

The Influence of Cloud Computing Adoption Challenges on e-Government Services

A case study: Jordanian e-Government

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Abstract— Jordan has invested in cloud computing technology in the e-government to provide the service in the form of (Infrastructure as a service) since 2014. This study aimed to understand the influence of cloud computing adoption challenges on e-government services in Jordan. The population of the study consists of top, middle and operational level in the information management departments and e-government departments in (12) ministries and government institutional, the total number of involved employees in these ministries and government institutional is (163). A comprehensive survey method was conducted to cover the target population. The researcher developed a questionnaire to gather the necessary data to conduct the study. Number of (163) questionnaires were distributed among all involved employees, however (98) questionnaires were returned and used in this study. The results showed that the cloud computing adoption challenges influencing the e-government services in Jordan. And the highest effect of the challenges was marked for the integration challenge since the employees of e-government was worried about the data migration and the cost of this integration process.

Keywords: *Cloud computing, e-government, e-services, Infrastructure as a service, adoption and integration.*

I. INTRODUCTION

Cloud Computing: Cloud computing is 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 [5]. The cloud model is composed of five essential characteristics, three service models, and four deployment models. Essential Characteristics are on-demand self-service, broad network access, resource pooling, rapid elasticity and measured service. Service Models are Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS). Deployment Models are private cloud, community cloud, public cloud and hybrid cloud [5]. Cloud computing is one of the modern technologies which can significantly improve the way a government functions, the services it provides to its citizens and institutions and its

cooperation with other governments. It may make a revolution in e-government systems, in terms of cost saving and actual and professional use of resources. The evolution of the cloud computing technique has opened up new possibilities for several governments over the world. Due to its advantages, many countries have launched e-governance services using cloud computing [8].

II. THE REFLECTIVE PROCESS

The main problem of this study is to shed light on the challenges facing the adoption of cloud computing in e-government and define the influence of these challenges on e-government services in Jordan. Therefore, this study is concerned with identifying the challenges that are considered to be obstructions to the adoption of cloud computing technology in the Jordanian government context and about the influence of these challenges on the e-services delivered by government. The present study combine the cloud computing adoption challenges from previous studies; security and privacy, service quality, accessibility and availability with new factor of challenges marked as integration. Since the privacy and security is the main concern for using cloud computing most of previous studies focused on. While the service quality is an important issue too, but the previous studies did not show that quality of e-services is a major concern for the consumers especially when the compare the e-services with real life services in government institutional. However the accessibility and availability challenges are affecting the e-services directly but they are known issues of e-services from the beginning of internet revolution till these days and some offline solutions helps to cover these issues in a proper way till now. This study focuses on integration challenge since it is new focus point have not been studies before and find out the influence of this issue on e-government services in Jordan in combination with all other challenges of cloud computing adoption challenges.

In addition, in this work the challenges encountered in Jordan during the adoption of cloud computing on e-

government services were investigated and the most significant ones were identified to conduct this study. Having accomplished this, a model was developed that relates these selected cloud computing challenges (independent variable) on e-government services (dependent variable).

To the best of the researcher knowledge, no similar work was conducted in Jordan. It is hoped that the outcomes of this work will be made use of by the remaining Jordanian ministers and government institutional which, are expected to adopt cloud computing in the near future. The model of study in fig.1

shows the independent variable of the (cloud computing adoption challenges: security & privacy [7], service quality [12], availability [11], accessibility [2], and integration [3]. And the dependent variable e-government services; measured with four dimensions; benefit of use [1], ease of access [4], interactivity [6] and personalization & flexibility [9]. As shown in the Fig 1 the model of study shows that the researcher tries to find if there is an influence of the cloud computing adoption challenges on e-government services? And what will be the influence?

