



THE IMPACT OF PERCEPTION ON ACADEMIC STAFF INTENTION TO USE CLOUD COMPUTING IN MAKERERE UNIVERSITY BUSINESS SCHOOL

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Abstract: *The purpose of this study is to examine the impact of perception on academic staff intention to use cloud computing in the case of Makerere University Business School. The theoretical underpin of the study is the Technology Acceptance Model (TAM) modified to fit the context of analysis. Factors used for this study are: Perceived Security, Perceived Ease of Use, Perceived Usefulness, Perceived Cost of Use and Intention to Use. Questionnaires were administered to academic staff of different departments of Makerere University Business School. Exploratory Factor Analysis (EFA) was used to downsize data, and Confirmatory Factor Analysis (CFA) was used to determine fitness indices for the hypothesized model. Structural Equation Model (SEM) was used to assess the proposed model. Findings showed that Perceived Security, Perceived Ease of Use, Perceived Usefulness and Perceived Cost of Use have significant effects on the Intention to Use cloud computing. Results revealed that Perceived Ease of Use was the most significant determinant followed by Perceived Usefulness, and Perceived Security. Results further indicate negative correlation between Perceived Cost of Use and Intention to Use. Besides the various contributions, this research seizes various significant practical and theoretical implications for researchers, practitioners, policy makers, managers and technology consultants.*

Keywords: *TAM, Perceived Security, Perceived Ease of Use, Perceived Usefulness, Intention to Use and Cloud Computing.*

Introduction

Globally, the developments of new technologies are increasingly becoming part of people's life, and as such, such new advancements are being implemented to meet people's needs in profitable and flexible ways. Today's technologies have advanced so much that they offer large amounts of data with tremendous speeds, as well as huge storage capacities to cater for variety of operations (Changchit, 2014). This explains the essence of computer technology in our daily lives. Also, the need for cloud computing is becoming paramount in concluding both business and non-business operations (Kostanica, Youssef, & Zeqiri, 2017).

Cloud computing is an essential issue to study (Kostanica, Youssef, & Zeqiri, 2017, Changchit, 2014, Shiau & Chau, 2015), especially its presence in universities and its use by academic staff. To this effect, the purpose of this research is to

examine the impact of perception on academic staff intention to use cloud computing in Makerere University Business School. Cloud computing is characterized with many advantages; one of which is, low costs to use (Kostanica, Youssef, & Zeqiri, 2017). In addition to the advantage of cost-effectiveness of cloud computing, an important factor influencing the rapid adoption of this technology is the desire for the use of new applications in universities systems (Kostanica, Youssef, & Zeqiri, 2017). Usage of cloud computing can help academic staff to flexibly complete tasks, teach online lessons, supervise group projects, create and edit documents and presentations, as well as for work or entertainment.

In effect, considering the benefits of using cloud computing, it is interesting to examine how academic staff perception impacts intention to use this technology in Makerere University Business School. Therefore, this paper is aimed at examining

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the impact of academic staff perception on intention to use cloud computing in Makerere University Business School. The research model used in this paper is Technology Acceptance Model (TAM) (Davis, 1989). The two main factors of TAM are; perceived usefulness (PU) and perceived ease of use (PEOU). But, in this study the researcher also used these variables: Perceived Security (PS), Perceived Cost of Use (PCOU) and Academic Staff Intention to Use (ASIU) which is dependent variable in this study. This extended model will help to understand better the intention to use cloud computing services by academic staff in Makerere University Business School.

Research Problem

Considering the increasing role of academic staff acceptance of Information Systems and Information Technology, many scholars have used different research models to investigate users' acceptance of new technologies and systems (Arpaci, 2015, Yeboah-Boateng & Essandoh, 2014). Intention to use is quite important key indicator of success for organizations (Alzabi & Shah, 2015). In this regard, TAM has been mainly considered to understand user's acceptance behaviour. According to TAM as shown in Figure.1, two core parameters are stated: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) being significant determinants of individuals' behavioural intention to accept or reject any Information System (Davis, Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology, 1989). Perceived usefulness is defined as "the user's perception of the degree to which using the system will improve his or her performance in the work place" whereas, perceived ease of use is defined as "the user's perception of the amount of effort needed to use the system" (Venkatesh & Davis, 1996). Although several scholars have considered TAM due to its expediency, robustness, some believe that PU and PEOU which are core beliefs of TAM do not provide enough explanation of IS/IT users' intention to use, therefore additional variables in the model can enhance the power of prediction of TAM.

