

QUALITY OF SERVICE ACCEPTANCE MODEL FOR CLOUD SERVICE IN  
PALESTINIAN HIGHER EDUCATION INSTITUTIONS

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## **DEDICATION**

This thesis dedicated to my beloved mother Nada, who taught me any ambition can be accomplished if it is done step by step, also dedicated to my father Husam, who has always been there for me and provide all the guidance and support I needed throughout my life. I also dedicate this thesis to my wife Sawsan, who has been supported me during difficult times, my children's Husam, Seraj and Aram for their patience on my absence from them, without forgetting my brothers and sisters who have been prayers for me.

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## ABSTRACT

Cloud computing service has been found to be effective in increasing the capacity of Higher Education Institutions (HEIs) since it delivers services through enhanced information technology capabilities. Quality of Service (QoS) in cloud service is considered a rapidly growing phenomenon to guarantee a high level of service and is identified as an essential aspect of service provision. Despite the importance of QoS, identifying the QoS acceptance factors by decision-makers for cloud based services in HEIs in Palestine has been a critical challenge. There are limited studies conducted on QoS acceptance factors from Technological, Organizational, Environmental and Human aspects, hence, this study addressed this gap and investigated potential factors influencing QoS acceptance by decision makers in the context of HEIs in Palestine. This study proposed a research model by combining Technological Organizational Environmental (TOE) framework and Human Organizational Technology (HOT) fit framework. The research model was developed through the factors identified through a comprehensive literature review. Seventeen hypotheses were developed and the significance of the relationship between the factors were investigated using a quantitative approach. A survey method using a paper-based questionnaire was employed to collect data from 267 decision makers in the target higher education institutions. The data were analysed using Structural Equation Modelling (SEM) with Partial Least Squares (PLS) technique. The finding used to develop the QoS acceptance model facilitated the understanding of factors impacting QoS acceptance by the HEIs in Palestine. The results that indicated the most significant factors for QoS acceptance by HEIs in Palestine were Availability ( $\beta= 0.046$ , p-value = 0.002), Compatibility ( $\beta= 0.043$ , p-value= 0.001), Security Concern ( $\beta= 0.037$ , p-value= 0.006), and Relative Advantage ( $\beta= 0.046$ , p-value= 0.001), Vendor Support ( $\beta= 0.037$ , p-value= 0.025), Legal Issues ( $\beta= 0.068$ , p-value= 0.027) and Competitive Pressure ( $\beta= 0.064$ , p-value= 0.028). The results of this study and the proposed model would assist the practitioners in HEIs to better understand the importance of QoS acceptance in cloud service.

## ABSTRAK

Servis pengkomputeran awan didapati berkesan dalam meningkatkan kapasiti Institusi Pengajian Tinggi (IPT) kerana ia dapat memberikan perkhidmatan melalui keupayaan teknologi maklumat yang dipertingkatkan. Kualiti Perkhidmatan (KP) dalam servis awan dianggap sebagai fenomena yang berkembang pesat untuk menjamin tahap perkhidmatan yang tinggi dan dikenal pasti sebagai aspek penting dalam penyediaan perkhidmatan. Walaupun pentingnya KP, mengenal pasti faktor penerimaan KP oleh pembuat keputusan untuk perkhidmatan berasaskan awan di IPT Palestin telah menjadi cabaran kritikal. Terdapat kajian terhadap yang dilakukan terhadap faktor penerimaan KP dari aspek Teknologi, Organisasi, Alam Sekitar dan Manusia. Oleh itu, kajian ini akan menegenal pasi jurang dan mengkaji faktor-faktor yang berpotensi mempengaruhi penerimaan KP oleh pembuat keputusan dalam konteks IPT di Palestin. Kajian ini mencadangkan model kajian berdasarkan gabungan kerangka kerja Teknologi Organisasi Persekitaran (TOE) dan rangka kerja Teknologi Organisasi Manusia (HOT). Model kajian dibangunkan melalui faktor-faktor yang dikenal pasti melalui tinjauan literatur yang komprehensif. Tujuh belas hipotesis dibangunkan dan hubungan yang signifikan antara faktor-faktor yang dikaji menggunakan pendekatan kuantitatif. Kaedah tinjauan menggunakan soal selidik berdasarkan kertas digunakan untuk mengumpul data dari 267 pembuat keputusan dari institusi Pendidikan tinggi yang disasarkan. Data dianalisis menggunakan Model Persamaan Struktur Kuasa dua Terkecil Separa (PLS-SEM). Dapatan yang digunakan untuk membangunkan model penerimaan KP memudahkan pemahaman terhadap faktor-faktor yang mempengaruhi penerimaan KP oleh IPT di Palestin. Hasil analisis menunjukkan bahawa faktor yang paling signifikan untuk penerimaan KP oleh IPT di Palestin adalah Ketersediaan ( $\beta= 0.046$ , nilai  $p= 0.002$ ), Keserasian ( $\beta= 0.043$ , nilai  $p= 0.001$ ), Keprihatinan Keselamatan ( $\beta= 0.037$ , nilai  $p= 0.006$ ), dan Kelebihan Relatif ( $\beta= 0.046$ , nilai  $p= 0.001$ ), Sokongan Vendor ( $\beta= 0.037$ , nilai  $p= 0.025$ ), Isu Undang-Undang ( $\beta= 0.068$ , nilai  $p= 0.027$ ) dan Tekanan Kompetitif ( $\beta= 0.046$ , nilai  $p= 0.028$ ). Hasil kajian ini dan model yang dicadangkan akan dapat membantu para pengamal di IPT Palestin untuk lebih memahami pentingnya penerimaan KP dalam servis awan.