A. Model of Study

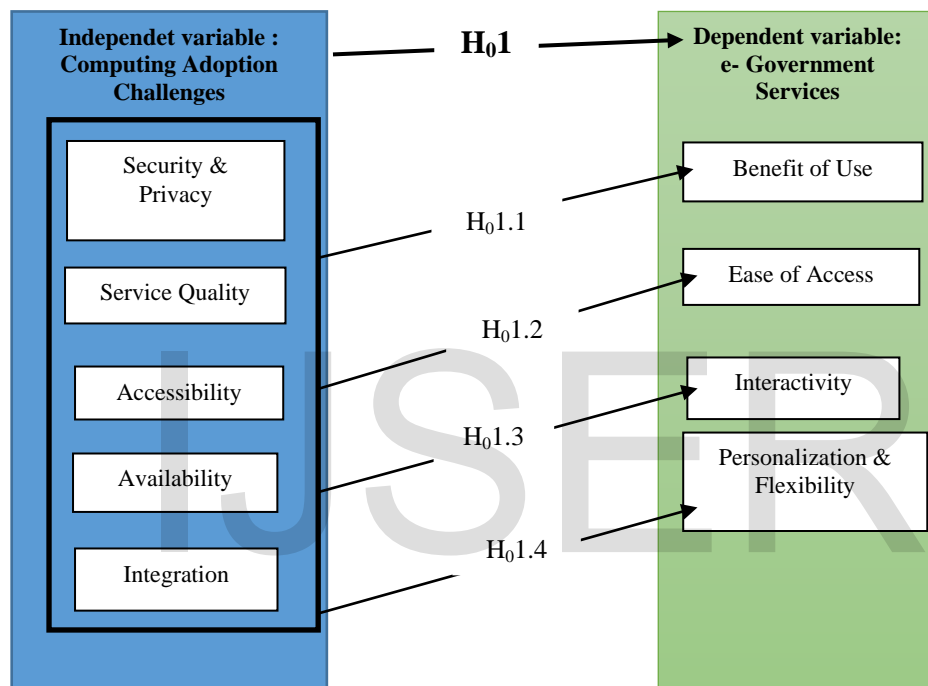


Fig 1: Model of Study Independent Variable (Cloud computing adoption challenges) and Dependent Variable (E-government services).

B. Hypotheses

Hypotheses that are forming the proposed theoretical model of the study are:

Major Hypothesis

H₀1: There is no statistically significant impact of the cloud computing adoption challenges (security & privacy, service quality, accessibility, availability, and integration) on e-government services in Jordan at the significant level ($\alpha \leq 0.05$).

Minor Hypotheses

H₀1.1: There is no statistically significant impact of the cloud computing adoption challenges (security & privacy, service quality, accessibility, availability, and integration) on benefit of use e-government services in Jordan at the significant level ($\alpha \leq 0.05$).

H₀1.2: There is no statistically significant impact of the cloud computing adoption challenges (security & privacy, service quality, accessibility, availability, and integration) on ease of access e-government services in Jordan at the significant level ($\alpha \leq 0.05$).

H₀1.3: There is no statistically significant impact of the cloud computing adoption challenges (security & privacy, service quality, accessibility, availability, and integration) on interactivity of e-government services in Jordan at the significant level ($\alpha \leq 0.05$).

H₀1.4: There is no statistically significant impact of the cloud computing adoption challenges (security & privacy, service quality, accessibility, availability, and integration) on personalization & flexibility of e-government services in Jordan at the significant level ($\alpha \leq 0.05$).

III. THE RESEARCH METHOD

Objective of the study is to identify the challenges affecting cloud computing adoption in e-government. For this, questionnaire based survey method was followed in which data was gathered from the ministries and governmental institutions those have adopted cloud computing.

A. Instrument development

A self-administered postal questionnaire incorporating five-point Likert scales was developed. The questionnaire contained three parts:

- Demographic values (gender, qualifications, age, and years of experiences)
- Cloud computing adoption challenges as independent variable: security & privacy, service quality, availability, accessibility and integration.
- E-government services as dependent variable measured with four dimensions; benefit of use, ease of access, interactivity and personalization & flexibility.

Two consecutive rounds of pre-testing were conducted in order to insure that respondents can understand the items used in the study: first, the questionnaire was reviewed by the academic researchers experienced in questionnaire design and next, the questionnaire was piloted with IT experts known. Further, responses on the questionnaire were collected from the top and middle level IT professionals of the ministries who in the process of adoption (potential adopters). This way, purposeful sampling was used for the data collection in which the respondents were approached through personal visits, email and/ or telephone to know whether they are aware of cloud computing and if yes, whether they are willing to adopt cloud computing or they are in the process of adoption. If so, a suitable time was decided with an appointment for data collection. Most of the responses were collected through personal visits to the respondents and a round of conversation was held before seeking their responses on the questionnaire. Other few responses were collected through email. The population of the study was selected from (12) dedicated ministries in Jordan to answer the research questions. The participants were the top and medium level managers in e-government department in each ministry or government institutional and advisors of the IT companies. The total number of (163) questionnaires were distributed; however (98) were recovered and valid for the statistical analysis with response rate of (60%).

