computing in this context.

The remainder of this paper is organized as follows: in Section 2, a literature review is discussed in two parts, cloud computing benefits and characteristics and Technology Acceptance Model (TAM); in Section 3, the theoretical research model is developed. Finally, in Section 4, discussion and conclusions are presented.

2. Literature review

2.1 Cloud computing benefits and characteristics

Previous research has focused on different characteristics of cloud computing from different points of view as shown in Table 1. Some of these benefits, refer to the IT economics and management as well as technology operation. However, others deal with organizational process and end-user advantages. It is clear that not all stakeholders make equally benefits from all cloud characteristics. As illustrated in Table 1, cost saving, ease of implementation, flexibility, mobility, scalability, sustainability, personal learning environment, processing capabilities, agility, collaboration, usability, risk reduction, measured services, flexibility, on-demand self-service, and resource pooling are the main characteristics of cloud computing cited in the previous literature. Some factors such as cost saving, ease of implementation, scalability, sustainability, processing capabilities, agility, risk reduction, measured services, on-demand self-service, and resource pooling refer to the organizational benefits of cloud computing. Since the main focus of this study is on user behavioral intention towards cloud computing technology, these factors are eliminated from the context of the study. Therefore, personal learning environment, mobility, and collaboration are more discussed and considered as main factors influencing user adoption behaviour of cloud computing in the present study.

Interestingly, cloud computing provides flexibility to create learning environments (González-Martínez et al. 2015). Cloud-based services give new opportunities to students to use available Aplication Programing Interfaces (API) and create learning environments suited to thier needs and preferences. Therefore, cloud technology facilitates the creation of Personal learning environments for students and lecturers (Rizzardini et al. 2012). Personalization is very important concern that is considered by individual users when they want to choose between different service providers. By considering the explosion of information on the cloud, the demand for personalized services is increasing (Guo et al. 2009). Mobility is taken into account as a significant characteristic of cloud computing (Bansal et al. 2012; Brohi and Bamiah 2011; Buyya et al. 2008; Chadwick and Fatema 2012; Cisco 2014; "Drivers for Adoption of Cloud Computing" 2012; González-Martínez et al. 2015; Jeong and Hwa-Hong 2012; Mell and Grance 2009; Miseviciene et al. 2011; Pardeshi 2014; Sclater 2010; Thomas 2011). Cloud technology can solve the current difficulties of mobile learning (Chen et al. 2010) by providing enough computing resource and scalability advantages (González-Martínez et al. 2015). Students can use their mobile phones to access, edit, and share learning materials anywhere and any time in virtual storage resources offered by cloud computing (Shuai 2011). Cloud computing brings ubiquity, advanced internet-based tools and collaboration for education and offered unique opportunities to them (González-Martínez et al. 2015). Vance (2011) claim that "Cloud-based collaboration means that many of the basic challenges to entry for collaboration, such as expensive initial investment in infrastructure, have been reduced or eliminated". González-Martínez et al. (2015) believe that cloud computing provides easier communication, resource sharing, and collaborative pedagogies for students and educational practitioners.

2.2 Technology Acceptance Model

Technology Acceptance Model (TAM) is proposed by Davis et al. (1989) and is one of the basic models for testing user adoption of information systems. This theory is

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the most widely applied model in the field (Shropshire et al. 2015). TAM is comprised of perceived usefulness (PU) and perceived ease of use (PEOU) which they explain the probable adoption of new innovation. PU is defined as "the degree to which a person believes that using a particular system would enhance his or her job per-formance," while PEOU is "the degree to which a person believes that using a particular system would be free of effort" (Davis et al. 1989). According to original TAM behavioural intention is affected by both PU and PEOU, while PU is influenced by PEOU.

Table 1
Cloud computing benefits and characteristics.

	Cost saving	Ease of implementation	Flexibility (elasticity)	Mobility	Scalability	Sustainability	Personal Learning Environment (PLEs) 6	Processing capabilities	Agility	Collaboration	Usability	Risk reduction	Measured service	On demand Self service	Resource pooling
González-Martínez et al. (2015)	√		√	√	√		√	√		√				√	
Pardeshi (2014)	√			√	√				√	√					
Cisco (2014)	√	√	√		√	√								√	√
Bansal et al. (2012)	√	√	√	√	√	√									
Drivers for Adoption of cloud computing," (2012)	√		√	√	√					√	√	√			
Hu et al. (2012)										√					
Chadwick and Fatema (2012)	√			√				√							
Jeong and Hwa-Hong (2012)	√			√						√					
Miseviciene et al. (2011)	√	√		√						√					
Thomas (2011)				√			√	√		√					
Son and Lee (2011)	√		√						√						
("Primary Drivers for Cloud Adoption in the UK" July 19, 2011).	√		√						√						
Brohi and Bamiah (2011)	√			√	√					√					
Edwards (2011)										√					
Shimba (2010)	√		√		√										
Sclater (2010)	√		√	√						√					
Thorsteinsson et al. (2010)										√					
White et al. (2009)										√					
Mell and Grance (2009)				√									√	√	√
Buyya et al. (2008)				√			√							√	

different beliefs. They believed that perceived usefulness is influenced by perceived ease of use and external variables. However, perceived ease of use is theorized to be determined by external variables (Fig. 2). There have been many studies conducted on the user adoption of new innovations applying TAM. A mete-analysis study has been conducted on 88 TAM studies and concluded that incorporating external factors as predictors of percieved usefulness and percieved ease of use is one of the major