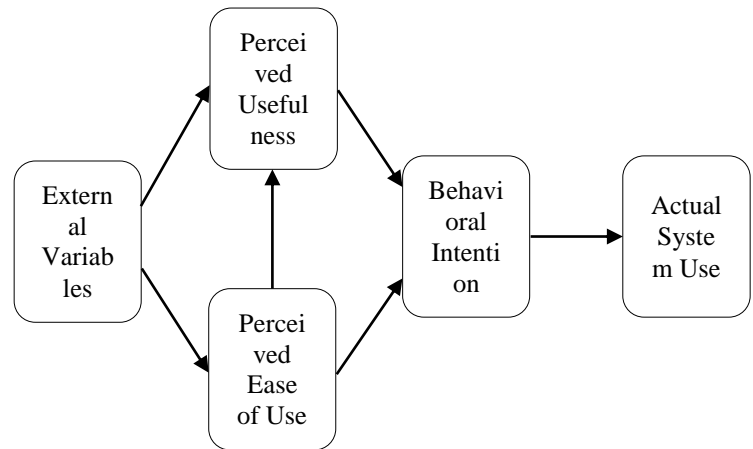


Fig 1. Final version of Technology Acceptance Model (TAM) (Venkatesh & Davis, 1996).

Theoretical Underpinnings

Various definitions of cloud computing can be found in the literature (Au, 2016, Sharma, 2013, Buyya, Yeo, Venugopal, Broberg, & Brandic, 2009), which may differ from one another, but in broader terms, they have the same meaning. Cloud computing is defined by National Institute of Standards and Technology (NIST), as convenient model for, on demand network access for computing resources including: networks, servers, storage, applications, and services (Mell & Grance, 2011). Cloud Computing can further be defined as a system that uses advanced technological developments to deliver a range of online services (Ratten, 2014).

Cloud computing consists of three interrelated services or delivery models. They include: firstly, Infrastructure as a service (IaaS); where the provider controls the hardware while, clients have control over the operating systems and applications that runs on the infrastructure, secondly, platform as a service (PaaS), where the provider manages the infrastructure and the Operating systems with the client deploying onto the cloud infrastructure, consumer-created or acquired applications created using programming languages and tools supported by the provider, and lastly, software as a service (SaaS) where the applications or software are stored by the provider and accessed from the network by the client who pay for the services consumed with the provider controlling the fundamental hardware, platform and the application (Mell & Grance, 2011).



Cloud computing applications have various advantages and disadvantages compare to other applications (Sharma, 2013). Although cloud computing is defined in diverse ways and is used in different perspectives, cloud computing enables users and developers to access services without the knowledge, expertise, or control over the supporting technology infrastructure.

In order to research if the services offered by cloud computing are adopted or not, the extended version of TAM will be used (Davis, 1989). The initial model developed by Davis is based on two factors that influence the intention to use technology: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). As (Taylor & Hunsinger, 2011) provided broader clarifications, the model is extended to include different factors influencing intention to use cloud computing. The extended model used for study includes the subsequent factors that are explained below: Perceived security and Perceived cost of use.

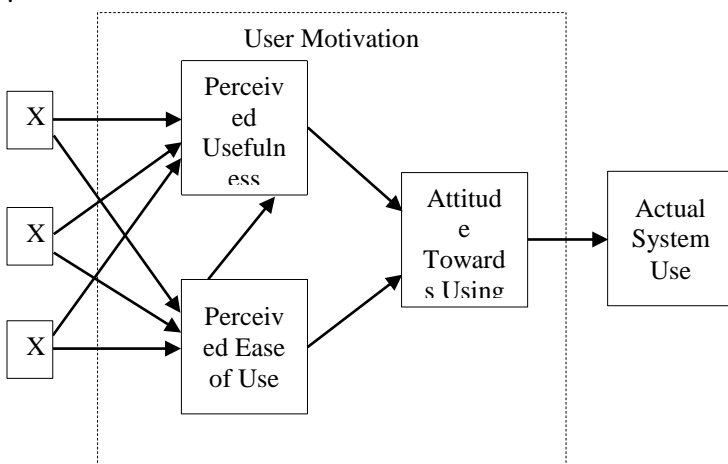


Fig. 1. Original Technology Acceptance Model (Davis, A technology acceptance model for empirically testing new end-user information systems: Theory and results, 1986)

