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Adoption of Cloud Based E-Learning: A Systematic Literature Review of Adoption Factors and Theories

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Abstract: Cloud computing is a new paradigm shift. Researchers attempts to find the factors that affect the adoption of cloud computing. However, few studies were conducted in educational institutons and there is ambiguity regarding the sitaution of the adotion of cloud based learning. The purpose of this study is to review, analyse and integrate the literature to present the state of the cloud based learning and to provide researchers with direction for future works. Mainly, the study were extracted from educational background studies. Search engine such as Science Direct and Emerald and IEEE were used to identify the studys. A screening process was conducted to remove the unrelated studys. As a result, a total of 32 Articles were considered suitable based on the context of this study. Factors were extracted from the 32 Articles and a frequency analysis was conducted to identify the most frequent factors that have been used by previous studies. The result showed that ease of use, usefulness and security are the most frequent factors. TAM is still the most widely used theory for the adoption of cloud based learning. Followed by TOE and UTAUT. The majority of the respondents are students followed by IT professional and decision makers. The study is limited to the included studys and the used search engine. Future works are recommeded to investigate the adotpion of cloud based learning using UTAUT and to incoporate security and trust.

Key words: Coud computing adoption, TAM, UTAUT, education institutions, integrate

INTRODUCTION

Cloud computing is considered as a new paradigm in the Information Technology (IT) that has emerged in 2007 (Nasir and Niazi, 2011). It is a result of innovations in Internet technologies, hardware technologies, systems management and distributed computing (Buyya, 2013). A dynamic technology platform addresses a wide range of needs by providing cyber-infrastructure to maintain and extend information storage capabilities. In addition, cloud computing provides access to software and hardware without large capital outlays and provides easier access to applications and services that can be realized with minimal service provider interaction (Yang *et al*., 2015). This has enabled cloud computing to develop as a technological innovation that can handle large amounts of information that are transferred and stored via electronic applications (Sarrab *et al*., 2016).

Empirical adoption studies have been trying to identify the factors that affect the adoption of cloud computing by different stakeholders such as IT professional, organizational users, individual users and public sector adoption of cloud. Many adoption theories such as Technology Acceptance Model (TAM) by (Davis, 1989) and the Unified Theory of Acceptance and Use of Technology model (UTAUT) by Venkatesh *et al*. (2003) have been employed by researchers to address the adoption of cloud computing. Other theories such as the Diffusion Of Innovation (DOI) by Rogers (2004) and Technology-Organization-Environment (TOE) also have been used.

The majority of the previous studies are empirical and conceptual studies (Safie, 2009; Safie and Aljunid, 2003; Raja *et al*., 2015). Few literature review studies conducted to describe the advancement in the field and provide researchers with statistics regarding the status quo of the cloud computing adoption. As a result, this study aims to review and consolidate the literature to provide a description of the current situation of cloud computing adoption in term of factors affect the adoption, theoretical adoption model used in the cloud, countries and respondents types and to provide direction for future works.

Literature review

Cloud computing background: The most acceptable definition of cloud computing is maintained by the US National Institute of Standards and Technology (NIST),

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according to NIST, cloud computing is "a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction" (Aharony, 2015; Mohammed *et al*., 2015). There are three layers of cloud computing. Previous studies pointed out that cloud can be divided into Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) (Goscinski and Brock, 2010; Low *et al*., 2011; Lian, 2015). SaaS includes process that entitles the service providers to rent application on demand using the internet and it is mainly used by end users (Goscinski and Brock, 2010; Low *et al*., 2011). The PaaS category represents clouds that access a range of computer, database and storage functions within a virtualized platform provided over the internet and services released by providers such as Microsoft Azure and Google App Engine (Goscinski and Brock, 2010; Low *et al*., 2011). IaaS is considered as a provision model that provides the organization with the ability to outsource the equipment used to support operations that include storage, servers, hardware and networking components (Goscinski and Brock, 2010; Low *et al*., 2011).

Cloud computing deployment can be divided into four types: private clouds, public clouds, community clouds and hybrid clouds (Safie and Aljunid, 2013; Lian, 2015). Public clouds have open access and it is often referred to as the cloud infrastructure available to the public. Private clouds run within organizations. It can be built and managed by the organization itself or by a third party. Community clouds is a strategic alliance where partners utilize common cloud computing resources in line with shared standards and goals while hybrid clouds encompass two or more cloud models and it provides more secure and elastic service (Lian, 2015; Yu *et al*., 2016).

Existing models: A total of 32 studies were identified that have investigated the cloud adoption using different theoretical adoption models and theories. Table 1 shows a summary of the reviewed study.

