

# Critical Success Factors For Adoption Of Cloud Computing In Jordanian Healthcare Organizations

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**Abstract**—Cloud Computing (CC) is currently attracting the attention of healthcare organizations to solve and facilitate some of the barriers to e-health. However, in Jordan's healthcare organizations, there is a lack of empirical research that adopts Cloud Computing. This research seeks to comprehend several factors that affect Jordanian healthcare organizations' adoption of CC. Based on the context of the technology, organization, and the environment factors (TOE), this study examined the adoption of CC in Jordanian health organizations. This study used the quantitative approach and carried out a survey among healthcare organizations in Jordan. Surveys were completed by participants working in Jordan's healthcare organizations. He showed that the TOE variables have been statistically important and could have an impact on CC adoption. The overall findings this examination have demonstrated that CC offers numerous advantages for Jordanian healthcare organizations, for example, cost reduction, reducing the information gap in healthcare, and spreading a culture of collaboration among healthcare facilities. However, Cloud Computing services are still ineffective spread for Jordanian researchers.

**Index Terms**— Cloud Computing, healthcare organizations, TOE framework

## 1 INTRODUCTION

Jordan has one of the latest healthcare infrastructures in the Middle East [1]. Healthcare services face some problems in Jordan, as well as the increasing cost of medical services and; therefore, difficulties in managing information when integrating individuals and organizations [2]. Consequently, several healthcare organizations have implemented information and communication technologies (ICTs), including electronic health activities, in their frameworks to provide higher levels of patient awareness, increase efficacy and effectively use their financial capital. Nevertheless, the growth of e-health is facing several challenges that seem to be holding back its implementation [3]. The greatest of these barriers are legal and regulatory issues such as confidentiality, licensing and redemption rules, and medical care problems that arise due to technology limitations [3]. Despite these obstacles, the Jordanian healthcare organizations have made an ability to execute and grow their e-health services. This gives the premise to utilize new technologies and models that can advance them, for example, the presentation of (CC). CC is a miracle in the arena of ICT, which is increasingly attracting the attention of healthcare organizations to overcome some e-health barriers. CC is defined as storing data on remote networks, rather than on local servers. CC provides a tactical strategy for delivering healthcare services, reduces the cost of information technology (IT), and provides computing services based on demand [4]. [5] reported that the basic architecture of CC is separated into two main parts; Front End (FE) and Back End (BE) (see Figure 1). The FE is part of the user. It consists of interfaces and applications that are important for getting various other applications. The BE internally connected via the Internet. For example, Internet browsers are an interface. The BE is the cloud itself, which includes an enormous data warehouse, safety, models of deployment, service, servers, cloud infrastructure and management (Figure. 1). Future

information systems will rely on CC technologies; this is since it can decrease the charge of IT services while improving quality and adaptability [6]. The CC enables communication at any time and place which is continuously available to share information from one platform to another. It creates a prospect for information portability within various medical devices existing in health organizations with another medical device deployed at other health organizations. CC infrastructure enables extracting the various databases of treatment, patients and diseases that can be easily accessible to doctors to perform investigation and to understand statistical outcomes. The system provides access which is connected with a database server. This required a lot of information, data, and computing controlling the healthcare field. This technology provides patient historical data at the time of treatment. This technology enables clinicians to provide comprehensive patient health information for complete and accurate treatment. CC helps healthcare providers to solve many of their current problems and provides timely and effective health care.

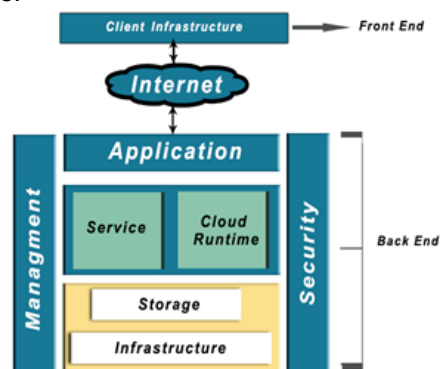


Figure 1. Cloud computing architecture

The CC in healthcare is an innovative solution that provides cost-effective solutions to patients and clients associated with the healthcare industry [7]. Healthcare suppliers using CC and cloud services give many advantages over their client-server schemes, including financial, operational, and functional benefits, according to the [8]. CC's economic