B. Scale Measurement

The scales have been developed from previously tested scales. In sum, a total of scale items were used to measure the constructs in the model. With the exception of the demographic questions, constructs have been operationalized using 5-point Likert scale, ranging from 1 to 5. Reliability: The reliability analysis applied the level

of Cronbach's Alpha (α) as the criteria of internal consistency. The minimum acceptable level suggested by Sekaran [10] ($\alpha \geq 0.7$). As all the values of Cronbach's Alpha are above (0.70), the researcher approved that the instrument is consistent. Finally, the overall Cronbach's Alpha coefficient equal (97.38%) so all these coefficient levels accepted as shown in table 1.

Table 1: Cronbach's Alpha (α) test results for the study variables

Variable	No. of questions	Cronbach's Alpha (α)
Cloud Computing Adoption Challenges	33	95.84%
Security & Privacy	12	88.09%
Service Quality	7	90.96%
Accessibility	5	84.37%
Availability	5	83.59%
Integration	4	84.55%
e-Government Services	23	95.66%
Benefit of use	5	90%
Ease of access	5	88.9%
Interactivity	6	87.78%
Personalization & Flexibility	7	93.55%
Overall	56	97.38%

IV. ANALYSIS AND RESULTS

Sample distribution in accordance to gender shows that percentage of male participants was (67.3%) and female participants (32.7%). Sample distribution in accordance to qualifications level shows that percentage of participants in the B.Sc. holders was the highest and equal was (69.4%) and participants in the High School was the lowest (1.0%). Sample distribution accordance to age shows that percentage of participant's ages (30-39) was the highest (65.3 %) and participants from Over 60 ages were the lowest (1.0%). Sample distribution in accordance to years of experience shows that percentage of participant's years of experience (6-10) was the highest (49.0%) and participant's years of experience (less than 6 years) was the lowest (12.2 %).

A normal distribution test of the data collected has been conducting in order to ascertain whether the data is under the normal distribution or not, where a test (One-Sample Kolmogorov-Smirnov Test) was conducted, it is natural distribution terms to be the value of Sig greater than (0.05) of the data and less than the value of KS as shown in table 2.

Table 2: Normal distribution test

Variables	Means	Standard dev	K-S	sig
Cloud Computing Adoption Challenges	3.7483	0.52730	0.695	0.722
Security and Privacy	4.0434	0.51748	1.057	0.214
Service Quality	3.3557	0.67639	0.742	0.640

Accessibility	3.5673	0.63551	1.112	0.196
Availability	3.8469	0.64139	1.059	0.212
Integration	3.6531	0.63269	1.350	0.052
e-Government Services	3.8984	0.55882	0.792	0.557
Benefit of Use	3.7980	0.68894	0.971	0.302
Ease of Access	3.9837	0.64195	1.111	0.170
Interactivity	3.6752	0.62102	0.853	0.461
Personalization & Flexibility	4.1006	0.64321	1.210	0.061

Results shown in the table 2 that (K-S) values are less than (5) and sig value is more than (0.05), which means that, the data was normally distributed.

To ensure the availability of mentioned condition, the researcher extracted (inflation variability VIF) coefficient and (Variation allowed Tolerance). After statistical treatment procedure, indicating that the coefficient of variation allowed for independent variables was less than (10) and greater than (0.01) as inflation coefficient of variation values were less than (10) where is an indication that there is no high correlation between independent variables and this demonstrates the acceptance of the values and they are suitable for a multiple linear regression analysis and thus test the hypotheses of the study number refer that the acceptable as shown in table 3. Tolerance for the independent variable dimensions was less than one (1) and more than (0.01), beside the VIF was less than (10). This test has been used to be sure that there is no-interference between the independent variable five dimensions before testing the study hypothesis These results refer that there is no-interference between the independent variable dimensions and the model of study was good as shown in table 3.

Table 3: Results of VIF and Tolerance Test

Cloud Computing Adoption Challenges	VIF	Tolerance
Security & Privacy	2.419	0.413
Service Quality	3.637	0.275
Availability	6.409	0.156
Accessibility	4.834	0.207
Integration	2.413	0.414

A. Hypotheses Test

H01: The calculation results present F values equal (38.922) and significant of F value is (0.00) which is less

than ($\alpha \leq 0.05$). This provides evidence to reject the main hypothesis H01. Adjusted R^2 for the hypothesis equal (0.662), which means that cloud computing adoption challenges, have about (66.2%) impact on the e-government services. Besides R equal to (82.4%) which means there is a strong relationship between variables as shown in table 4.