With the significant theoretical and empirical support given to the emerging technologies, cloud computing has become quite attractive for studies. There is lack of research conducted for the intention to use by academic staff, as the main contributors to use of new technologies contrary to other aspects like; students' perception of cloud computing (Changchit, 2014), influencing factors for professionals' decision for cloud computing adoption (Mathur & Dhulla, 2014) and factors

influencing adoption of cloud computing by small and medium enterprises in developing economies (Yeboah-Boateng & Essandoh, 2014). Cloud is a convenient tool for academic staff performance, as teaching is no longer focused only in the classroom. Additionally, it is perceived as a promising prospect especially for educational institutions (Changchit, 2014), by allowing academic staff to have access to teaching resources anytime and everywhere with minimal cost (Mathur & Dhulla, 2014). Similar, institutions benefit from such reduced cost (Changchit, 2014). Therefore, the significance of cloud computing stretches far from only cost advantage to include: secure and enormous data storage capacity, processing power, accessibility and improve reliability (Gayathri & Srinivas, 2014).

Empirical evidence revealed that majority of studies concluded in this area are mainly focused on organizational adoption of cloud-based technology with insignificant attention on individual usage (Li & Chang, 2012). To this effect, this study is designed to focus on individual usage with specific attention on academic staff perspective.

Purpose of the Study

As most recent researches such as those concluded by (Stieninger, Nedbal, Wetzlinger, Wagner, & Erskine, 2017, Yeboah-Boateng & Essandoh, 2014, Harfoushi, Akhorshaideh, Aqqad, Al Janini, & Obiedat, 2016) are mainly focused on the organizational adoption. (Li & Chang, 2012) Indicate that little scholarly attention has been directed toward individual usage. To this effect, academic staff perspective is of interest to be studied. Therefore, the purpose of this study is to examine the impact of perception on academic staff intention to use cloud computing in Makerere University Business School. This study sought to answer the following questions: What is the relationship between perceived security and academic staff intention to use cloud computing technologies in public universities in Uganda?, how does perceived ease of use influence the academic staff intention to use cloud computing technologies in public universities in Uganda? and how does perceived usefulness influence the academic staff intention to use cloud computing technologies in public universities in Uganda?



Objectives of the Study

This study is guided by the following objectives: To assess the relationship between perceived security and academic staff intention to use cloud computing technologies in public universities in Uganda, to establish the relationship between perceived Ease of Use and academic staff intention to use cloud computing technologies in public universities in Uganda and to examine the relationship between Perceived Usefulness and academic staff intention to use cloud computing technologies in public universities in Uganda.

Significance & Contribution of the Study

The study will guide educational policy makers in designing policies that enhance the academic performance of academic staff and students in Makerere University Business School. The findings will help academic staff to conceptualize the aspects of technology-enhanced tools and realization of the potential of the use of cloud computing in teaching and learning contexts. The study contributes to the existing literature by aligning perception as a significant predictor of intention to use cloud computing by academic staff in Makerere University Business School an area that had been less considered.

Literature Review and Hypotheses formulation

Conceptual Framework

TAM has been widely applied to clarify intention to use of new Information System. However, the model has been thought to have some limitations such as being overemphasized in scholarly research and for being too straightforward (Rind et al., 2017). According to (Davis,1989), Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology can further be adapted. It is assumed that investigators can expand the predictive power of TAM by establishing new indicators that could affect its key variables to make it appropriate for elucidating specific technology adoption contexts. Therefore, in addition to core PU and PEOU, some other factors related to user characteristics and the nature of technologies/service or system may be added to enhance its explanatory power (Rind et al., 2017). In this study, TAM is used as baseline model while perceived security and perceived cost of use were added as supplementary independent variables. The research model posits that intention to use cloud computing is jointly determined by P_U, P_EOU, Perceived Cost of Use (P_COU),

and Perceived Security (P_Sec) as shown on the proposed model below.