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## LIST OF ABBREVIATIONS

AVE	-	Average Variance Extracted
CRDO	-	Chief of Research and Development Officer
CIO	-	Chief Information Officer
CR	-	Composite Reliability
CA	-	Cronbach's Alpha
CEO	-	Chief Executive Officer
CTO	-	Chief Technology Officer
DOI	-	Diffusion on Innovation
HEI	-	Higher Education Institution
HOT	-	Human-Organization- Technology
HR	-	Human Resources
IS	-	Information System
IT	-	Information Technology
ICT	-	Information and Communication Technology
MOHE	-	Ministry of Higher Education
MTIT	-	Ministry of Telecommunication and Information Technology
PLS	-	Partial Least Square
PITA	-	Palestinian Information Technology Association
QoS	-	Quality of Service
TOE	-	Technology-Organization-Environment
TAM	-	Technology Acceptance Model
UTAUT	-	Unified Theory of Acceptance and Use of Technology
PCBS	-	Palestinian Central of Bureau Statistics
SEM	-	Structural Equation Modelling

## LIST OF SYMBOLS

$\alpha$	-	Cronbach Alpha
$\lambda$	-	Standardized Factor
$\delta$	-	Error Variance
$n$	-	Number of items
$\sigma_x^2$	-	The variance of the observed total test scores
$\lambda_i$	-	The loading of $x_i$ on $X$ , Var denotes variance
$\varepsilon_i$	-	The measurement error of $x_i$
$f^2$	-	Effect size
$R^2$	-	Coefficient of Determination
$\beta$	-	Path Coefficient



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# CHAPTER 1

## INTRODUCTION

### 1.1 Overview

Higher Education Institutions (HEIs) have been identified by researchers as the primary pillars of change in communities, due to their associations with government and industry (Drăgan *et al.*, 2014; Lazowska *et al.*, 2008). HEIs are increasingly moving from traditional learning to e-learning. Accordingly, HEIs requires the implementation of cloud service which is found to reduce costs, improve effectiveness, enhance the efficiency of learning, and facilitate knowledge-exchange among staff and students (Ercan, 2010; Prasad and Rao, 2014). However, for effective use of service, the decision-makers must be well-prepared for right-time decision, appropriate decisions, novel developments, and high willingness to respond to new technologies.

The imperative for the implementation of HEIs computing services depends on having decision-makers who have not only the knowledge and experience to find the best solutions to improve organizational performance, but also the motivation to respond to priorities on the way in which their institutions operate. It is therefore essential that decision-makers become more aware of the benefits of cloud service by catalyzing the management process and boosting performance and saving time, costs and effort. This requires two important steps. First step is identifying the barriers for the acceptance of QoS for cloud service at Palestinian HEIs. The second step is distinguishing between the significant factors and non-significant ones in deciding to accept such services by HEIs. This study seeks to develop a QoS acceptance model for HEIs and to identify the factors that influence this acceptance.

