From E-government to Cloud-government: Challenges of Jordanian Citizens' Acceptance for Public Services

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Abstract—**On the inception of the third millennium, there is much evidence that cloud technologies have become the strategic trend for many governments, not only for developed countries (e.g. the UK, Japan and the USA), but also developing countries (e.g. Malaysia and countries in the Middle East region). These countries have launched cloud computing movements for enhanced standardization of IT resources, cost reduction and more efficient public services. Cloud-based e-government services are considered to be one of the high priorities for government agencies in Jordan. Although experiencing phenomenal evolution, government cloud-services are still suffering from the adoption challenges of e-government initiatives (e.g. technological, human, social and financial aspects) which need to be considered carefully by governments contemplating their implementation. While e-government adoption from the citizens' perspective has been extensively investigated using different theoretical models, these models have not paid adequate attention to security issues. This paper presents a pilot study to investigate citizens' perceptions of the extent to which these challenges inhibit the acceptance and use of cloud computing in the Jordanian public sector and examine the effect of these challenges on the security perceptions of citizens. Based on the analysis of data collected from online surveys, some important challenges were identified. The results can help to guide successful acceptance of cloud-based e-government services in Jordan.**

Keywords- Acceptance, Challenges, Cloud Computing, E-government, Jordan

I. INTRODUCTION

One of the significant characteristics of this era is Information Communication Technology (ICT) and, like any new innovation, it has an important influence in terms of changing people's lives to some extent. The evolution of ICT has dramatically changed citizen-government interactions, developing their expectations in this regard [1]. With the advent of e-government systems, many governments worldwide have moved to an electronic form of public administration to deliver high quality and more efficient services to its citizens [2]. However, with further use of e-government services more adoption challenges have emerged (e.g. technological and financial issues) [2]. Innovative ICTs, such as cloud computing, can contribute to solving these challenges; cloud technology represents a profound change in the technological construction of the whole public sector and the ways that governments conduct their business [3]. In the last two decades, the government sector focused predominantly on traditional web-based services to improve transparency, accountability and accessibility to public services and information. Guided by the pioneering initiatives of many developed countries, such as the UK, the EU, the USA and Japan [4], cloud computing has successfully progressed towards being the next generation of e-government services. The idea is to use highly scalable, ubiquitous, location-independent IT resources to improve organizational processes and reinvent the services that meet citizens' expectations, to improve collaboration between government agencies with more open, flexible, low-cost and unified computing. However, cloud-based e-government is considered a fundamental change within governments, it also represents a user-centric services platform aiming to increase citizens' participation. Recently, public sectors in the Middle East and other developing countries have started to gear toward cloud computing to achieve increased levels of performance and efficiency while offering cost-effective outcomes [5]. However, a number of these governments are still at a rudimentary stage. The Hashemite Kingdom of Jordan (HKJ), a country at the heart of the Middle East region, is in the process of making a complete transformation to cloud-government. Jordan recognised the fundamental role of cloud

computing in the e-government environment and launched the "*National Cloud Platform*", designed to enable continued improvements and growth within e-government applications [6]. Currently, a number of ministries and government entities use cloud-based solutions to deliver improved public services to their citizens; however, a high-percentage of Jordanian people do not yet use cloud-based e-government services and still depend on paper printouts of their official transactions. Therefore, services provided using cloud technology, such as "*Issuing Certificate of Non-Criminal Record",* are not exploited effectively. A number of models and theories of IT/IS acceptance, such as the Technology Acceptance Model (TAM), the Theory of Planned Behaviour (TPB) and the most recently developed model, the second version of the Unified Theory of Acceptance and Use of Technology (UTAUT2), have been largely used to examine individuals' low adoption or reluctance to use new e-government services [7]. These models are criticised for not considering the constructs representing the specific perspectives of e-government (e.g. security). This paper takes a step toward answer the question: "*Do the barriers and challenges of e-government adoption influence the use of cloud-based e-government services from the Jordanian citizens' perspective*?" This research identified that some e-government challenges still affect the acceptance of cloud-based public services, such as lack of awareness and security. In addition, to determine some of the security concerns relevant to the research context, these can be taken into account when formulating a new theoretical model.

