

# Develop a New Model for Measure Influence Factors on Adoption Cloud Computing in Governmental Institutions (Case study of the Jordanian Ministry of Interior)

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## **Abstract**

This research aimed at developing a new model for measure the influence factors of adopting cloud computing in governmental institutions. In order to achieve these objectives the researchers developed a new model and questionnaire consisted of four dimensions (technological, organizational, environmental and public), the sample of the study was randomly selected, consisted of (278) employees work in the Jordanian Ministry of Interior, the study used Goggle drive to distributed the questionnaire, and retrieved (262) questionnaires valid for statistical analysis. The results of the study showed that the developed model is suitable for measure the influence factors of adopting cloud computing in the Jordanian Ministry of Interior, there are both encouraging and opposing factors to adopting cloud computing, and all of the developed model factors (technological, organizational, environmental and public) have significant effect on adopting cloud computing in the Jordanian Ministry of Interior. In light of the study results have been suggested a set of recommendations, including: the necessity of alerting the Jordanian Ministry of Interior to cloud computing and activating it, in order to achieve maximum benefit from this technology.

**Category:** Smart and intelligent computing, Convergence computing.

**Keywords:** Cloud Computing; governmental institutions; influence factors.

## **I. INTRODUCTION**

In light of the digital revolution, and the rapid growth in information and knowledge data, and with the successive developments of the web and the Internet, many software manufacturers have tended to make their information resources available for use in what is known as cloud computing technology. Cloud computing adopts the principle of renting information resources instead of purchasing applications and servers, where computing provides access to these applications without the need to provide them on the user's device, which helps the organization to reduce investment in the information infrastructure and convert investment expenses into operating expenses or expenses related to the core of its core activity (Khaled, 2016).

According to Budņiks & Didenko (2014), the past few years have seen an increase in IT services in various business sectors in the world. Cloud computing has emerged as the best solution to cope with this ever-increasing IT services. Cloud computing defined as a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.

Gupta, Seetharaman & Raj (2013) pointed out that the massive growth in the volume of data and information limits the ability of institutions, whether governmental or private, to manage these data and information and control them effectively, because the high cost of storing data, reviewing it, and preparing backups contributed to the emergence of problems that institutions face in developing information technologies used, in addition to the cost of new hardware and software.

From this standpoint, the use of modern information technologies has become an urgent necessity, such as cloud computing technology, which represents the best solution to these problems, as cloud computing contributes to helping employees access applications from any place and time, through devices connected to the Internet, in addition to accessing database applications and social networks, through a variety of computers or mobile devices (Li, Min, Yang & Wei, 2010).

Besides, cloud computing is the main direction in the entire world today, as it is considered a real trend that will change the form of the software and information technology industry in the world, and then all sectors will change, whether governmental or private, in addition to that cloud computing will become a way of life in the

future like the internet, due to its ability to store large amounts of data in one cloud and return it on demand, which contributes to helping organizations reduce the cost of information technologies and technology tools used (Hsu, Ray & Li-Hsieh, 2014).

The adoption of the government's strategy of cloud computing has great economic and development returns, which has become evident in both developing and developed countries, where the process of using cloud computing includes various benefits such as low cost and high organizational flexibility, and this is what made all governments worldwide interested in cloud computing strategies. Whether by developing cloud services or recommending and motivating organizations to implement them (Jabi, 2015).

Despite the importance of cloud computing and the need to apply it in government and private institutions, it is not considered a ready-to-use recipe, but rather requires unconventional material and human capabilities, requiring appropriate preparation for its multiple constituents, in addition to the existence of organizational support that depends on the senior management's conviction of the need to shift towards modern environments for administrative work. From here, the idea of the study crystallized in identifying the factors that affect the adoption of cloud computing in government institutions.

## **II. PROBLEM STATEMENT**

The rapid development in network technology has led many institutions to make their applications available for use through the internet in what is known as cloud computing, as this technology has allowed its users better features, such as saving costs, and providing services to the largest sector of beneficiaries, and there is a growing awareness that one day, cloud computing will come the main tool that will be relied upon in corporate and corporate management (Mvelase, Dlamini, Sithole & Dlodlo, 2013)

Many studies (Lian, 2015; Low, Chen & Wu, 2011; Lin & Chen, 2012) indicated the importance of using cloud computing application for any institutions seek to develop their performance and deployment of electronic services, where the cloud computing model, considered as the most attractive model for government institutions that lack money, especially in developing countries such as Jordan, which is trying to expand quickly in the deployment of electronic services more transparent and compatible to meet the increasing number of citizens who are aware of information and communication technology.

Besides that, it is important to consider adopting the cloud computing model as an appropriate solution to meet the growing demand for e-services in Jordan. The cloud computing model is the right solution to reduce costs, especially in government institutions whose work necessitates using electronic services in a big way, such as Jordanian Ministry of Interior is one of the ministries in Jordan which is witnessing a continuous increase in the demand for electronic services.

