



Cloud Computing Adoption in Higher Education Institutions of Kingdom of Saudi Arabia

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Abstract Cloud computing has technologically transformed the businesses worldwide. This computing platform offers diversified on-demand provisions for business sector to improve the business performance, lower development, procurement, implementation and maintenance cost. The main objective of the study is to improve the adoption of cloud computing in Higher Education Institutions of Saudi Arabia. This study will examine the literature to find the key factors that affect the adoption of cloud technologies in general and will instill some new variables and their relations. Which will bring in depth, more credible information for adoption of cloud computing. The results of this study will help business decision makers of education sector to ensure the successful adoption of cloud computing. Study will contribute the body of knowledge and will enrich the adoption status of cloud technology.

Keywords: *Cloud Computing, Average Variance, Technology Acceptance Model*

I. INTRODUCTION:

Cloud computing has recently achieved extensive acceptance worldwide and appreciation from information technology (IT) companies in business organizations. Cloud computing is an improved computing paradigm catering instant computing resources from a well-organized pool of resources. It also supports the payment plan known as Pay-as You-Go. Cloud customers can rent compute resources, like processing power, disk space, memory, network or even an application, as per the consumer's demand [1]. Cloud Computing Technology is defined as under:

“Model for enabling pervasive, 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” [2]

II. CLOUD COMPUTING:

In last around twenty years' time, cloud computing has been the key area for researchers and for individuals. Cloud computing is based on the cloud delivery, which consists of a front-end platform like *thick* and *thin* clients and mobile devices. It has also a back-end platform like servers and storage over a network i.e. Internet, Intranet, Inter-cloud [3]. Following are main cloud components:

- **Cloud Clients:** Cloud customers are computing devices that are utilized by clients to get to the resources utilizing the cloud computing facilities. Customers are additionally classified into three categories, THIN, and THICK kind of users [4]. Thin clients are without capacity drives sand users to show data by utilizing least equipment and lessen IT cost and expanded security, allowing communication with less power utilization [5].
- **Cloud Data Center:** A data center is a facility equipped with physical or virtual server computer and some other network components, like tele-com and storage systems that host cloud service applications [6].

III. CLOUD COMPUTING DEPLOYMENT MODELS:

Cloud deployment models have been providing efficient services to consumers as per their technical, business and operational requirements. Cloud computing grants four types of cloud applications for clients. Public, private, hybrid and community are the main models of cloud computing deployment [7]. These models are given below:

- **Private Cloud:** Private cloud is an alternative distributed paradigm for offering cloud services. It is fully dedicated for the business organizations and anonymous organizations cannot take part in the cloud architecture from inside or outside [8].
- **Community Cloud:** Community cloud in collaborative computing where infrastructure is shared among group of business organizations from a common perspective to serve and provide the security, compliance, jurisdiction, etc. Which is managed internally by the cloud provider or an outsourced cloud service and hosted locally or remotely [8].
- **Public Cloud:** It is a cloud service that shares computing services among different customers, even though each customer's data and applications running in the cloud remain hidden from other cloud customers [9].
- **Hybrid Cloud:** It is an arrangement of a private cloud setup and hosted locally in an organization data center and public cloud setup leased from one of the providers of public cloud accompanied by adaptation between the two setups [10].

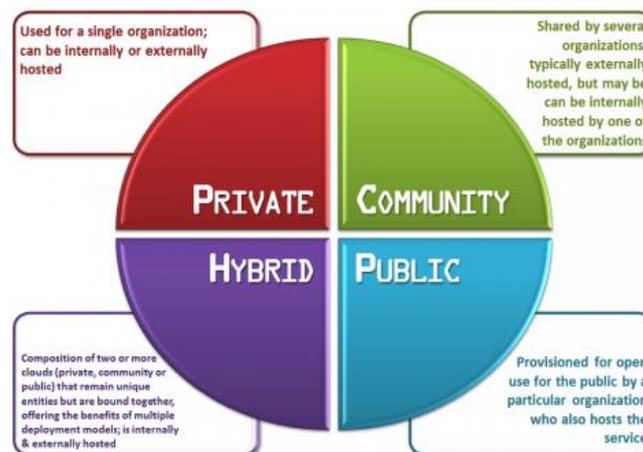


Figure 1: (<https://www.google.com>) Accessed on 12-05-2020

IV. RESEARCH PROBLEM:

Higher education sector has not adopted the best practices and capacities of cloud computing in Saudi Arabia. Cloud computing adoption still has not been realized and understood by the Saudi higher education sector. Literature review has pointed out that there is still narrow gap in adoption of newly introduced technologies in the higher education sector. There is a gap found in terms of developing trust in cloud technology, technicality concerns are also a big issue in adoption of the cloud technology. On the other side, technology readiness level and management support is a key concern in adoption of the technology in Saudi higher education institutions. The study will address this core issue and recommend some solutions for better deployment of cloud technology Saudi higher education institutions.