II. CHALLENGES OF E-GOVERNMENT

E-government initiatives aim to achieve a high level of government performance and provide citizens with improved public services. However, a number of researchers indicate the many difficulties faced by government organizations that obstruct the realization of e-government promised goals and degrade its successful adoption [4]. Therefore, the public sector has a responsibility to overcome these barriers. In spite of government efforts in this regard, the success of e-government initiatives are based significantly on citizens' willingness to use and accept e-government services utilizing new ICT . One of the major determinants to using e-government services is security [8].

The challenges of e-government adoption experienced most often can be categorised as illustrated in Table 1.

Compared to a large number of studies that address e-government challenges from a citizens' perspective, relatively limited research exists regarding the influence of these challenges on the adoption and acceptance of cloud-based services in the public sector. Also, the extent to which such challenges are relevant to the security of cloud-based e-government services. Thus, there is a concurrent need to gain empirical investigation for the impact of these challenges on the acceptance and security of cloud computing applications in the public sector. For this paper, an online survey was developed to achieve this aim.

TABLE I. CATEGORIES OF E-GOVERNMENT ADOPTION CHALLENGES

Challenges	Examples	Ref.
Technological		
• IT infrastructure	• Insufficient networking capacity • Inadequate integration across systems • Poorly updated hardware and software • Incompatibility and complexity of the existing systems	**[9]**
• Security	• Lack of transaction protection • Lack of trust in online and government e-services • Lack of security hardware in public sector	**[9-11]**
• Availability	• Inability to deliver services and information upon request • Slow response to citizens expectations, making unsuccessful delivery of e-services.	**[9, 12]**
• Accessibility	• Difficulty accessing the system for people with disabilities • Internet coverage is limited	**[9, 13]**
• Website design	• Limited languages to present the website content • Perceived ease of use • Perceived usefulness	**[10, 12]**
Human-aspects		
• Lack of awareness	• Lack of knowledge about e-government services and its benefits • Lack of orientation campaigns to promote e-government	**[10, 12]**
• ICT skills	• Lack of IT skills among users of e-government (i.e. citizens, employees, IT staff) • Lack of baseline knowledge related to secure online practices	**[9, 14]**
Social		
• Culture	• Religious and tribal beliefs • Language problems • Change resistance	**[13, 15]**
Financial		
• Lack of budget / high cost	• High maintenance and operational cost • High budget for security solutions	**[11]**

III. CLOUD COMPUTING

Cloud computing, which provides a highly scalable computing resource, has become a salient milestone in the development of information systems (IS) architecture and, more importantly, IT strategies for governments. According to the National Institute of Standards and Technology (NIST), cloud computing is an emerging 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" [16].

Cloud technology, perceived as one of the most promising information technologies today, has a number of inherent distinguishing characteristics including broad network access, pooled resources, on-demand self-service, rapid elasticity and measured service [16]. Wang et al. (2016) defined cloud computing as *"the delivery of computing as a service rather than a product"* [17]. This service is delivered to individuals, businesses and government agencies on three different levels, including Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). In addition, based on the usage range, cloud technology can be classified into four deployment models, namely private cloud, public cloud, community cloud and hybrid cloud [16, 17]. Security concerns become crucial during service delivery and affect users' acceptance for those services .

IV. Cloud Computing in the E-government Context

Evidence from the prior literature shows that cloud technology is adopted as a novel delivery channel for public services [18]. It can contribute to significant improvements in the performance of government sectors, also creating novel public services worldwide . Around the world, governments have begun to deliver their services depending on cloud computing applications and platforms to develop the service quality, reduce costs and realize efficiency [19]. Adopting cloud technologies to deliver public services provides several benefits, such as dynamic scalability, security management, distributed storage, accountability, and green IT [20]. However, there are a number of risks associated with cloud-based e-government services, including tangible risk (e.g. availability and infrastructure) and intangible risk (e.g. security) [3]. Security concerns are the main source of risk [21]. Therefore, it is necessary to identify and address such concerns for cloud-based e-government services along with other risks. Thus, government sectors will require the ability to undertake cloud risk-management, which is deemed as the main determinant of cloud computing success and acceptance.