Since the Jordanian Ministry of Interior is primarily a service organization, providing services and relief to citizens, and by virtue of the large responsibilities assigned to it, as well as the many administrative procedures and permanent contact with the public, it was natural for this government institution to adopt the introduction of modern technology from unified entry system path, however, modern technology has not been utilized, especially with regard to the introduction of computing technology as hoped. Kuiper, Van Dam, Reiter & Janssen (2014) has indicated that shifting the provision of government services from the traditional to the modern electronic method is a challenge as for some government institutions, because it is based on procedures and mechanisms that are completely different from the procedures used in traditional methods, so knowing the role of modern electronic technologies such as cloud computing to raise the level of performance and efficiency helps to provide the conviction of the higher authorities to move towards the application of these technologies, and work to provide the requirements and financial capabilities necessary to ensure their success.

Although there are many previous studies (Phaphoom, Wang, Samuel, Helmer & Abrahamsson, 2015; Pollyviou & Pouloudi, 2015; Stieninger, Nedbal, Wetzlinger, Wagner & Erskine, 2014) that dealt with the subject of cloud computing, but most of these studies relied on two models (the technology acceptance model (TAM) and the technology-organizational-environmental model (TOE)) in most cases to explain the process of adopting cloud computing and the factors affecting it, whether in private or government institutions. This indicates that there is an urgent need to develop a new model that takes into account the characteristics and requirements of government institutions, which differ significantly from private institutions, whether in the style of management or its goals.

Therefore, this research explores the factors influencing the adoption of cloud computing in the Jordanian Ministry of Interior, in order to identify factors that encourage the use of cloud computing and factors that may hinder the application of cloud computing.

### **A. Research Questions**

This research seeks to answer the following questions:

1. What is the appropriate model for measuring factors affecting the adoption of cloud computing in the Jordanian Ministry of Interior?
2. What are factors that encourage adoption of cloud computing model in Jordanian Ministry of Interior?
3. What are factors that impede adoption of cloud computing model in Jordanian Ministry of Interior?

### ***B. Research Objectives***

This research aimed to achieve the following objectives:

1. To develop a new model capable of measuring the factors affecting the adoption of cloud computing in government institutions
2. To determine the factors that encourages adoption of cloud computing model in Jordanian Ministry of Interior.
3. To identify the factors that encourages adoption of cloud computing model in Jordanian Ministry of Interior.

### ***C. Research Hypothesis***

H1: Technological factors have significant effect on adopting cloud computing in in Jordanian Ministry of Interior.

H2: Organizational factors have significant effect on adopting cloud computing in in Jordanian Ministry of Interior.

H3: Environmental factors have significant effect on adopting cloud computing in in Jordanian Ministry of Interior.

H4: Public factors have significant effect on adopting cloud computing in in Jordanian Ministry of Interior.

## **III. EMPRICAL REVIEW**

Hiran & Henten (2020) conducted a study aimed to explore the main and sub-factors that linked to the adopting of cloud computing by providing an integrated framework consisting of two theories Technology–Organization–Environment (TOE) and Diffusion of Innovation (DoI), in the Ethiopian Higher Education (EHE) sector. The study used a questionnaire with four main factors (technological, organizational, environmental and socio-cultural) and eight sub-factors (relative advantage, compatibility, organization readiness, top management support, competitive pressure, government regulation, socio-economics and politics), the results of the study pointed out that four factors considered as influence factors for adopting cloud computing in the Ethiopian Higher Education (EHE) sector.

Sandu & Gide (2018) conducted a study to analyze the factors affecting the cloud-based services adoption in Indian small and medium enterprises (SMEs), the study rely on Technological, Organizational and Environmental (TOE) factors. Factors analyzed included top management support, technology readiness and regulatory support, global scope, firm size and competitive pressure. The results of the study indicated that environmental factors have a significant impact on the adoption of cloud services more than organizational and

technological factors. Also, the study results disagree with the results of the previous studies, where this study pointed out that, there's no relationship between technological and organizational factors in SME in order to adopt cloud services.

Al-Shura et al. (2018) explored the factors affecting the adoption of cloud computing in pharmaceutical manufacturing companies in Jordan, based on the technological organizational and environmental (TOE) framework. The study tested eight important success factors for the adoption of cloud computing in pharmaceutical manufacturing companies, namely Complexity, compatibility, relative advantage, top management support, firm size, technical readiness, competitive pressure, and trading partner pressure. The study concluded that the technological factors are the most influential in the adoption of cloud computing, followed by environmental factors and finally organizational factors. The study presented basic and important results of the strategy of adopting cloud computing in manufacturing companies in Jordan in terms of the reason and how to choose cloud services.

Odeh et al. (2017) conducted a study to understanding of related factors affecting the adoption of cloud computing in the educational context of developing countries, in order to determine the main enablers and barriers; the field study was conducted at higher education institutions in Jordan. The study collected the perspectives of both academic and technical and found that academic experts and technical professionals strongly recommended the adoption of cloud computing in educational institutions in developing countries. Also, the results indicated that the main enablers are: cost-effectiveness, compatibility, easy to use, centralization, management support and knowledge sharing. While barriers are: security, privacy, the resistance of new technology, compatibility with in-house and lack of management awareness.