V. LITERATURE REVIEW:

Literature showed that the studies taken place in the recent times have studied only few aspects of the customer satisfaction and service quality in the telecommunication sector. Literature GAP has been identified in these studies in a comprehensive comparison, which studies the profitability of the concerned segments were not addressed particularly in higher education sector. The Technology Acceptance Model (TAM) is adopted for the current study, as it generally demonstrates that at what level computing technologies can be accepted and utilized in the modern and innovative technology based platforms. TAM addresses user's behaviors at deeper level, user's perception level and perceived ease of use of using the technology platform. It also caters the impacts of the convenience level in using the new technology or the platform. Following are the three basic constructs of TAM is adopted for the current study:

- **Behavioral Intention (BI):** Behavioral intention is key factor of the actual use of the proposed system and used to observe the user's intention towards adoption of the technology. Behavioral intention is considered as "the sole forecaster regarding the use of proposed technology" [12].
- **Perceived Usefulness (PU):** Perceived Usefulness is described by author of the TAM model "as the degree to which a person believes that using a particular system would enhance his or her job performance" [12].
- **Perceived Ease-of-Use (PEU):** Perceived Ease of Use is defined by author of TAM model "as the degree to which a person believes that using a particular system would be free from effort" [12].

VI. PROPOSED MODEL FOR THE STUDY:

Researcher has proposed a small conceptual study model for analyzing adoption of cloud computing in higher education institutions of Saudi Arabia. External variables have been constructed from the literature review to influence the perceived ease of use and perceived usefulness directly and indirectly. Following is the proposed model for the study:

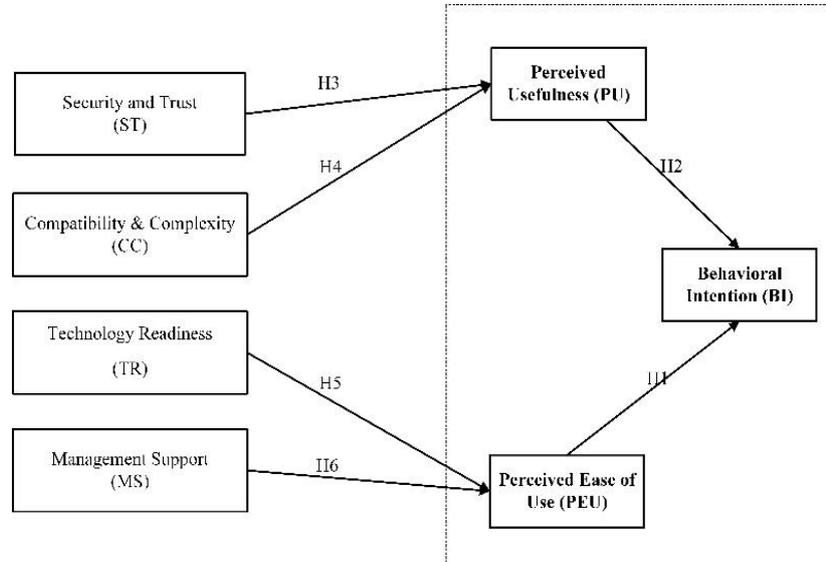


Figure 1: Proposed Model for Research Study

VII. HYPOTHESIS DEVELOPMENT:

Study hypotheses were developed in accordance with the findings of relevant literature used in adoption of technology to address the research problem. Following are the study hypotheses used as external variables:

- **Security & Trust:** This is based on evidences, subjective logic and is used to evaluate security breaches based on the historical data [13]. A framework for secure application execution is a modified hypervisor that secures the processor architecture, thereby making secure execution environment [14]. This ultimately develops the trust of the employee and employer in the cloud technology.
- **Compatibility & Complexity:** This is defined as “Cloud compatibility is the degree to which an innovation is perceived as being consistent with the existing values, needs and past experiences of potential adopters” [15]. Whereas, cloud complexity defined “as the degree to which an innovation is perceived as being difficult to use” [16].
- **Technology Readiness:** This is known as using similar type of IT skills, IT infrastructures and IT policy in business organizations [16]. Another researcher pointed out that technological readiness reflects different technological aspects and top management support reflects organizational dimension and lastly regulatory support explained the environment factors [17].
- **Management Support:** It is an important requirement for the successful adoption of cloud computing technology. It can provide a long-term strategic vision, initiative, support and a commitment to create a positive environment for innovation. Management support plays crucial role for the given of the substantial of amount needed in adoption of cloud technology [17].