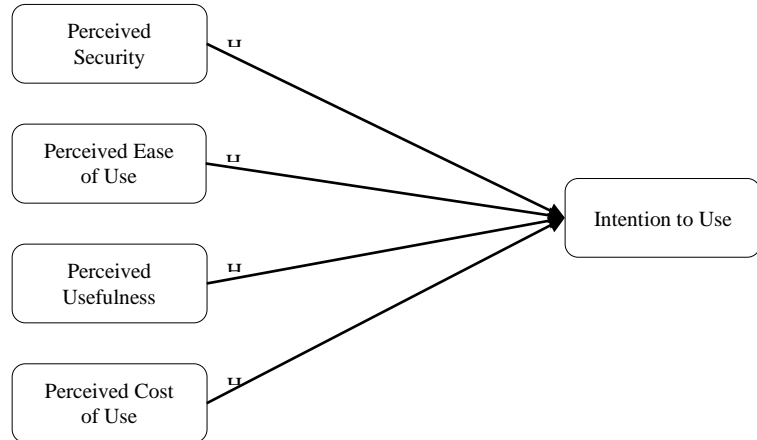


Fig. 2. Proposed research model

Perceived Security

Perceived Security (P_Sec) can be defined as the degree to which an academic staff believes that cloud computing is secure for storing and sharing data (Arpaci, 2015). Cloud computing service providers ensure that their core security goals are: reliability, confidentiality, non-repudiation, authentication and authorization and integrity. Reliability refers to ascertaining that there is reduced possibility of failure. Confidentiality refers to protection of data access by unauthorised individuals. Non-repudiation refers to ascertaining that all parties have non-deniable proof of receipt. Authentication and authorisation refers to ascertaining that there are reliable proofs of identities of all parties involved and that they are recognized and granted the desired rights and privileges. Integrity refers to protecting personal data from unauthorised modification, deletion or fabrication. In line with this discussion, the following hypothesis is formulated:

H₁: Perceived Security is positively related to the academic staff intention to use cloud computing.

Perceived Ease of Use

Perceived ease of use (P_EOU) can be defined as the extent to which a person believes that using a specific technological system would be free of effort (Davis, 1989). This construct is similar to the effort expectancy construct in the UTAUT. From cloud computing perspective and in line with this study, perceived ease of use relates to the academic staff perception



that using cloud computing services does not require additional effort. Several researchers found P_EOU as a direct considerable feature to affect intention to use a particular IS/IT system or services. Therefore it can be hypothesized as follows:

H₂: Perceived Ease of Use explains academic staff intention to use cloud computing.

Perceived Usefulness

Perceived usefulness (PU) is described as a person's level of assurance to assume that the use of a particular system or service would be useful (Davis, 1989). This is related to other constructs including performance expectancy as explained in the UTAUT model (Venkatesh & Davis, 1996) and relative advantage in IDT model (Rogers, 2003). The core features of cloud computing services such as data storage, data sharing and data synchronisation among devices enable academic staff to effectively manage their files and documents (Arapaci, 2015). Therefore, this study hypothesised that:

H₃: Perceived Usefulness significantly affects academic staff intention to use cloud computing.

Perceived Cost of Use

From a cloud computing perspective, perceived cost of use is the cost involved in using cloud computing services including storage costs, software costs, space costs, maintenance costs, application download costs and access costs (Rind et al., 2017). The cost of using cloud computing is a major concern for everyone. No matter how great cloud computing services could be, it will be perceived as useless if the associated cost factors are higher than the perceived benefits (Changchit, 2014). Therefore, it is hypothesised that:

H₄: Perceived Cost of Usage is related to the academic staff intention to use cloud computing.

Methodology and Justification

This research is conclusive case study design with specific interest in the case of MUBS. The philosophical underpinnings are objectivism ontology and positivism epistemology. Data are quantitatively analysed using Structural Equation Modeling (SEM) approach. Appropriate tests for parametric assumptions and model fitness parameters for Confirmatory Factor Analysis (CFA) and SEM were all observed. Data management was concluded using Exploratory Factor Analysis (EFA) and were further confirmed using CFA required for the analysis of SEM.