Rababah et al. (2017) conducted a study aimed to examine the influence factors on the student's intention to use cloud computing in the Jordanian universities. In order to achieve this objective, the study used a questionnaire to collect the data from (400) information technology students in four Jordanian universities, the study results pointed out that there are five factors impact the student's intention to use cloud computing, including perceived usefulness, perceived ease of use, perceived security, perceived speed of access, and perceived cost of usage. Besides that, the results indicated that the developed model explains 50.4% of the variance in the students' intention to use cloud computing.

Scholten (2016) conducted a study to determine the main factors that encourage and prevent institutions from adopting cloud computing in the Netherlands; the study depends on three main factors (technological, organizational and environmental) including sub-factors such as (actual use, intention to use, ease of use, social system, attributes of innovations, knowledge and decision). The study reviewed sixteen positive and negative drivers for adopting Cloud Computing as follows: perceived security, quality of supplier, costs, payment model, flexibility & scalability, triability, type of software, perceived adopter style, firm size, top management support, regulatory compliance, partner's pressure, competitive pressure, peer pressure, expert opinions and way of the future, which were collected from literature research, interviews and surveys in this study. The study used a questionnaire distributed among IT-managers, the results showed that the chosen model is suitable as influence factors of adopting cloud computing, and the most critical factor among the model factors is the organizational context.

McKinnie (2016) conducted a study aimed to provide a holistic model consist of all cloud service layers for cloud adoption in firms; the study analyzed the six influence factors (expected benefits, technology competence, security concerns, organizational innovativeness, trust, and competitive pressure) on organizational cloud adoption through using data from 150 questionnaires from U.S. manufacturing firms. The results of the study showed that there is a negative relationship between organizational innovativeness and cloud computing adoption, which mean that organizational innovativeness considers as a crucial factor to cloud computing adoption. Besides that, the results indicated other factors that influence cloud adopting including trust and technical competency, technical and trust.

## IV. METHODOLOGY

### A. Research Method

This study relied on the descriptive analytical method, by referring to theoretical literature related to the subject of the current study, in addition to developing a questionnaire as a major tool to collect data from the study sample.

### B. Proposed Model

Through a review of previous studies related to the topic of Cloud Computing adoption, can be observed that many factors affect the process of Cloud Computing accreditation in all institutions, as these factors fall under three main field: technological, organizational, and environmental.

The factors that were mentioned in the previous studies were limited and amounted to (107) factors (see appendix A), and the researcher studied all factors and the extent of their impact on the adoption of cloud computing, or hindered the process of adopting the cloud computing, and after scrutiny and study the researcher reached to the most (15) influencing factor in cloud computing.

Besides, through the work of the researcher as an employee in the Information Technology Department in Karak Governorate / Ministry of Interior, found that there are a set of factors that affect the adoption of any new technology in government institutions in particular, as these factors relate to the nature of administrative and organizational work within the government institutions.

Also, the researcher added a new field (the public) to the original model, which includes three fields (the technological field, the environmental field, and the organizational field), where the researcher developed the original model and improved it in a way that is compatible with public government institutions. Five factors have been added to the public field that were added to the original form, thus the number of factors becomes (20) factor.

The original form Technological-Organizational-Environmental (T-O-E) has been developed to become Technological – Organizational -Environmental - Public (T-O-E-P) for the following reasons:

1. The nature of the work environment in government institutions, which differs significantly from private institutions, whether in the way of management or the hierarchy of the institution.
2. The set of regulations and laws governing the operation of public government institutions differs significantly from private institutions.
3. The public institution has an administrative function, while the private institution has its economic, commercial or industrial activities.
4. The goal of the public institution is to provide a public service or interest (it is a public utility), while the private institution has its primary goal of making a profit.
5. Legal regulation: The provisions and rules of administrative law regulate the work of the public institution, while the rules of private law (civil and commercial) regulate the work of the private institution.
6. Judicial jurisdiction: The administrative judiciary is concerned with examining and adjudicating cases and disputes of the public institution, whereas, the ordinary judiciary specializes in private institution disputes.

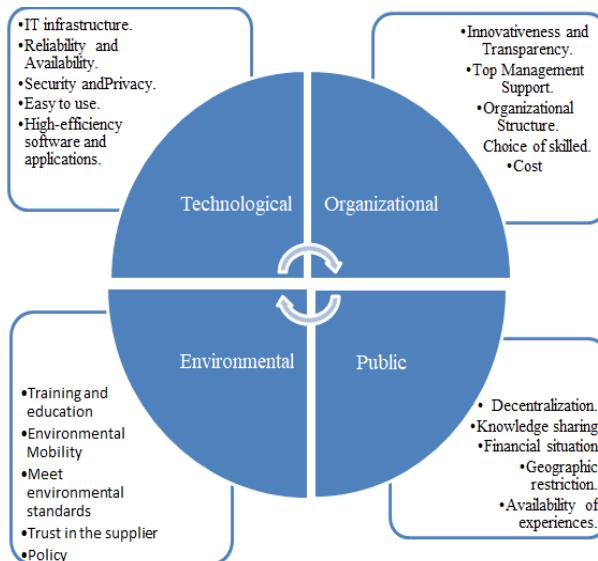
Depending on what identified from the factors in the previous studies, the researcher classified the factors according to the four fields, as shown in the following table.