VIII. DATA ANALYSIS AND INTERPRETATION:

Data analysis and interpretation is generally defined as descriptive statistics to understand the nature of the respondents and analyze the respective frequencies. It also relates to the proposed model analysis for the research study. Finally, an analysis of the moderator/mediator variables is performed. For the current study following analysis are performed:

- **Convergent Validity:** Convergent validity is mostly used to measure the theoretical relation of the model construct's. It also includes the discriminant validity, which is subtype of construct validity. According to Churchill (1979), "a fundamental principle in science is that any particular construct or trait should be measurable by at least two, and preferably more, different methods [18]. Hence, convergent validity refers to the extent to which a measure correlates highly with other alternative measures of the same construct in terms of performance [18]. To establish convergent validity in the present study, the Average Variance Extracted (AVE) of each construct was examined using criterium recommended by Fornell and Larcker (1981). Methodologically, convergent validity is demonstrated if the AVE of each construct is 0.50 or more as shown in table 4 that AVE value for each latent construct exhibited high loadings (>0.50), suggesting that adequate convergent validity is proved in the statistical test for the current study.

First Order	Items	Loadings	AVE	CR	Cronbach's α
Behavioral Intention (BI)	BI1	0.7583	0.5046	0.7532	0.5138
	BI2	0.7662			
Perceived Usefulness (PU)	PU1	0.7101	0.5401	0.8732	0.8541
	PU2	0.7201			
Perceived Eases of Use (PEU)	PEU1	0.7223	0.5743	0.8542	0.8432
	PEU2	0.7341			
Security and Trust (ST)	ST1	0.7223	0.5401	0.8732	0.8541
	ST2	0.7341			
Compatibility & Complexity (CC)	CC1	0.7223	0.5401	0.8732	0.8541
	CC2	0.7341			
Technology Readiness (TR)	TR1	0.7223	0.5401	0.8732	0.8541
	TR2	0.7341			
Management Support (MS)	MS1	0.7223	0.5401	0.8732	0.8541
	MS2	0.7341			

Table 1: Composite Reliability Coefficient

- **Discriminant Validity:** Discriminant validity is the access study measurements, which are not supposed to be related or otherwise to test the correlations that the items on the two tests are discriminate, as state by Campbell Fiske (1959). To establish discriminant validity in this study, Fornell and Larcker's (1981) criterion was implemented by paralleling the correlations amongst the study constructs with square roots of average variance assessed and showed in table below. Furthermore, a thumb rule for establishing discriminant validity, Fornell and Larcker (1981) suggested that the AVE square root should surpass the correlations between the study constructs [20].

STUDY ITEMS	BI	PU	PEU	ST	CC	TR	MS
Behavioral Intention (BI)	0.82						
Perceived Usefulness (PU)	0.23	0.77					
Perceived Eases of Use (PEU)	0.35	0.26	0.75				

Security and Trust (ST)	0.22	-0.01	0.16	0.74			
Compatibility & Complexity (CC)	-0.07	0.39	0.16	0.28	0.79		
Technology Readiness (TR)	0.17	-0.06	0.08	0.21	0.03	0.82	
Management Support (MS)	0.09	0.17	-0.09	0.31	0.09	0.31	0.84

Table 2: Discriminant Validity Analysis

IX. CONCLUSION:

Study has focused and analyzed the general to technical perceptions about adoption of cloud computing in the higher education institutions of Saudi Arabia. Literature review showed detail and diverse views of different interpretations. Literature review has proven that there is inconsistency in adoption of cloud computing technology in different hypothetical perceptions, research complications, variables and measurement tools. On the basis of this evidence current study only focused on the research gap identified and collected data from higher education students, faculty and general staff. Study results have proven that study has contributed to the body of knowledge and helped the business decision makers to enhance the adoption of cloud technology. Study will also help and guide the future research prospect to further extend for better identification, understanding and to contribute the other business facets in terms of adoption of cloud computing.

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