Table 1: Summary of articles

Author (s)/ years/country	Adoption theory	Method/sample size	Unit of analysis	Summary of result
(Park and Ryoo, 2013; Lim *et al*., 2015; Park and Kim, 2014; Kang *et al*., 2013; Yadegaridehkordi *et al*., 2014; Phaphoom *et al*., 2015; Atchariyachanvanich *et al*., 2014)	No adoption theories were used in these studies	Questionnaire was the instruments of data collection	Students are the target respondents	These studies investigate the benefits and challenges of using the cloud computing in educational settings. In addition, the factors of adoption were investigated
(Burda and Teuteberg, 2014; Aharony, 2015; Alkharusi and AlBadi, 2016; Senyo *et al*., 2016; Tarhini *et al*., 2014; Tarhini *et al*., 2015; Arpaci, 2016; Ashtari and Eydgahi, 2015)	Technology acceptance model was used in these studies	Questionnaire was the instrument of data collection	Students 5, IT staff 1 and managers 2	Ease of use, usefulness and other factors such as security, trust and IT related knowledge are key factors for the adoption of cloud computing among students, IT staffs and managers
(Low *et al*., 2011; Senyo *et al*., 2016; Yang *et al*., 2015; Alkhater *et al*., 2014; Lian *et al*., 2014)	Technology-organizations environmental was used in these studies	Questionnaire was the instrument of data collection	IT staff are the respondents of these studies	TOE variables have a significant effect on the adoption of cloud computing. Most important factors are technology readiness, security, privacy, trust
(Cao *et al*., 2013; Alharbi, 2014; Bellaaj *et al*., 2015; 2014; Nguyen *et al*., a,b)	UTAUT	Questionnaire is the instrument for all the studies	Students are the respondents of these studies	Effort expectancy, performance expectancy, social influence, facilitating conditions, moderators of UTAUT; age, gender, experience, and voluntarily are essential for the adoption of cloud based learning
(Arpaci *et al*., 2015)	Theory of planned behavior was used in this study	200 questionnaire	Pre-service teachers	Security and privacy have a strongly significant influence on the students' attitudes towards using cloud services in educational settings
(Hew and Kadir, 2016a, b)	Channel expansion theory, media richness	Questionnaire of 624	Student	All attributes expect content design affects school support, attitude affect knowledge sharing which affect the behavioral intention
(Gahtani, 2016)	TAM and TPB	288 student using PLS	Student	The perceived usefulness and ease of use affect the intention to use which affected the usage behavior
(Sasmita and Suki, 2015)	TAM and TOE	280 IT professional	IT professional	Variables of TAM and TOE are able to explain the variation in cloud computing

Table 1: Continue

Author (s)/ Years/country	Adoption theory	Method/sample size	Unit of analysis	Summary of result
	TAM/UTAUT	Questionnaire from 128 in USA and 121 in Turkey	Student	TAM and UTAUT factors in USA and Turkey are similar in their effect
(Shiau and Chau, 2016)	SQ/SE/TAM/ DOI/TPB andTRA/MM	Questionnaire of 487	Student	All the six models (TAM, TRA and TPB, Service Quality (SQ), Self-Efficacy (SE), motivational model (MM)) and the unified model showed adequate exploratory power
(Hew and Kadir, 2016a,b)	Self-determination theory, channel expansion theory	Questionnaire of 1064	Student	Virtual Learning Environment (VLE) content design, attitude, trust, school support and education affect intention to use VLE