**Table 1.** Proposed model factors

Field	Factor
Technological	IT infrastructure.
	Easy to use.
	Security and Privacy.
	Reliability and Availability.

	High-efficiency software and applications.
Organizational	Innovativeness and Transparency.
	Top Management Support.
	Organizational Structure.
	Choice of skilled.
	Cost.
Environmental	Policy.
	Training and education.
	Meet environmental standards.
	Trust in the supplier.
	Environmental Mobility
Public	Decentralization.
	Knowledge sharing.
	Financial situation.
	Geographic restriction.
	Availability of experiences.

Depend on the above table the researcher introduce the study model as follow:



**Fig. 1.** The proposed model Public-Technological-Organizational-Environmental (P-T-O-E)

### C. Research Respondents

The respondents of the current study are all employees working in the Ministry of Interior with the rank of (Administrative Governor, Head of Department, Information Technology staff), whether in the center of the ministry or in the governorates of the Kingdom, which their total is (958) employees (according to the human resource department of the Ministry of Interior, 2020), where the reasons for choosing the respondents stem out from their knowledge and culture about the topic of this study. Also, the researcher considered the significant information that can be collected from this population.

The sample comprised (278) individual's that selected in randomly way from total of employees working in the Ministry of Interior, for apply the study instrument, where the researcher choose this sample depend on (Krejcie & Morgan, 1970).

### D. Study Instrument

This study used questionnaire, based on the Likert scale, consisting of five choices ranging from strongly agree and strongly disagree to a relative weight (5-1). The questionnaire was divided into two main sections, the first concerned with the personal data of the respondents, while the second was about the subject of the study and includes a set of paragraphs that relate to four aspects (technological, organizational, environmental, and public).

### **E. Validity of the Study Instrument**

To verify the validity of the study tools, content validation and internal construction validation were used as follows:

#### **Content Validity**

The study tool was presented to a group of experienced and specialized arbitrators from the department heads and faculty members in Jordanian universities, whose number reached (4) arbitrators, where they were asked to express their opinion on the comprehensiveness of the paragraphs, their belonging to the field, the appropriate language formulation and the clarity of the paragraphs, and adding, deleting or amending what they deem appropriate. The arbitrators' advice came to not delete any paragraph, with some paragraphs being rewritten in the study tool.

#### **Internal construction validation**

The validity of the study tool was verified by using the validity of the internal construction, where the tool was applied to an exploratory sample, randomly chosen from within the study community and from outside its sample, amounted to (50) individuals, then the correlation coefficient was calculated between the degree of the individual on the paragraph and its overall score on the tool as shown in following table.

**Table 2.** Correlation coefficients between the individual's score on the paragraph and its overall score on the instrument

Item No.	Corr-Coeff						
1.	.476**	16.	.413*	31.	.399*	46.	.437*
2.	.434*	17.	.449*	32.	.462*	47.	.589*
3.	.542**	18.	.544**	33.	.348*	48.	.399*
4.	.465*	19.	.602**	34.	.568***	49.	.434*
5.	.604**	20.	.379*	35.	.593***	50.	.374*
6.	.375*	21.	.443*	36.	.611***	51.	.568**
7.	.456*	22.	.374*	37.	.436*	52.	.544**
8.	.567**	23.	.432*	38.	.387*	53.	.611**
9.	.423*	24.	.572**	39.	.349*	54.	.436*
10.	.385*	25.	.365*	40.	.465*	55.	.613**
11.	.376*	26.	.493*	41.	.579***	56.	.462*
12.	.542**	27.	.449**	42.	.564***	57.	.375*
13.	.501*	28.	.610**	43.	.456*	58.	.354*
14.	.571**	29.	.434*	44.	.604***	59.	.567**
15.	.442*	30.	.416*	45.	.432*	60.	.426*

**F. Reliability of the Study Instrument**

The consistency of the study instrument will determine by using the coefficient of internal consistency based on the Cronbach's Alpha equation. The internal consistency coefficient of the study instrument will extract by distributing it to a sample of (50) randomly selected respondents. The following table showed that.

**Table 3.** Cronbach's Alpha for the dimensions of the study instrument

Dimensions	Cronbach alpha coefficient
Technological	0.82
Organizational	0.81
Environmental	0.80
Public	0.82
Study Instrument	0.81

**V. RESULTS****A. Answer the study questions:**

The first question: What is the appropriate model for measuring factors affecting the adoption of cloud computing in the Jordanian Ministry of Interior?