## 1.2 Research Background

The American National Institute of Standards and Technology define cloud service as "a model for enabling ubiquitous, convenient, on-demand network. The computing scene is increasingly evolving to build software to be used as a service by millions users instead of applications running on different personal computers (Sasikala, 2013). HEIs has made it possible to use cloud service for different purposes (Puthal *et al.*, 2015) and in more effective and faster ways (Malathi, 2011; Puthal *et al.*, 2015), which allows users to utilize services in effective computing infrastructure and storage capacity (Shawish and Salama, 2014). Cloud service is particularly crucial for education. Education promotes social equality, national solidarity, and economic improvements and make it possible for equal educational opportunities for all people (Noor *et al.*, 2013). An advanced educational system is therefore vital to create a workforce capable of supporting a nation's economic growth. Nowadays, cloud service broadly helps to achieve this aim. In particular, HEIs will help advance communities by introducing this technology (Blueprint, 2015). It is found that HEIs usually delay implementing any newly-introduced model of information technology. This indicates that there will be some time to introduce new models and this approach remains unchanged with respect to the use of technical resources for the learning process (Persico *et al.*, 2014). However, this delay is not required for cloud service, as it can be adapted easily (Haenisch, 2012; Shakeabubakor *et al.*, 2015).

Cloud service can also help the entire learning process (Alharthi *et al.*, 2015; Rizzardini and Amado, 2012; Rizzardini *et al.*, 2012). In Internet-based learning frameworks that use cloud service, adaptability, flexibility, and change are particularly important (Persico *et al.*, 2014). When HEIs choose to implement cloud service, they can use that service to expand their technical infrastructure with the least possible costs and the highest possible security standards (Masud *et al.*, 2012). Cloud service also allows HEIs to easily access processing resources such as networks, storage, application, servers, and services. Therefore, the development of their own IT infrastructure is important (Chao, 2011; González-Martínez *et al.*, 2015), as well as connectivity, virtualization, and new environments (Malathi, 2011; Singh and Chana, 2015).

Cloud service provides vital IT tools and solutions for companies with such capabilities (Rizzardini *et al.*, 2012) as well as virtual platforms to help customers access the service from various locations at any time and minimum costs (Avram, 2014). One advantage of this is the affordance of moving software, services, and information from on-premises servers to the web, which improves performance, increases security and makes information more readily available (Manvi and Shyam, 2014; Shakeabubakor *et al.*, 2015). Cloud service, in turn, is more likely to enhance services (Manvi and Shyam, 2014) and ensure the quality of service delivery (Abdelmaboud *et al.*, 2015).

This issue of QoS has been one of the important challenges for researchers world-wide. According to (Akpan and Vadhanam, 2015), QoS implies "the levels of performance, reliability, and availability offered by an application and by the platform or infrastructure that hosts it." The concept also involves the general experience of applications over a network (Toney and Kale, 2014), both the server-side and the customer side (Chen *et al.*, 2014). While the server-side deals mostly with capacity and infrastructure, the customer side is concerned with the reaction time, throughput, and probabilities of failure. For customers and providers, QoS is primarily essential. Cloud users expect the service to deliver predictable quality features (Wang *et al.*, 2014). On the other hand, cloud service providers need to balance the operating costs and the QoS appropriately (Ardagna *et al.*, 2014). Meanwhile, the QoS for education should be more prominent than it would be for regular services (Wang *et al.*, 2014). As a matter of fact, when choosing a cloud computing service, the first concern for HEIs decision-makers is ensuring the quality of the service in terms of performance, availability, reliability, and infrastructure compatibility and service provider support (Persico *et al.*, 2014; Rajput and Deora, 2017; Suradi *et al.*, 2018).

### **1.3 Rationale**

Education institutions worldwide intend to invest in cloud service to enhance services and attract more students (Mtebe and Raisamo, 2014). Utilizing cloud computing services will successfully help HEIs in Palestine avoid technology

obstacles to providing quality educations (Almunawar *et al.*, 2015; Masud *et al.*, 2012). It is found that Palestinian HEIs need high processing capacities, storage, and high availability education system (Barham, 2014a; Barham, 2014b; Kihara and Gichoya, 2014; Rygielski and Kounev, 2013). HEIs decision-makers should include mindful assessments concerning whether, where, and how they can utilize cloud computing services (Seke, 2015; Smith *et al.*, 2014). It has shown that regarding the initial stage of utilizing cloud service, decision-makers in Palestinian HEIs still face vulnerabilities in security and privacy (Ghosh *et al.*, 2015; Mokhtar *et al.*, 2016) and vendor lock-ins (Alharthi *et al.*, 2015; Mokhtar *et al.*, 2016). In addition, HEIs have very few means with which to evaluate which suppliers offer high QoS (Lansing *et al.*, 2013; Sabi *et al.*, 2016) and are trustworthy (Sunyaev and Schneider, 2013).