This study is aimed at examining the impact of perception on academic staff intention to use cloud computing in Makerere University Business School. The theoretical underpin is based on the Technology Acceptance Model which was modified and extended by two factors to fit the context of study. The focus is on academic staff for reasons, not only to close the empirical gap, but to emphasize increasing importance of technology in higher education systems. It is thus assumed that academic staff are more inclined to adopting new technology when compare to other groups. Data was primarily sourced using questionnaire-survey and was quantitatively analysed. The research instrument used was based on the existing literature and was modified to fit the context of the study.

The questionnaire was divided into two sections. The first section contained demographic questions, whereas the second section relates to questions about TAM constructs: Perceived Ease of Use (PEOU), Perceived Usefulness (PU) and further it contains the added factors Perceived Security (P_Sec) and Perceived Cost of Use (P_COU). Five-point Likert scale type questions were used to measure all items of the proposed model.

Analysis and Findings

Descriptive statistics

The purpose of this study is to examine the impact of perception on academic staff intention to use cloud computing in Makerere University Business School. Table 1 Represent demographic results of respondents such us: gender, age and employment status. The table also shows results of the level of knowledge regarding how computer storage works, internet access and computer ownership.

Table 1: Respondent Characteristics

Respondent Characteristics	Frequency	Percentage
Computer ownership		
Yes	98	98.0
No	2	2.0
Home Internet Access		
Yes	55	55.0
No	45	45.0
Work Internet		



Access		
Yes	90	90.0
No	10	10.0
Knowledge about how computer storage works		
Excellent	15	15.0
Very Good	20	20.0
Good	31	31.0
Fairly Good	21	21.0
Fair	11	11.0
Poor	2	2.0
Employment Status		
Full-time	91	91.0
No	9	9.0
Gender		
Male	69	69.0
Female	31	31.0
Age		
25 – 34	55	55.0
35 – 44	29	29.0
45 & Above	16	16.0

Pattern Matrix^a

	Component				
	1	2	3	4	5
PSEC2				.852	
PSEC3				.776	
PSEC4				.868	
PEOU1	.909				
PEOU2	.878				
PEOU4	.870				
PEOU5	.900				
PU1			.794		
PU2			.825		
PU3			.902		
PU4			.651		
PCOU3					.792
PCOU4					.814
PCOU5					.760
IU1		.870			
IU2		.860			
IU4		.850			
IU5		.924			

Extraction Method: Principal Component Analysis.

Rotation Method: Promax with Kaiser Normalization.

a. Rotation converged in 5 iterations.

Statistical results

The study employed Exploratory Factor Analysis (EFA) technique, Confirmatory Factor Analysis (CFA) and Structural Equation Model (SEM) analysis. SPSS software was used to analysis EFA whereas; AMOS software version 23 was used to conclude analyses for CFA and SEM. EFA was carried out to downsize data meanwhile, CFA was employed to indicate model fitness indices for the hypothesized model.

Exploratory Factor Analysis:

Standardized loading results indicated that factor items/indicators: PSEC1, PSEC5 related to Perceived Security construct; PEOU3 related to Perceive Ease of Use construct; PU5 related to Perceived Usefulness construct; PCOU1 and PCOU2 related to Perceived Cost of Use construct and; IU3 related to Intention to Use construct were found to have factor loading of less than the recommended value of 0.5 and were dropped from further analysis. As shown in Table 2, all factor loadings results found above the recommended value of 0.5 were retained.

Table 2: Exploratory Factor Analysis (EFA)

Confirmatory Factor Analysis and model fit indices

Structural equation modeling (SEM) was employed via maximum likelihood using SPSS AMOS (version 23.0) to test the research model. The model produced acceptable fit indices as shown in Fig. 1. The results of confirmatory factor analysis demonstrated that PSEC1 and PSEC5 related to Perceived Security (P_SEC), PEOU3 related to Perceived Ease of Use (P_EOU), PCOU1, PCOU2 and PCOU3 related to Perceived Cost of Use (P_COU), PU2, PU4 and PU5 related to Perceived Usefulness (P_U) and IU3 and IU5 related to Intention to Use (I_U) were dropped from the model to form an adequate measurement model.