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advantages can be important as CC offers cost flexibility and cost reduction capability. High capital costs can be prevented as IT resources are obtained on demand and paid as operating expenses as necessary. Besides, CC's cost includes the costs of staff resources needed to deploy and maintain IT resources. Cloud services give the scalability and the capacity to adapt rapidly to demand from an operational point of perspective. Cloud services provide better security and privacy for medical data and healthcare systems. Using contemporary physical and technical techniques implemented and backed by skilled employees, data centers for cloud service suppliers usually have a high degree of safety and reliable protection from external and internal threats. Cloud services, including data encryption and login, provide sophisticated security controls. Cloud-based healthcare systems can provide data access to the Internet, thereby avoiding the need to store client device information. Healthcare-based services use standard protocols, so when communicating with other systems and applications is usually simple. The CC literature focuses on technology adoption in developed countries [9]. Few studies include empirical studies conducted to study the CC adoption in the Jordanian context at the organizational level. There are very few studies examining the impact of CC on the Jordanian healthcare organizations [10, 2, 11]. A study by [11] emphasized that the implementation of CC in several wide company industries, particularly in Jordanian healthcare organizations, still needs to be analyzed to better comprehend some of the variables influencing the implementation of CC in Jordanian healthcare organizations. [2] explored several variables affecting hospitals' desire to embrace CC in Jordan. The research disclosed that in the choice to embrace CC in hospitals in Jordan, the TOE variables suggested by the framework played a part. Furthermore, [10] explored factors influencing the implementation of embedded cloud-based e-health documents based on the TOE structure in Jordanian healthcare organizations. The research was performed at a healthcare organization in Jordan by conducting interviews with IT professionals. According to the [10], "cloud is new in Jordan, and vague for many, the level of awareness of decision-makers in the insurance sector about the advantages of CC is still weak. I think they will be not convinced about this trend". According to [12], Cloud Computing offers a number of benefits for healthcare organizations as follows (see Figure 2):

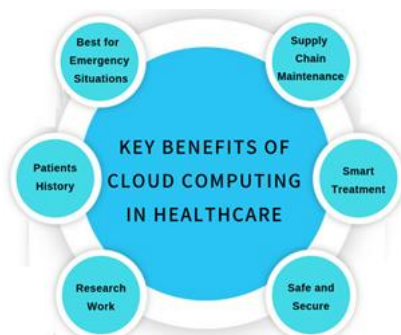


Figure 2. Key benefits of cloud computing in healthcare organizations

- **Best for Emergency Situations:** where emergency services are required, and specialist doctors could not get there. CC in healthcare technology can transmit

information through the cloud to service personnel and give them orders on how to treat injured or sick people.

- **To Achieve Perfection:** In large hospitals, they store a good amount of data that needs to be processed well, so that new doctors or practitioners can learn from the same and can apply an already proven theory without wasting time.
- **Safe and Secure:** Healthcare services face death and life every day. They cannot afford to skip any data or its misuse.
- **Research:** Doctors and healthcare providers do a lot of research on their work so that they can get better every day and store the most important information about operations and treatment. Based on the stored information, they can well research different things and can serve as an example for future doctors.
- **Supply Chain Maintenance:** Supply chain service: data on medical equipment, medicines, and pills is huge and needs good management. At the time of storage, the data should contain all columns, such as - expiration date, purchase date, purchase, etc. This data can be stored in the cloud and can be extracted if necessary.
- **Patients History:** Most patients lose their medical records and medical history, but it's crucial for medical institutions to keep their records safe and accessible. CC in the medical field can solve this problem by storing patient records in a central space, from where they can be easily found at any given time.
- **Smart Treatment:** The Healthcare cloud system is developing and playing an important role in providing intelligent treatment on the table. Thus, whenever a patient enters a hospital, doctors can feed his condition in the cloud healthcare system and can receive the ideal treatment process in the shortest possible time, which is also verified and tested [13].

Although CC has a great potential for use at healthcare organizations compared to developed countries, CC in the healthcare organizations in Jordan is still in its infancy. The objective of this study is to understand the factors that affect the adoption of CC at Jordanian healthcare organizations.

## 2 RESEARCH MODEL AND HYPOTHESES

As [14] demonstrate, technology adoption is influenced by factors that can be recognized through the setting of technology, organization, and the environment factors (TOE). Technological setting makes reference to how organizations choose the decision to receive technology dependent on the innovation's openness and how it suits with the organization's present technology; organizational setting examines the characteristics of the organization such as its structure, the nature of human resources or the degree to which the decision to select technology is influenced by its size; environmental setting alludes to the organization part that may incorporate factors, for example, its area, competitive pressure and public laws. A number of examinations have used the TOE structure to investigate the adoption of technology. Depending on the nature of CC technology, the significant adoption issues are safety and privacy [15, 16, 17] in particular at healthcare organizations [18, 19]. For this reason, safety and privacy are included in the technology dimension as one of the major key factors.