3. Theoretical research model

According to Davis et al. (1989) user acceptance is affected by external variables that have influence on

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modifications in TAM-related studies (King and He 2006). Therefore, recently different researchers have successfully extended TAM by adding external variables to this model in different context and based on the different technology under consideration (Calisir et al. 2014; Cheung and Vogel 2013; Chow et al. 2012; Du et al. 2013; Hong et al. 2011; Lee and Lehto 2013; Park and Kim 2014; Park et al. 2014). According to the research results of Cheung and Vogel (2013) perceived resource and compatibility positively influence perceived ease of use and sharing has significant influence on perceived usefulness of Google application platform. Calisir et al. (2014) have reported the positive influence of image on percieved usefulness and significant effects of percieved system quality and anxiety on percieved ease of use in the context of web-based learning. Park and Kim (2014) employed a TAM-based model and confirmed the significant role of percieved mobility on percieved usefulness of mobile cloud services. Moreover, Lee and Lehto (2013) have found significant influence of self-efficacy, vividness, content richness, and task technology fit on percieved usefulness of youtube for procedural lerning. Du et al. (2013) employed TAM and reported that percieved ease of use, security, responsiveness, and social influence have significant impact on percieved usefulness of software as services. Park et al. (2014) have incorporated anxiety, self efficacy, institutional support, and voluntariness as antecedents of perceived ease of use and institutional support, voluntariness, and anxiety as antecedents of perceived usefulness in order to better examine the factors affecting teleconferencing systems among employees.

Therefore, as shown in Fig. 3, for the theoretical research model in this study, TAM is chosen as basic model and personal learning environment (personalization), mobility, and collaboration are supplemented to the TAM as external variables influencing perceived usefulness and perceived ease of use.

4. Discussion and conclusions

The term cloud computing is described as the delivery of computing resources on demand self-service through the internet. Utilizing this technology not only enhances the quality of teaching and learning but also reduces overhead expenditures of educational institutions. Despite the proliferation usage of cloud technology in different areas of business, it is rarely used in the educational landscapes (Bittman 2009). Based on the objective , this research-in-progress offers a cloud computing adoption model for both universities administratives and cloud computing service providers. We expect that the research model will be able to fill the theoretical gap that the adoption of cloud computing in a university setting is unknown specially from the perspective of individual behavior, and the lack of attention in how a university organization adopt cloud computing in the organization. Introducing a new technology requires investments in time and money. Therefore, when an organozation decides to implement a new technology , they would like to predict whether the new system will be fully accepted by individual users or not (Davis et al. 1989). This study can help university administrative to make careful plan in order to increase the acceptability of the new technology. On the oder hand, cloud service providers can consentrate on the factors that are significant from users' perspective and prioritize them to accelerate the process of adoption. The next step of the research is to test the theoretical research model through a large scale survey. Therefore, we will consider a public university in the south of the Malaysia to distribute the questionnaire survey and to examine the behavioral intention of students towards adoption of cloud computing.

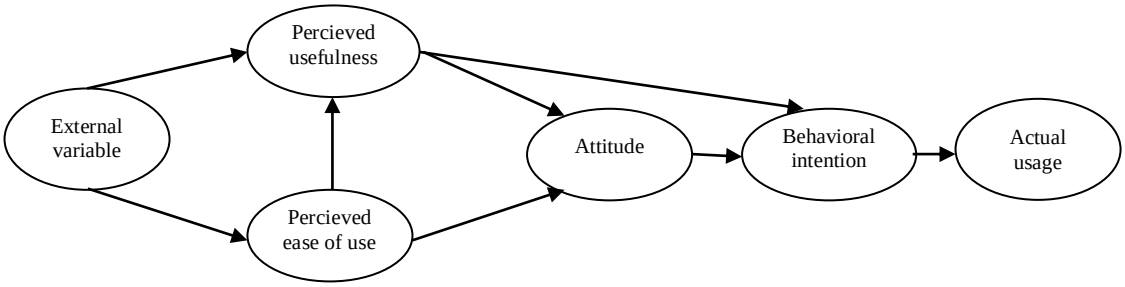

Fig. 2. Technology Acceptance Model (Davis et al., 1989).

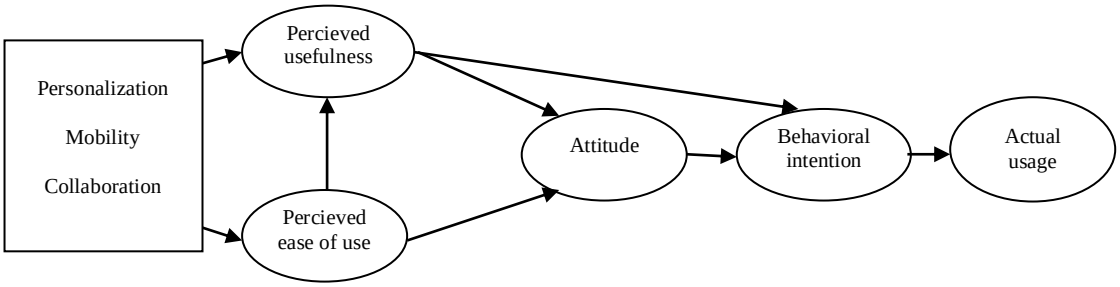

Fig. 3. Theoretical research model.

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