V. Acceptance and Adoption of New Technology: Theories and Models

Research on individuals' IT acceptance covers one of the well-established streams in the field of information systems (IS) [22]. So far various competing models have been developed to understand IT/IS acceptance behaviour. Among these models are the TAM, TPB, the theory of reasoned action and so forth [23]. A comprehensive model that offers a more complete picture of the IT acceptance process of users was needed. Venkatesh et al. (2003) developed the new UTAUT model through integration and consolidation of eight dominant technology acceptance theoretical models [23]. The UTAUT model includes four core determinants (performance expectancy, effort expectancy, social influence and facilitating conditions) of behavioural intention and actual usage behaviour. While gender, age, experience, and voluntariness have been constructed as moderators to the key relationships (see Fig.1) [23].

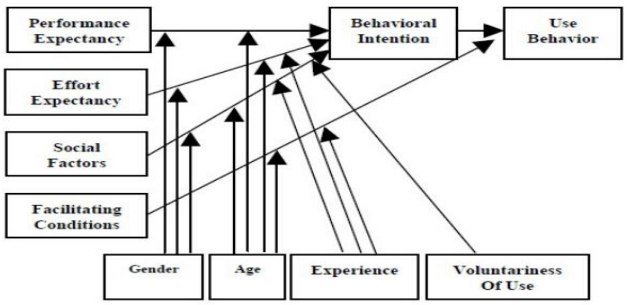

Figure 1. UTAUT [23]

Since its inception, the unified theory's (UTAUT) relationships have been extensively confirmed in the context of e-government acceptance and use [7]. Hence, the UTAUT model is proper for understanding the acceptance of e-government services using cloud technology. According to Venkatesh et al. (2012), the UTAUT2 model, the extended version of the UTAUT model, is geared towards the consumer use and acceptance of IT [24]. This can serve the aims of this study better as the citizen is the main consumer of e-government cloud-based services . Moreover, compared to the original model, UTAUT2 provides a notable improvement with respect to explained variance (R^2) up to 74 percent in behavioural intention (BI) to use technology. However, the unified theory tends to be limited to not taking into account security concerns and trust, which represents one of the specific constructs associated with the e-government context [2].

VI. Research Methodology

In this study, a quantitative research method using an online questionnaire survey was selected to meet the aims of the research. A survey questionnaire was employed as it is low cost with respect to both money and time, participants' anonymity can be guaranteed and it has the ability to provide an inflow of data from a large study sample with minimum researcher bias [25]. After the initial design for the questionnaire, a pre-test was done by PhD researchers, academic staff and some of the Jordanian public. This was important to enhance questions and check participant comprehension before the distribution of the actual survey [26]. This resulted in some amendments to the wording of a few questions. The questionnaire was employed to determine what Jordanian citizens perceived to be challenges facing the acceptance of cloud-based e-government services, and the effect of these challenges on the perceived security. Because cloud computing is a relatively new concept in developing

countries, the researchers provided a definition of this new technology on the first page of the online survey. The online survey link was advertised to targeted respondents through various communication channels (e.g. personal emails, social media groups and university mailing lists). In general, the research sample can be classified as Jordanian citizens who are internet users and have a basic understanding of CC and e-government services. The questionnaire includes four sections: (1) general respondent information; (2) respondents' perceptions about challenges and barriers facing acceptance of cloud-based public services; (3) respondents' perceptions of the security of cloud-based public services; (4) respondents' experience in internet and e-government usage. The questionnaire was carried out following the University of Bradford human research ethics.

VII. Data Analysis and Findings

The next sections highlight the key results and provide indications to the answer to the research question, drawing on the survey findings. An overview of the online survey is presented in the first section. Then, illustration of the implications of the study question with more details is presented in the second section.