Moreover, prior surveys have also shown that the complexity and compatibility of IS [20, 21, 22, 23, 24, 25, 26, 27, 28, 29] will be affect IT adoption decision positively [30, 31, 32, 24, 25, 22, 33, 34, 35, 36]. On the other hand, a number of examinations have also shown that top management support [37, 38, 27] and technological readiness [18, 19] will have a positive impact on the adoption of IT [39]. Organizational factors Have been seen as variables such as technological readiness and support for top leadership [18, 15]. The third point of view in this study is the point of view of (should be removed) the environment in which two variables are used. They facilitate conditions [40, 41, 42] and environmental uncertainty [32, 43, 29]. For a technology adoption project, the facilitate conditions necessary and environmental uncertainty for technology adoption must be taken into account [39]. Figure 3 below illustrates the proposed model of the factors that affect the adoption of CC in healthcare organizations in Jordan. The following hypotheses were created to evaluate based on the goals and research model.

*The first hypothesis (H1) states that the technological factor will have a positive impact on the intention to adopt CC in Jordanian healthcare organizations.*

*The first hypothesis (H2) stated that organizational factor will have a positive impact on the intention to adopt CC in Jordanian healthcare organizations.*

*The first hypothesis (H3) stated that environmental factor will have a positive impact on the intention to adopt CC in Jordanian healthcare organizations.*

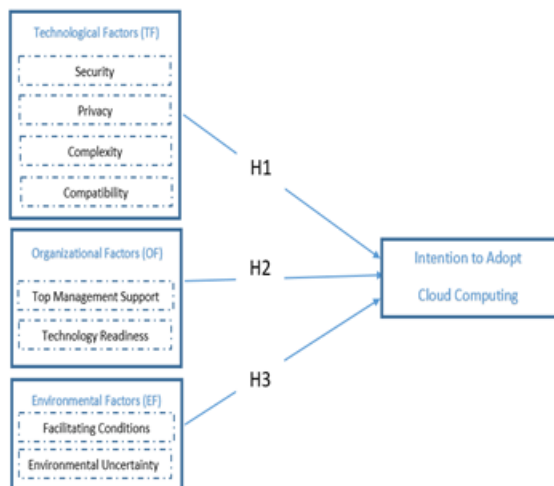


Figure 3. Hypothesis research model

### 3 MATERIALS AND METHODS

A quantitative method was used to assess the effect of technological, organizational and environmental variables that could influence the Jordanian healthcare organizations' objective of implementing CC in CC. Using a self-administered questionnaire, data was gathered. This technique is intended to assist healthcare organizations

better comprehend the effect on their decision of adopting and deploying a CC model from these three variables. This study has been researched in 25 health organizations in Jordan, and IT decision-makers and executives have financed 250 questionnaires. The factors affecting the CC choice are evaluated by 8 variables; technological factor containing 4 items; compatibility, complexity, safety, and privacy. Additionally, the organizational factor containing 2 items; support for top leadership and readiness for technology. Finally, the environmental factor contains 2 items; facilitate conditions and environmental uncertainty.

## 4 DATA ANALYSIS AND RESEARCH RESULTS

### 4.1 Respondent's Profile and Background Information

According to the demographic data and other personal information, 64.4% of the 250 respondents were females. Most of the respondents (74.8%) were over 30 years old, and (25.2%) - 22-30 years. The largest educational group had a bachelor's degree (80%). Most of the respondents 72% used CC for more than 8 years, and 28% used CC for 4-8 years. The survey showed that 100% of participants use a mobile phone Internet link. Finally, at Jordanian healthcare organizations, the amount of participants presently using CC is 15.2%. Consequently, the adoption of CC at the Jordanian medical organizations is in its infancy. Table 1 below presents the demographic statistics.