To answer this question, the researchers reviewed the theoretical literature and previous studies related to the topic of adopting cloud computing and the factors affecting it, and the researcher found that most of the previous studies and theoretical literature spoke about two models (the technology acceptance model (TAM) and the technology-organizational-environmental model (TOE)), but most of the factors present in the two models do not fit entirely with the nature of the work of government institutions, as working in government institutions differs from that in private institutions.

This is what invited the researchers to try to focus on the most important factors that affect the adoption of cloud computing and are compatible with the nature of the work of the Jordanian Ministry of Interior as a government institution, where the factors that were mentioned in the previous studies were limited and amounted to (107) factors, and the researchers studied all factors and the extent of their impact on the adoption of cloud computing, or hindered the process of adopting the cloud computing, and after scrutiny and study the researcher reached to the most (15) influencing factor in cloud computing.

Besides, the researchers have tried to support the factors that have been chosen, with other factors that are more related to the nature of the work of government institutions, since all the previous factors were related to three fields (technology, organizational, environmental) which are closer to being similar between all governmental and private institutions. Therefore, the researcher added a new field (Public) that includes (15) factors that could affect the process of adopting cloud computing in government institutions.

The second question: What are factors that encourage adoption of cloud computing model in Jordanian Ministry of Interior?

The Third question: What are factors that impede adoption of cloud computing model in Jordanian Ministry of Interior?

To answer these two questions the researcher calculated the arithmetic mean and standards deviation for all main factors with their items.

The result showed that, the technological factors mean came at medium degree and reach (2.67) with standard deviation (1.05), the dimension level also came with a moderate degree, where (easy to use) dimension came at first rank with mean (2.77) at medium degree, followed by (security and privacy) dimension with mean (2.74) at medium degree, while third rank came (reliability and availability) with mean (2.64) at medium degree, the (IT infrastructure) dimension came at fourth rank with mean (2.59) at medium degree and finally the (High-efficiency software) dimension came at fourth rank with mean (2.58) at medium degree.

According to this results can indicated that, technological factors have two types of factors, some of these factors support and encourage the adoption of cloud computing in the Jordanian Ministry of Interior, while others are an obstacle to the adoption of cloud computing in the Jordanian Ministry of Interior. According to the

criterion of judgment table these factors can divide into two categories as shown in next table.

**Table 5.** Encourage and obstacles factors for technological field

<b>Encourage</b>	<b>Obstacles</b>
Enable to scale IT resources	Increases the resiliency of IT services
Applications are easy to use	Efficiency of computers and the Internet
Availability of a variety of programs and applications	Simplification of procedures in the Ministry
Security and privacy	Passwords and authentication
Data protection and archiving	Services continuously
Data and information are highly reliable	Comprehensiveness and diversity
System with high reliability	Store and process data
Efficient and effective	

The data presented in the above table indicate that some of the technology factors that reached (8) factors are considered encouraging to adopt cloud computing in the Jordanian Ministry of Interior, while there are (7) factors that are an obstacle to the adoption of cloud computing in the Jordanian Ministry of Interior according to the opinion of respondents .

Also the results showed that, the organizational factors mean came at medium degree and reach (2.72) with standard deviation (1.04), the dimension level also came with a moderate degree, where (organizational structure) dimension came at first rank with mean (2.80) at medium degree, followed by (innovativeness) dimension with mean (2.76) at medium degree, while third rank came (choice of skilled) with mean (2.74) at medium degree, the (top management support) dimension came at fourth rank with mean (2.70) at medium degree and finally the (cost) dimension came at fourth rank with mean (2.58) at medium degree.

According to this results can indicated that, organizational factors have two types of factors, some of these factors support and encourage the adoption of cloud computing in the Jordanian Ministry of Interior, while others are an obstacle to the adoption of cloud computing in the Jordanian Ministry of Interior. According to the criterion of judgment table these factors can divide into two categories as shown in next table.

**Table 6.** Encourage and obstacles factors for organizational field

<b>Encourage</b>	<b>Obstacles</b>
Diverse avenues for creativity	Environment conducive to creativity
Creative services	Use of modern technological
Highly qualified senior management	Sufficient support
Relationships and responsibilities	Selection and appointment
Administrative and hierarchical levels	Cost of cloud services
Organizational units	
Efficient staff	
Special skills	
Reduce or avoid costs	
Potential benefit	

The data presented in the above table indicate that some of the organizational factors that reached (10) factors are considered encouraging to adopt cloud computing in the Jordanian Ministry of Interior, while there are (5) factors that are an obstacle to the adoption of cloud computing in the Jordanian Ministry of Interior according to the opinion of respondents .