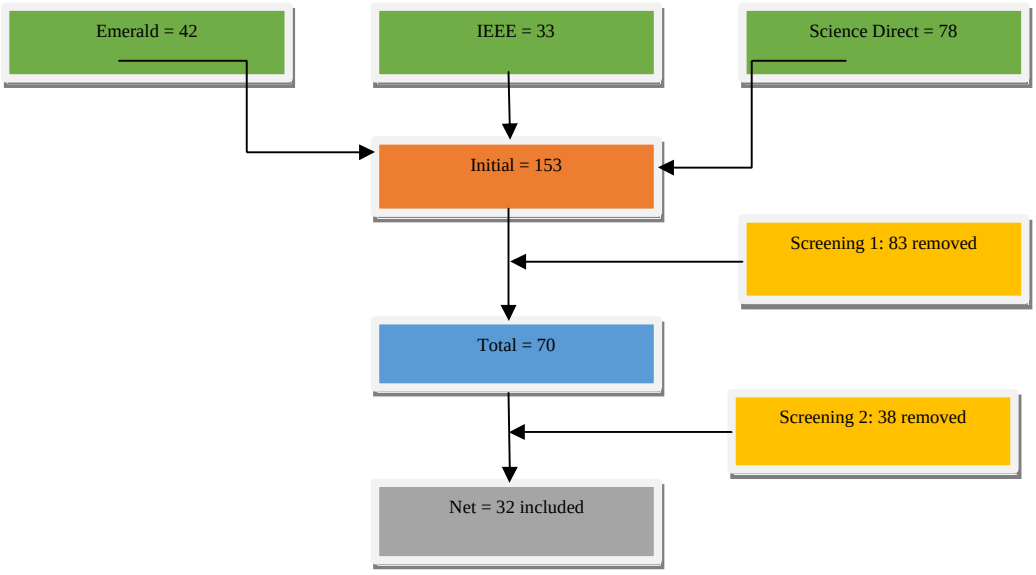

Fig. 1: Studys refinement

MATERIALS AND METHODS

This study is a quantitative research aiming to review and analyze the literature related to the adoption of cloud computing in educational learning organizations. As a result, the studys related to the filed were extracted from the search engine using google scholar to assess in the searching. A total of 153 Articles from Science Direct, Emerald and IEEE explore were identified. The first screening of the studys based on the topic resulted in excluding 83 Articles. A total of 70 Articles were further screened by reading the abstract and the body of the studys. This resulted in excluding a total of 38 Articles. A total of 32 Articles pertaining to the educational learning were included. Figure 1 shows the refinement of the studys. The timeframe of the included study is from 2013-2016. The factor extracted from the existing frameworks and a frequency analysis of the factors that have been used in previous studies was conducted.

RESULTS AND DISCUSSION

This studys reviews and analyses the literature related to the factors that affect the adoption of cloud computing by educational, business organizations, IT professional and individual users. A total of 32 Articles were refined and analysed. Factors were extracted from the studys and a factor frequency analysis was used to identify the most frequent factors. A total of 78 factors were extracted and they further refined. Factors that have frequency of less than three times were excluded. Table 2 shows the result of the frequency analysis of the factors that affect the adoption of cloud computing.

Factors: Figure 2 shows that the most frequent factors are the ease of use, usefulness and security. These factors have been used by researchers to investigate the adoption of cloud computing. The least frequent factors are cost, quality and satisfaction among others.

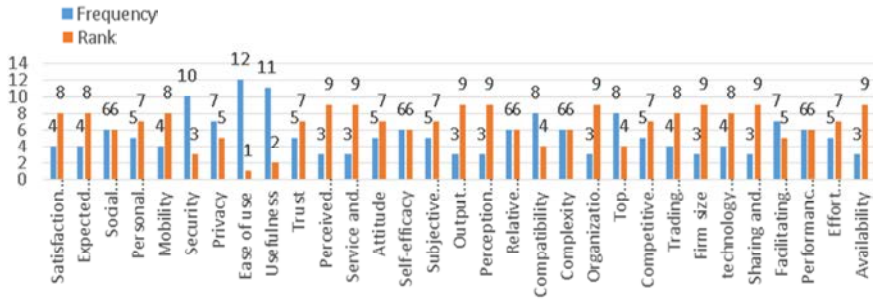

Fig. 2: Frequency and rank

Fig. 3: Adoption theories

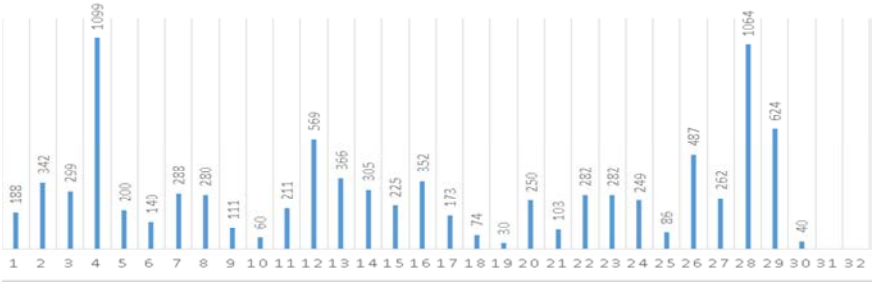

Fig. 4: No. Respondents of the studies

Adoption theory: The adoption theories that were used in the 32 Articles is shown in Fig. 3. Seven of the studies have not used any adoption theories. The remaining 25 studies showed that 12 of the studies have use the TAM model in their studys followed by 7 used the TOE model and 6 used the UTAUT, 3 used TPB.

Respondents of the studies: The respondents of previous studies are presented in Fig. 4. It shows that the respondents ranges from 1099 to low at 30 respondents. The mean score value of the response is 301 respondents.