TABLE 1  
DEMOGRAPHICS STATISTIC

Respondents' Profile	Classification	Frequency	Percentage
Gender	Female	161	64.4
	Male	89	35.6
Age	22-30	63	25.2
	Above 23	187	74.8
Education	Diploma	18	7.2
	Bachelor	200	80.0
	Master	32	12.8
Period in Using CC	More than 8 years	180	72.0
	4-8 years	70	28.0
	Smart Phone	95	59.4
Using Internet Connection Via Mobile	Yes	250	100.0
	No	0	0.0
Using CC in Jordanian healthcare organizations	Yes	38	15.2
	No	212	84.8

### 4.2 Analysis Validity and Reliability

The reliability of the internal consistency and validity of the structure using SPSS was assessed by calculating the main axis factoring with Varimax rotations and the alpha coefficients of Cronbach between 0.811 and 0.891 as shown in Table 2. [32] stated that according to reliability analysis, the weakest Cronbach Alpha value is less than 0.6. All the components measured in this research have accomplished internal consistency reliability and a valid instrument to form the study.

TABLE 2  
RELIABILITY STATISTICS FOR INDEPENDENT AND DEPENDENT  
VARIABLE

Variables	Mean	Cronbach's Alpha	No of Item
Technological Factor (TF)	3.712	.872	4
Organizational Factor (OF)	3.582	.911	4
Environmental Factor (EF)	3.329	.816	4
Intention to Adopt CC (IACC)	3.426	.895	4

#### 4.3 Hypothesis Testing

"Pearson product-moment correlation provides a numerical summary of the direction and the strength of the linear relationship between two variables" [32]. We can conclude that all the hypothesized relationships have been endorsed based on the outcomes described in Table 3.

TABLE 3  
PEARSON CORRELATION MATRIX

Model	IACC	TF	OF	EF
TF	.467			
OF	.565	.446		
EF	.511	.487	.532	

#### 4.4 Factors Affecting the Adoption of Cloud Computing

Regression analysis was used to check the connection in CC acceptance between TOE factors. The regression model included the TOE factors as independent variables and the adoption of CC as a dependent variable. Based on the regression in Table 4, the R Square (R<sup>2</sup>) coefficient = 0.432 shows that all autonomous factors represent 43.2% of the CC adoption variance.

TABLE 4  
REGRESSION ANALYSIS RESULTS

Variables	Beta	Sig.
Technological Factor (TF)	.322	.004
Organizational Factor (OF)	.211	.017
Environmental Factor (EF)	.304	.005
R Square (R <sup>2</sup> )		43.2 %
F-value	11.211 Sig. (000)	
Best Predictor: Technological Factor (TF)	Beta. 301 Sig. (.000)	

#### 5. DISCUSSION

This study's empirical information convincingly confirms the theoretical model proposed. As hypothesized, TOE variables were significant variables that determined the Jordanian healthcare organizations' implementation of CC. The technological factor had a beneficial influence on CC's intention to adopt. The value of the coefficient of correlation of the controlled connection between the two variables was 0.467 (average correlation) at a substantial  $p < 0.01$  stage. This outcome is compatible with other research, such as [18, 44, 19]. The comparative benefit of implementing cloud computing in healthcare organizations can improve business communications velocity, business-to-business coordination efficiency, client communication, and engagement access to market data. The organizational factor had a beneficial effect on CC's intention to embrace.

At a substantial point  $p < 0.01$ , the correlation coefficient of the tested connection between the two factors was 0.565 (big correlation). In other research like [45, 46], this outcome is valid. The implementation of fresh techniques clearly needs the assistance of top management because they have more resources and can take better risks, larger businesses that are more likely to adopt CC. The environmental factor influenced the desire to embrace CC positively. The price of the tested relationship correlation coefficient between the two factors was 0.511 (big correlation) with a substantial rate of  $p < 0.01$ . This discovering is reliable with different examinations like [45, 2, 47]. The model generally stated 43.2 percent of the intention to adopt CC, but 56.8 percent of the deviations are still not covered by this theoretical basis. Contrasted to other research in developed countries, the discoveries of earlier research in Jordan were confined.

#### 6. CONCLUSION

This research aimed to understand some of the variables affecting the TOE framework-based implementation of CC in Jordanian healthcare organizations. The effects of this examination have indicated that TOE factors are interconnected and have an important repercussion on the Jordanian healthcare organizations' implementation of CC. In this research, TOE factors were recognized as key variables. The research findings would benefit healthcare organizations in developing CC adoption policies. The examination model can help healthcare organizations obviously understand how and why they decide to adopt CC services. Besides, organizations can likewise survey the unpredictability of the service and how it very well may be applied to their frameworks and how it tends to be executed. As a basis for future studies, this study can be used. Further research in the context of Jordanian healthcare organizations is also required to summarize study results. Additional research should also be conducted using quantitative and qualitative techniques to understand the factors that influence the adoption of CC by Jordanian health organizations.

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