In addition the results showed that, the environmental factors mean came at medium degree and reach (2.58) with standard deviation (.99), the dimension level also came with a moderate degree, where (trust in the supplier) dimension came at first rank with mean (2.81) at medium degree, followed by (policy) dimension with mean (2.80) at medium degree, while third rank came (meet environmental standards) with mean (2.67) at medium degree, the (training and education) dimension came at fourth rank with mean (2.65) at medium degree and finally the (environmental mobility) dimension came at fourth rank with mean (1.98) at medium degree.

According to this results can indicated that, environmental factors have two types of factors, some of these factors support and encourage the adoption of cloud computing in the Jordanian Ministry of Interior, while others are an obstacle to the adoption of cloud computing in the Jordanian Ministry of Interior. According to the criterion of judgment table these factors can divide into two categories as shown in next table.

**Table 7.** Encourage and obstacles factors for environmental field

<b>Encourage</b>	<b>Obstacles</b>
Policies encourage	Policies implemented conflict
Policies and regulations	Employees training
Highly trained and qualified employees	Employees learn and develop
Provision of services	Environmental standards
Supplier mutual trust	Environmental standards conflict
Fair dealing	Data and information quickly
Supplier stands	Environmental mobility
	Mobility conflict

The data presented in the above table indicate that some of the organizational factors that reached (7) factors are considered encouraging to adopt cloud computing in the Jordanian Ministry of Interior, while there are (8) factors that are an obstacle to the adoption of cloud computing in the Jordanian Ministry of Interior according to the opinion of respondents.

Also, the results showed that, the organizational factors mean came at medium degree and reach (3.09) with standard deviation (1.04), the dimension level also came with a moderate degree, where (financial situation) dimension came at first rank with mean (3.58) at medium degree, followed by (knowledge sharing) dimension with mean (3.33) at medium degree, while third rank came (decentralization) with mean (3.02) at medium degree, the (geographic restriction) dimension came at fourth rank with mean (2.96) at medium degree and finally the (availability of experience) dimension came at fourth rank with mean (2.57) at medium degree.

According to this results can indicated that, public factors have two types of factors, some of these factors support and encourage the adoption of cloud computing in the Jordanian Ministry of Interior, while others are an obstacle to the adoption of cloud computing in the Jordanian Ministry of Interior. According to the criterion of judgment table these factors can divide into two categories as shown in next table.

**Table 8.** Encourage and obstacles factors for public field

<b>Encourage</b>	<b>Obstacles</b>
Decentralization standards	Application of decentralization
Laws and regulations of decentralization	Ability and efficiency to provide the necessary knowledge
Convenient environment	Financial situation
Share knowledge and information	Cover the geographic areas
Financial condition required	Highly qualified and skilled employees
Financial resources	
Effectively to providing data and information	
Connect geographically dispersed institutions	

Sufficient and qualified expertise	
Experienced staff	

The data presented in the above table indicate that some of the public factors that reached (10) factors are considered encouraging to adopt cloud computing in the Jordanian Ministry of Interior, while there are (5) factors that are an obstacle to the adoption of cloud computing in the Jordanian Ministry of Interior according to the opinion of respondents.

### B. Hypothesis Testing

**H<sub>1</sub>:** Technological factors have significant effect on adopting cloud computing in the Jordanian Ministry of Interior.

To test this hypothesis the researcher calculated arithmetic mean, standards deviation and (T) value, through using one sample test, the following table showed the result.

**Table 9.** One-Sample test for technological factors

Factors	Mean	Std. Deviation	T value	Sig
IT infrastructure	2.59	1.09	38.437	.000
Easy to use	2.77	1.16	38.432	.000
Security and Privacy	2.74	1.09	40.535	.000
Reliability and Availability	2.64	1.10	38.660	.000
High efficiency software	2.58	1.23	34.038	.000
Technological	2.67	1.05	40.780	.000

Table (9) showed that, the mean of the technological factors (2.67), with a standard deviation of (1.05), and T value (40.780) with significant (.000) which is less than (0.05), that's mean technological factors have significant effect on adopting cloud computing in in Jordanian Ministry of Interior. Also, all dimensions of technological factors (IT infrastructure, easy to use, security and privacy, reliability and availability, high efficiency software) according to their T value (38.437, 38.432, 40.535, 38.660, 34.038) respectively, have significant effect on adopting cloud computing in in Jordanian Ministry of Interior. This means Technological factors have significant effect on adopting cloud computing in in Jordanian Ministry of Interior.

**H<sub>2</sub>:** Organizational factors have significant effect on adopting cloud computing in the Jordanian Ministry of Interior.

To test this hypothesis the researcher calculated arithmetic mean, standards deviation and (T) value, through using one sample test, the following table showed the result.