H01.1: The calculation results present F values equal (26.065) and significant of F value is (0.00) which is less than ($\alpha \leq 0.05$). This provides evidence to reject the minor hypothesis H01.1. Adjusted R^2 for the hypothesis equal (0.584), which means that cloud computing adoption challenges, have about (58.4%) impact on the benefit of use e-government services. Besides R equal to (76.6%) which means there is a strong relationship between variables as shown in table 4.

H01.2: The calculation results present F values equal (21.653) and significant of F value is (0.00) which is less than ($\alpha \leq 0.05$). This provides evidence to reject the minor hypothesis H01.2. Adjusted R^2 for the hypothesis equal (0.516), which means that cloud computing adoption challenges, have about (51.6%) impact on the ease of access e-government services. Besides R equal to (73.3%) which means there is a strong relationship between variables as shown in table 4.

H01.3: The calculation results present F values equal (25.333) and significant of F value is (0.00) which is less than ($\alpha \leq 0.05$). This provides evidence to reject the minor hypothesis H01.3. Adjusted R^2 for the hypothesis equal (0.579), which means that cloud computing adoption challenges, have about (57.9%) impact on the interactivity of e-government services. Besides R equal to (76.1%) which means there is a strong relationship between variables as shown in table 4.

H01.4: The calculation results present F values equal (16.179) and significant of F value is (0.00) which is less than ($\alpha \leq 0.05$). This provides evidence to reject the minor hypothesis H01.4. Adjusted R^2 for the hypothesis equal (0.468), which means that cloud computing adoption challenges, have about (46.8%) impact on personalization & flexibility of e-government services. Besides R equal to (68.4%) which means there is a strong relationship between variables as shown in table 4.

Five hypotheses were all supported and consistent with the findings of the influence of cloud computing adoption challenges (security & privacy, service quality, availability, accessibility, and integration) impacted e-government services (benefit of use, ease of access, interactivity, personalization & flexibility). Thus, hypotheses were supported.

Table 4: Results of Regression Coefficient test for hypotheses (H01, H01.1, H01.2, H01.3, and H01.4).

	Cloud Computing Adoption Challenges															R ²	F	sig
	Security & privacy			Service quality			Accessibility			Availability			Integration					
	B	T	β _a	B	T	β _a	B	T	β _a	B	T	β _a	B	T	β _a			
e-government Services	0.068	0.686	0.063	0.073	0.781	0.088	0.156	1.185	0.177	0.069	0.611	0.079	0.453	5.594	0.513	0.679	38.922	0.00*
Benefit of use	0.135	0.972	0.101	-0.130	-0.995	-0.127	0.323	1.753	0.298	-0.070	-0.443	-0.065	0.660	5.818	0.606	0.586	26.065	0.00*
Ease of Access	0.308	2.256	0.248	0.047	0.370	0.050	0.139	0.770	0.138	0.060	0.394	0.061	0.347	3.117	0.342	0.541	21.653	0.00*
Interactivity	-0.142	-1.123	-0.118	0.442	3.735	0.482	0.029	0.171	0.029	-0.059	-0.409	-0.061	0.479	4.645	0.488	0.579	25.333	0.00*
Personalization & Flexibility	0.029	0.198	0.023	-0.081	-0.590	-0.086	0.185	0.808	0.156	0.284	1.693	0.283	0.360	2.994	0.354	0.468	16.179	0.00*

V. CONCLUSION

As a conclusion to this research the researcher found that the Jordanian e- government decision makers are not worried about the new technique of cloud computing challenges rather that they trust the available e-services level. Five hypotheses were all supported and consistent with the findings of the influence of cloud computing adoption challenges impacted e- government services in Jordan. This is to say that managers and policy makers need to focus on relative advantages and technological resources to enable cloud computing adoption.

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Also, the study finds that cloud computing adoption is not complex, and a firm should make necessary contribution to making cloud computing system compatible with the firm’s processes. Further, in line with findings, top management support is crucial in convincing their workers toward adopting cloud computing services, besides offering them the appropriate trainings on knowing how the technical and non-technical perceptions of cloud computing implementations are. Moreover, as found in study, the current research confirmed that perceived ease of use impacted perceived importance; and perceived usefulness had an impact on perceived importance as well. However, results reported in this research were based on Jordan, and in turn were applicable exclusively to this context. Thus, this raises inquiries regarding the generalizability to other cultures and different contexts. Consequently, further research is needed with regards to different sectors and industries and in different countries.

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