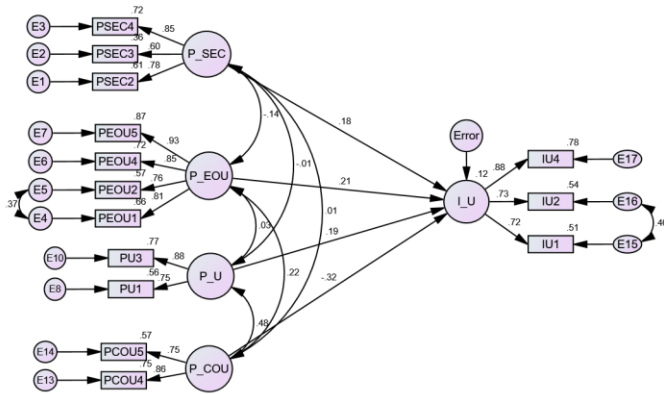


Table 4: Standardized Regression Weights: (Group number 1 - Default model)

Regression Paths	Estimate
I_U <--- P_SEC	.176
I_U <--- P_U	.185
I_U <--- P_COU	-.324
I_U <--- P_EOU	.212
PU1 <--- P_U	.747
PU3 <--- P_U	.878
PCOU4 <--- P_COU	.865
PCOU5 <--- P_COU	.754
IU4 <--- I_U	.884
IU2 <--- I_U	.732
IU1 <--- I_U	.717
PSEC2 <--- P_SEC	.783
PSEC3 <--- P_SEC	.597
PSEC4 <--- P_SEC	.850
PEOU1 <--- P_EOU	.815
PEOU2 <--- P_EOU	.757
PEOU4 <--- P_EOU	.847
PEOU5 <--- P_EOU	.933

Fig. 1: CFA model of the academic staff intention to use cloud computing.

Path Analysis – Multiple Regression

Table 3: Regression Weights: (Group number 1 - Default model)

Regression Paths	Estimate	S.E.	C.R.	P	Label
I_U <--- P_SEC	.177	.122	1.449	.147	par_3
I_U <--- P_U	.357	.280	1.274	.203	par_4
I_U <--- P_COU	-.349	.166	-2.106	.035	par_5
I_U <--- P_EOU	.288	.163	1.767	.077	par_6
PU1 <--- P_U	1.000				
PU3 <--- P_U	1.343	.311	4.318	***	par_2
PCOU4 <--- P_COU	.858	.078	10.940	***	pcou
PCOU5 <--- P_COU	.858	.078	10.940	***	pcou
IU4 <--- I_U	1.000				
IU2 <--- I_U	.611	.204	2.995	.003	par_7
IU1 <--- I_U	.629	.211	2.981	.003	par_8
PSEC2 <--- P_SEC	1.000				
PSEC3 <--- P_SEC	.677	.124	5.444	***	par_10
PSEC4 <--- P_SEC	1.100	.182	6.056	***	par_11
PEOU1 <--- P_EOU	1.000				
PEOU2 <--- P_EOU	.864	.082	10.561	***	par_12
PEOU4 <--- P_EOU	1.280	.131	9.808	***	par_13
PEOU5 <--- P_EOU	1.372	.129	10.627	***	par_14

* Significant at 10%; ** Significant at 5%; *** Significant at 1%

Standardized Regression Weights: (Group number 1 - Default model)

FIVE FACTOR CORRELATED ANALYSIS
CMIN/DF = 1.245, CHI SQUARE = 82.191, CFI = 0.975
SRMR = 0.59, GFI = 0.901, IFI = 0.976, TLI = 0.965
RMSEA = 0.50