Furthermore, HEIs in Palestine are confronted with challenges in building trust in cloud providers and it is demonstrated that QoS guarantees will help to accept the process (Alshuwaier *et al.*, 2012; Shakeabubakor *et al.*, 2015). In addition, the challenges include political conflicts, the commodisation of IT products, absence of QoS policy and government interest, and development of ICT tools (AlMabhouh and Alzaza, 2015; Sajid and Raza, 2013). Decisionmakers of HEIs in Palestine may also hesitate to exploit cloud service, as the processed and developed information is outside their institutions' control (Sajid and Raza, 2013). A few authors (e.g., (Almabhouh, 2015; Alshamaila *et al.*, 2013) contend that the vast majority of the security protection issues concerning cloud service arise due to an absence of control over the physical infrastructure. In other words, HEI decision-makers are careful who monitor and control the cloud-based service center and data. Additionally, there are some other issues with HEI which are the lack of human capital (Sabi *et al.*, 2016), IT personnel experience, skills influence QoS (Sultana *et al.*, 2017), training requirements (Sabi *et al.*, 2016; Sultana *et al.*, 2017), technical illiteracy, absence of internet access (Mokhtar *et al.*, 2016), lack of service commitment (Adrees *et al.*, 2016; Akin *et al.*, 2014; Smith *et al.*, 2014), and loss of control over cloud service data and applications (Alharthi *et al.*, 2015; Almabhouh, 2015; Sabi *et al.*, 2016).

There is an additional barrier to QoS acceptance, including possible loss of service control in developing countries, particularly in Palestine (Alharthi *et al.*, 2015;

AlMabhouh and Alzaza, 2015). Besides, security challenges remain regarding information and applications, and legitimate issues exist regarding contracts outside a country (Akin *et al.*, 2014; Odeh *et al.*, 2017; Sultana *et al.*, 2017). Moreover, Internet speed and infrastructure can likewise influence the QoS (Akin *et al.*, 2014; Chibaro, 2015). The reputation of the cloud service supplier and the utilization of regular information configurations are more imperative than some monetary issues, such as cost reductions or pricing of cloud computing services (Chibaro, 2015; Moreno-Vozmediano *et al.*, 2013). Since cloud suppliers need to consider the tradeoffs between QoS and operational costs (Ardagna *et al.*, 2014) to provide affirmation that a supplier offers cloud computing services with a high QoS (AlMabhouh and Alzaza, 2015; Manuel, 2015). Additionally, cloud service clients should be able to trust in the services being provided in terms of, for instance, accessibility, support, and training (Akin *et al.*, 2014; Almunawar *et al.*, 2015; Manuel, 2015). Besides, it has had new difficulties in QoS related to technology and exogenous factors (Ardagna *et al.*, 2014; Khwaldeh *et al.*, 2017; Mokhtar *et al.*, 2016). While there are many examples of implementing cloud service in HEIs, but there is a limitation in the utilization of cloud service due to QoS weakness of related technological and organizational factors.

Osaily (2013) summarized QoS problems in Palestinian HEIs in an example of Al-Quds Open University cloud service. One of the challenges was how to improve the infrastructure to meet cloud service requirements and QoS acceptance. Besides, training needs to be provided to cloud application clients to enhance QoS acceptance and experience in the evaluation process of QoS (AlMabhouh and Alzaza, 2015; Sabi *et al.*, 2016). It also increases the level of mindfulness protection from change (Qureshi *et al.*, 2012). In addition, Palestinian HEIs are sometimes unable to use cloud service as there is limited accessibility and reliability in cloud services in Palestine (AlMabhouh and Alzaza, 2015; Barham, 2014a; Barham, 2014b). Despite the widespread cloud service technologies around the world, the final decision to accept and implement such services has yet to be reached by Palestinian HEIs. While some Palestinian HEIs have already implemented this technology, some endogenous, as well as exogenous factors, still pose real challenges to adequate adoption. The present research is an effort to both identify such challenges and, at the same time proposing solutions to address them.

#### **1.4 Problem Statement**

Quality of Service (QoS) is identified as an integration of several qualities or variables of the services, for instance, availability, security, cost reduction, data control, trust and external environment. Therefore, it is important to know how HEIs can solve the issues and challenges in gaining QoS by utilization of cloud service. According to the literature review, there is a lack of prior studies to assess QoS acceptance variables of utilizing cloud service in Palestinian HEIs. Furthermore, there is a lack of previous studies using theories and models to comprehensively understand the QoS acceptance challenges and to identify variables of cloud service in education context, particularly in Palestinian HEIs. It is found that understanding the barriers and challenges that influence QoS acceptance of utilizing cloud service in Palestinian HEIs is an important stage of successful implementation of cloud service in HEIs.