**Table 10.** One-Sample test for organizational factors

Factors	Mean	Std. Deviation	T value	Sig
Innovativeness	2.76	1.11	40.300	.000
Top Management Support	2.70	1.17	37.394	.000
Organizational Structure	2.80	1.03	44.039	.000
Choice of skilled	2.74	.97	45.520	.000
Cost	2.58	1.25	33.439	.000
Organizational	2.72	1.04	42.072	.000

Table (10) showed that, the mean of the organizational factors (2.72), with a standard deviation of (1.04), and T value (42.072) with significant (.000) which is less than (0.05), that's mean organizational factors have significant effect on adopting cloud computing in in Jordanian Ministry of Interior. Also, all dimensions of technological factors (innovativeness, top management support, organizational structure, choice of skilled and cost) according to their T value (40.300, 37.394, 44.039, 45.520, 33.439) respectively, have significant effect on adopting cloud computing in in Jordanian Ministry of Interior. This means Organizational factors have

significant effect on adopting cloud computing in in Jordanian Ministry of Interior.

**H<sub>3</sub>:** Environmental factors have significant effect on adopting cloud computing in the Jordanian Ministry of Interior.

To test this hypothesis the researcher calculated arithmetic mean, standards deviation and (T) value, through using one sample test, the following table showed the result.

**Table 11.** One-Sample test for environmental factors

Factors	Mean	Std. Deviation	T value	Sig
Policy	2.8092	1.09376	41.572	.000
Training and education	2.6514	1.04953	40.891	.000
Meet environmental standards	2.6730	1.14895	37.657	.000
Trust in the supplier	2.8104	1.09999	41.355	.000
Environmental Mobility	1.9860	.92008	34.939	.000
Environmental	2.5860	.99128	42.226	.000

Table (11) showed that, the mean of the environmental factors (2.58), with a standard deviation of (.99), and T value (42.226) with significant (.000) which is less than (0.05), that's mean environmental factors have significant effect on adopting cloud computing in in Jordanian Ministry of Interior. Also, all dimensions of technological factors (policy, training and education, meet environmental standards, trust in the supplier, environmental mobility) according to their T value (41.572, 40.891, 37.657, 41.355, 34.939) respectively, have significant effect on adopting cloud computing in in Jordanian Ministry of Interior. This means Environmental factors have significant effect on adopting cloud computing in in Jordanian Ministry of Interior.

**H<sub>4</sub>:** Public factors have significant effect on adopting cloud computing in the Jordanian Ministry of Interior.

To test this hypothesis the researcher calculated arithmetic mean, standards deviation and (T) value, through using one sample test, the following table showed the result.

**Table 12.** One-Sample test for public factors

Factors	Mean	Std. Deviation	T value	Sig
Decentralization	3.0204	.52564	93.008	.000
Knowledge sharing	3.3372	.66506	81.221	.000
Financial situation	3.5865	.71767	80.891	.000
Geographic restriction	2.9695	.81331	59.098	.000
Availability of experiences	2.5712	1.17544	35.407	.000
Public	3.0969	.56891	88.113	.000

Table (12) showed that, the mean of the public factors (3.09), with a standard deviation of (.56), and T value (88.113) with significant (.000) which is less than (0.05), that's mean public factors have significant effect on adopting cloud computing in in Jordanian Ministry of Interior. Also, all dimensions of technological factors (decentralization, knowledge sharing, financial situation, geographic restriction, availability of experiences) according to their T value (93.008, 81.221, 80.891, 59.098, 35.407, 88.113) respectively, have significant effect on adopting cloud computing in in Jordanian Ministry of Interior. This means Public factors have significant effect on adopting cloud computing in in Jordanian Ministry of Interior.

## VI. CONCLUSION

According to the previous studies there are many models used to measure the factors that affect adopting of cloud computing in any institution, including the technology acceptance model (TAM) and the technology-organizational-environmental model (TOE), despite these models are suitable and good models for this mission, but in this study as the sample is government institution the model has to be suitable with the nature of

government work, while old models used for private institutions, which mean that these models can't measure the factors that affect adopting of cloud computing in government institution in efficient way, thus the researcher develop the (TAM) through added new factor (public) and enhance the categories of old factors (technological, organizational and environmental).

The new model consists of four main factors (technological, organizational, environmental and public) with five categories for each factor, this new model can considered as a suitable model to measure the factors that affect adopting of cloud computing in any institution whether private or government because it covered all the work area in an institution. The researchers indicated that the government institutions have different aspect from private institutions including the administrative, types of service and target, which mean that the same model can't be used for both institutions.

Besides that, the old models did not cover many important aspects of work in government institutions, such as decentralization, geographical restrictions and the financial position of the government institution, as the way the business is run in government institutions is different from the rest of the other institutions, and this makes it difficult to adopt the same factors of cloud computing itself In both cases, in addition to the financial situation of the government institution depends on government support only, as these institutions aim to provide a service and not a profit, therefore measuring the factors affecting the adoption of cloud computing needs an integrated and comprehensive model for all aspects of its work, and this can be found from the new model.

Also, the process of adopting cloud computing in government institutions such as the Ministry of Interior needs more complicated procedures than it is in other institutions, as there are a variety of factors that affect, whether negatively or positively, the adoption of cloud computing, related to the nature of government work such as the availability of administrative expertise and geographical restrictions which imposes on government institutions to spread throughout the country, all these factors cannot be measured through models designed to reveal the factors affecting the adoption of cloud computing in private companies, because these models do not fit with the nature of government work, therefore the new model that developed by researcher is considered an integrated, comprehensive and more appropriate model for measuring the factors affecting the adoption of cloud computing in government institutions such as the Jordanian Ministry of Interior.