Structural Equation Model and Hypothesis Testing

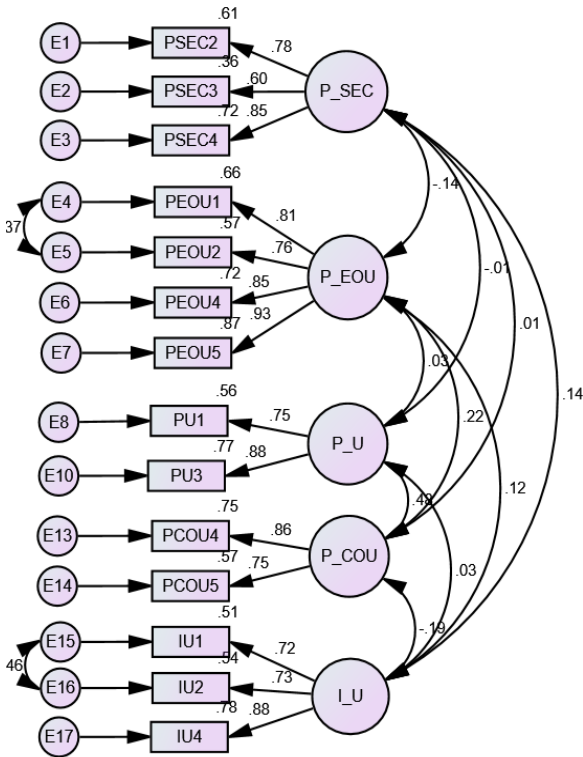


Fig. 2: Structural Equation Model of the academic staff intention to use cloud computing.

Hypothesis testing

Table 5: A summary of the hypothesis testing

Hypothesis	P-Value at 95% CI	Decision
H ₁	.14	Significant p ≤ 0.001
H ₂	.12	Significant p ≤ 0.001
H ₃	.03	Significant p ≤ 0.001
H ₄	-.19	Significant p ≤ 0.001

Discussions and Conclusion

According to results shown in Figure 2, P_Sec explains 14% of the variance in Intention to Use (dependent variable) and found to be the most significant determinant followed by P_EOU which explains 12%, P_U which explains 3%, and P_COU which explains -19%. These findings demonstrate that an

increase in P_Sec, P_EOU and P_U and decrease in P_COU (P_COU is a negative predictor) would increase academic staff intention to use cloud computing. The significant relationship between I_U and P_EOU supported the argument that perceived ease of use of the potential users have positive influence on the intention to use cloud computing. These results are consistent with the findings of original TAM in which P_EOU was found to have direct significant effect on the intention to use (Davis, Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology, 1989). These empirical findings suggest that academic staff intend to use cloud computing based on their beliefs established through the perception of its ease of use. Therefore, it can be predicted that cloud computing is more likely to be accepted on large scale in Makerere University Business School if its ease of use is realized by the academic staff. These results indicating the significant relationship between I_U and perception are in agreement with the empirical findings of many previous research studies (Kostanica, Youssef, & Zeqiri, 2017; Arpaci, 2016; Lai, 2016; Changchit, 2014; Venkatesh, Morris, Davis, & Davis, 2003; Rind M. M., et al., 2017) which also found that if users' concerns about cost of use increases the acceptance of new IS decreases, i.e. there is inverse proportion between cost of use and intention to use. Moreover, because of the unique nature of cloud computing (i.e., storage costs, maintenance costs), it is perceived as costly to use.

Results of this research fill in an important gap in literature by contributing the results of the determinants of individual's intention to use cloud computing in developing economies context, with a theoretical based empirical investigation. Consequently, the empirical validation of model posits that model is valid and can generally be applied to explore and achieve better results in similar contextual setting. In summary, results of this research provide important guidelines for cloud computing service providers, retailers, managers, technology consultants, software vendors, IS developers, investors and designers.

In conclusion, this research was aimed to examine the impact of perception on academic staff intention to use cloud computing in MUBS. The proposed research model was tested using 100 valid responses collected from MUBS. Research findings indicate that the ease of use, usefulness and security can lead to



an increase in the academic staff intention to use cloud computing. Therefore, the ease of use, usefulness and security should be taken into consideration when designing cloud computing systems in order to increase the academic staff intention to use. However, cost of use (i.e. storage costs, Cost in relation to software applications for a laptop/PC, Cost in relation to using open source or Internet applications, Cost reduction in relation to space used and Maintenance costs) negatively affect its acceptance among MUBS academic staff. Therefore, MUBS academic staff have prime concerns about the ease of use, usefulness, security and cost of use which jointly impact their intention to use cloud computing. Moreover, potential adopters of cloud computing are highly sensitive to cost factors. Which implies that, being an under developed economy, cloud computing users in MUBS have high concerns about its usage cost. Therefore, security, ease of use, usefulness and cost of use may be considered as barriers to large scale usage of cloud computing in MUBS.

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