In Fig. 5, it shows that the majority of the respondents are students (61%) followed by IT staff (25%) and decision makers (14%) such as SME managers and executives at companies.

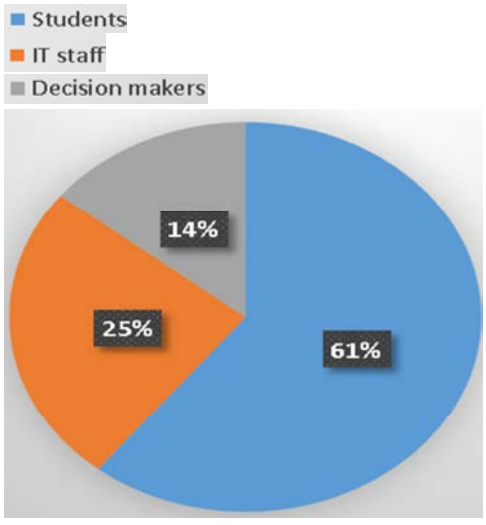

Fig. 5: Respondents of the studies

Table 2: Frequency and ranking of factors

Factors	Frequency	Rank
Satisfaction with IT	4	8
Expected switching costs	4	8
Social influence	6	6
Personal innovativeness	5	7
Mobility	4	8
Security	10	3
Privacy	7	5
Ease of use	12	1
Usefulness	11	2
Trust	5	7
Perceived connectedness	3	9
Service and system quality	3	9
Attitude	5	7
Self-efficacy	6	6
Subjective norms	5	7
Output quality	3	9
Perception of external control	3	9
Relative advantage	6	6
Compatibility	8	4
Complexity	6	6
Organizational competency	3	9
Top management support	8	4
Competitive pressure	5	7
Trading partner support.	4	8
Firm size	3	9
Technology readiness	4	8
Sharing and collaboration	3	9
Facilitating condition	7	5
Performance expectancy	6	6
Effort expectancy	5	7
Availability	3	9

CONCLUSION

This study was conducted to review and analyse the literature and present the state of the art of the cloud based learning and adoption along with providing direction for future work. A total of 32 Articles were extracted using search engine and publishers such as Science Direct, IEEE and Emerald. A frequency analysis was conducted on the factors that have been extracted from the studys. The result showed that security, factors of TAM, factors of TOE and factors of UTAUT in order of frequency were the most frequent factors. In addition, TAM was the most frequent used adoption theories followed by TOE and UTAUT. The mean of the respondents is 301 respondents. Most of the studies conducted in emerging economies. Limitations of the study were highlighted and direction of future works were discussed.

LIMITATIONS

This study was conducted to review and analyze the literature related to the cloud based learning and adoption. A total of 32 Articles used in this study. Thus, the result is limited to the 32 Articles. Science Direct and Other researchers might find different results if the search extended to include other sources. The findings indicated that TAM is still one of the most widely used adoption theory. Future work could extend the research in cloud computing to include other theoretical models such as UTAUT because only few studies have examined the adoption of cloud based learning using UTAUT.

RECOMMENDATIONS

Security and trust were among the most frequent factors in this study. Previous studies criticized TAM and UTAUT for not incorporating the security and trust in their conceptualizations. It is recommended for future work to include security and trust as factors that affect the adoption of cloud based learning. In addition factors such as IT knowledge is recommended to be incorporated due to the fact that the level of IT knowledge could play a key role in the acceptance and use of new technology. In this study, the DOI theory was incorporated into TOE in most of the studies. TAM and TOE were also integrated in one of the studies. Future research is recommended to integrate models such as UTAUT and TOE or UTAUT and DOI to better understand the factors that affect the cloud computing adoption. Students were the majority of the respondents of cloud computing adoption. This is because this study is focusing on the adoption of cloud based learning. However, others such as decision makers and IT professional received less attention (at least in this study), thus, future work is recommended to include decision makers in public sectors as respondents of their study.

Research regarding cloud computing in developing countries is still limited. It is recommended for future research to be conducted in developing countries that started the adoption of cloud computing such as African countries, Middle East countries and Asian countries. Sample size of some studies were relatively small at 30 or 60 respondents. Future works is recommended to enlarge the sample size to 300 responses to be able to use modern software such as Analysis of the Moment Structure (AMOS) and Partial Least Square (PLS).

Lastly, in this study, the factors that has less than three frequency were considered irrelevant because they are new factors and they are based on the conducted studies' context. As a result, this study has identified 19 factors as the most frequently used factors in cloud computing adoption. Security were the most frequent factors. For future researches, it is recommended that the adoption theories such as TAM and UTAUT incorporate the variables privacy, security and trust because they have been highly frequent and necessary for the adoption of technology.

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