The study results showed that, technological factors have significant effect on adopting cloud computing in in Jordanian Ministry of Interior. The researchers due this result to that cloud computing itself is considered one of the tools of technology, it depends on transferring the processing and storage space of the computer to what is termed the cloud, which is a server device that is accessed through the Internet, and in this way the IT programs are transformed from products to services.

The researcher also attributes this result to the fact that cloud computing technology depends on a set of systems that are reliable and high efficiency, and since all systems and tools that cloud computing technology uses are technological systems and tools; this confirms the great impact of technological factors on the adoption of cloud computing in the Jordanian Ministry of Interior. This result agrees with many previous studies results including Rababah *et al.* (2017), Scholten (2016).

The study results showed that, organizational factors have significant effect on adopting cloud computing in in Jordanian Ministry of Interior. The researchers attributes this result to the fact that the organizational factors in any organization are considered one of the most important and most influential factors on the use of the institution or the adoption of any modern technologies or applications, as the organizational factors greatly affect the decision-making process, therefore the decision to adopt cloud computing is highly dependent on the nature of organizational factors in the organization.

In addition, this result may be attributed to the fact that the institution's possession of highly qualified and skilled employees contributes to encouraging the institution to use modern technologies, as the presence of highly skilled and efficient employees prepares the institution to accept any modern technology due to its confirmation of the ability of its employees to deal with these technologies like cloud computing. This result is also due to the nature of the services provided by the cloud computing, which is characterized by its great ability and effectiveness, therefore these features contribute to encouraging the Jordanian Ministry of Interior to adopt

the cloud computing. This result agrees with many previous studies such as McKinnie (2016) and Scholten (2016).

The study results showed that, environmental factors have significant effect on adopting cloud computing in in Jordanian Ministry of Interior. The researchers attributes this result to the nature of the policies in place in the Jordanian Ministry of Interior that encourage the adoption of modern technologies, including cloud computing, as the policies and regulations of the Ministry of Interior contribute to a large amount in the smooth implementation and implementation of modern technologies. In addition to the Ministry of Interior laws encouraging the Ministry with its various institutions to adopt modern technologies in order to facilitate the process of providing service to citizens, therefore the policies and laws as an environmental factor greatly affect the adoption of cloud computing.

In addition to this, the researchers attributes the presence of an impact of environmental factors on the adoption of cloud computing in the Jordanian Ministry of Interior to the fact that the adoption of cloud computing contributes significantly to meeting the environmental standards of the ministry. Also, cloud computing technology applications, services and software do not contradict the ministry's environmental standards with the adoption of cloud computing. This result agrees with many previous studies results such as Al-Shura *et al.* (2018) and Sandu & Gide (2018).

The study results showed that, public factors have significant effect on adopting cloud computing in in Jordanian Ministry of Interior. The researcher attributes this result to the existence of a compatibility between the criteria of decentralization followed by the Jordanian Ministry of Interior with the services provided by cloud computing, as the existence of this type of compatibility positively affects the ministry's decision to adopt the cloud computing. In addition to the powers granted by cloud computing applications to the Ministry's employees according to their administrative level contribute to helping the ministry to make the decentralization process successful in it, therefore the existence of a correlation between the criteria for decentralization as one of the public factors in the Ministry of Interior and cloud computing explains the great impact of public factors on the adoption of cloud computing.

The researcher attributes the effect of public factors in the Jordanian Ministry of Interior in adopting cloud computing to the availability of a variety of experiences and high scientific qualifications among the ministry's employees, as the presence of this type of employee contributes significantly to influencing the opinion of decision makers in adopting cloud computing. In addition to that, cloud computing is able to develop and improve the level of employee performance, and since the Ministry of Interior is constantly striving to improve its performance and the performance of its employees, the cloud computing technology is the ideal solution for it. Therefore, a significant impact of the general factors on the adoption of cloud computing in the Jordanian Ministry of Interior is considered normal.

## **VII. RECOMMENDATIONS**

In the light of the research results, the researchers recommended that:

1. The necessity of alerting the Jordanian Ministry of Interior to cloud computing and activating it, in order to achieve maximum benefit from this technology.
2. Trying to address some of the obstacles, such as organizational and technological obstacles that stand in the way of the adoption of cloud computing in the Jordanian Ministry of Interior.
3. The establishment of a variety of training courses and workshops that contributes to increasing staff understanding of the importance of cloud computing technology and the need to benefit from its services.
4. Conducting other studies in different government institutions and ministries to ensure the suitability of the proposed model to the nature of the work of these institutions and their ability to adopt cloud computing.
5. Trying to discover other factors affecting the process of adopting cloud computing in government and private institutions such as the cultural and personal factors of employees.

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