The utilization of cloud service has triggered questions about QoS by decision-makers in HEIs. To date, HEIs have yet to explore effective ways to better understand and clarify QoS acceptance factors to use cloud service. In addition, QoS factors for better implementation of cloud service in HEIs are often affected by various internal and external challenges. Despite the imperative of such technologies and their global reach, they are still in their nascent stages in Palestine and there is little research on discovering QoS of these technologies by Palestinian HEIs. A comprehensive study is therefore required to identify the determinants and challenges in education, particularly in Palestinian HEIs, for the acceptance of QoS in cloud service. This research aims to address this gap in the literature by developing a QoS acceptance model for cloud service, to enable adequate examination of the most important factors influencing the acceptance of QoS by decision-makers within Palestinian HEIs.

#### **1.5 Research Question**

The research questions are defined based on the main research question as follows:

How can Palestinian Higher Education Institutions (HEIs) accept the Quality of Service of cloud Service?

Consequently, three sub-questions to address the main research question are defined as follows:

- i. What are the factors that can influence the HEIs QoS acceptance of cloud service?
- ii. What is the relationship between the various factors involved in the HEIs QoS acceptance of cloud service?
- iii. How can QoS acceptance model for cloud service be developed for Palestinian HEIs?

## **1.6 Research Objectives**

The research objectives are defined based on the problem statement and the research questions as follows:

- i. To identify the factors influencing the HEIs QoS acceptance of cloud service.
- ii. To examine the relationships between various factors involved in the HEIs QoS acceptance of cloud service.
- iii. To develop and validate a QoS acceptance model of cloud service in Palestinian HEIs.

## **1.7 Research Scope**

Based on the research questions and objectives, the scope of this research is covers Palestinian HEIs (private and public), specifically those that can utilize cloud service in their core processes. In addition, the HEIs are selected that have already decided to use cloud service. From these institutions, the focus is mainly on decision-makers with different areas of expertise to use cloud service in the core processes of



HEI due to different infrastructures. The focus of this research is on QoS acceptance factors of cloud service by HEIs.

### **1.8 Research Aim**

The aim of this research is to develop a QoS acceptance model in which QoS variables are identified and the appropriate acceptable factors are examined by decision-makers of QoS in HEIs. This research also investigates the most influence factors on the QoS acceptance in Palestinian higher education institutions and examine the relationship between these factors by developing a QoS acceptance model to understand the impact of technological, organizational, and environmental factors on the decision-makers' attitude toward utilization of cloud service in HEIs. This developed QoS model can help and guide the decision-makers to effectively utilize cloud services in HEIs.

### **1.9 Research Significance**

This research allows researchers to understand the construct of the Technology-Organizational-Environment (TOE) framework integrated with the Human-Technological-Organization (HOT) framework to be used to design of the QoS Acceptance model which aims to enhance QoS in HEIs. Additionally, this research uses the proposed model which includes several important factors in technological, human, organizational, and environmental aspects to reveal their impact on the acceptance of QoS. Moreover, this research investigates how QoS can be accepted by Palestinian HEIs to improve the quality of services by cloud service in educational sectors.

It supports decision-makers to develop strategic plans that integrate cloud service for quality assurance. Furthermore, it contributes to professional practice and knowledge-exchange within Palestinian HEIs. Besides, it is essential for HEIs that are considering integrating the cloud service within their operations to use the proposed model for a better understanding of cloud service QoS. As well, the cloud service QoS acceptance model supports HEI policymakers to enhance cloud service use,

particularly in the policy design. In sum, increases the level of QoS acceptance by decision-makers in HEIs.

## **1.10 Thesis Structure**

This thesis is organized and presented in six chapters, which are closely related and complementary to each other.

Chapter 1 presents the research background, the research problem, the research objectives, the significance of research, the rationale, and the structure of this study.

Chapter 2 includes the literature reviews on HEIs, conceptual studies, importance of cloud service in HEIs, concept of cloud service, QoS aspects and its acceptance by HEIs, progresses in cloud service, and components of cloud service. In addition, this chapter provides the factors for the proposed model.

Chapter 3 presents the research design and approach, as well as the research methodologies that are relevant to this study. Besides, this chapter details the operational framework, data collection procedure and explain the pilot study.

Chapter 4 introduces improvements to the proposed model based on the literature review and particularly the current literature on QoS acceptance of cloud service. The integration of the TOE framework with HOT was explained. This chapter also completely discusses the hypotheses of the study.

Chapter 5 presents the primary analysis used for developing and testing the proposed model through the Structural Equation Model (SEM) technique in the SmartPLS 3.0 software.

Chapter 6 discusses the conclusion of the findings and provides the contributions, and recommendation for future work.

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