A. Overview of the Online Survey

As outlined above, the online survey consisted of four parts. It was presented in Arabic for better understanding of its questions, as Arabic is the native spoken language for Jordanian citizens. However, an English survey was also designed for the purpose of the research. Involvement in the questionnaire was entirely voluntarily and informed consent was obtained through the first question in the cover sheet indicating that consent is explicit by the "yes" response to the question. The survey could be accessed through the online survey website eSurveyCreator.com. It was available "online" for one month to all Jordanian people worldwide. During that time, 187 responses were received. However, 23 were discarded because of missing or incorrect answers. Thus, a total of 164 responses were valid for the data analysis process, in order to identify the extent to which e-government challenges affect the acceptance of cloud services in the public sector from the Jordanian perspective and its influence on perceived security. People who understood cloud-based services (e.g. university students, ICT sector employees) were qualified participants. This stems from the fact that they are among the adult groups for whom the use of the internet has become an essential part of their daily life, and they have the required knowledge about CC services. Furthermore, since the development of cloud-based services in Jordan is in the early stages, the respondents will be the main potential users. So, knowledge of their understanding and perceptions is crucial to improving cloud-based e-government services. The analysis results are described below.

B. General (Demographic) Information:

Table 2 shows the respondent sample who answered the first section of the questionnaire by providing personal information. The majority of respondents were male (108), with 56 female respondents. The bias towards males is due to the fact that Jordan is considered a male-dominated society where the majority of elements of women's lives are at the mercy and authority their male relatives, this could affect various aspects such as conducting government transactions.

TABLE II. General (Demographic) Information From the Survey

Characteristics	Percentage(%)
Gender	
Male	66%
Female	34%
Age	
18-20	3%
21-30	68%
31-40	16%
41-50	11%
50+	2%
Education Level	
Secondary school or below	7%
Diploma	8%
Bachelor	63%
Postgraduate	22%
Residency Country	
Jordan or developing countries	78%
Developed countries	22%
Security Awareness Level	
Beginner	57%
Medium	32%
Advanced	11%

The subjects' ages mainly ranged between 21 and 30 years old (68%), consistent with the highest majority of internet users in Jordan. Most subjects had Bachelor's degrees (63%) which lies in agreement with the general distribution of Jordanian internet users. Seventy-eight percent of all subjects lived in Jordan or other developing countries, while 22% lived in developing countries such as the UK or USA. This overview of participants' general information will help in the results interpretation and answering the research question in the following sections.

C. Challenges to Cloud-Based E-Government Services Acceptance: Interpretation of the Study Question

According to the results, there are many barriers and challenges to e-government adoption and acceptance (e.g. technological, human, social and financial aspects). These inhibit the acceptance and use of cloud computing in the public sector from the Jordanian citizens' perspective (see Fig. 2). Table 3 lists these barriers, ranked based on the percentage of respondents who consider the challenge as either important or very important.

TABLE III. Barriers to Accepting Cloud-Based Services

Rank	Barrier	Percentage of respondents

1	Lack of awareness	63.4%
2	Security	61.2%
3	Culture	53.7%
4	IT infrastructure	44%
5	Website design	41%
6	Accessibility	31.8%
7	IT skills	27.6%
8	Availability	25%
9	Lack of budget / high cost	17%

Promotion is one of the most important factors for successful initiatives in the e-government context. For any new technology (e.g. cloud computing) there are a number of steps to encourage and convince citizens to use and accept it. Therefore, government's promotional activities will contribute significantly to accomplishing this aim. From the above table, it is evident that more than 63% of respondents cited the lack of awareness of cloud services and its advantages in the e-government context, as the number one barrier to the use and acceptance of cloud-based e-government services.

Security concerns are a serious technical obstacle identified in this study and are a well-documented issue for e-government systems adoption and implementation worldwide [8, 19, 27]. More than 61% of the participants in this research indicated security to be a significant concern, making it the second-ranked challenge to cloud-based e-government use and acceptance.

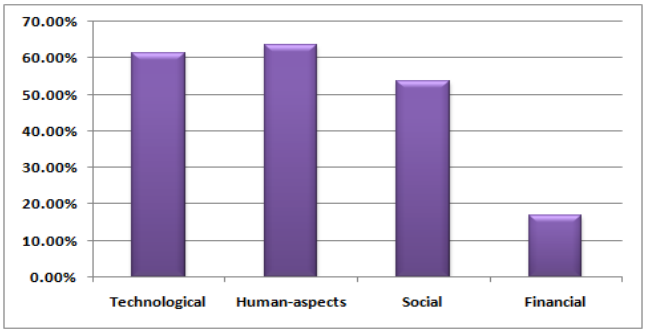

Figure 2. Challenges of Cloud Computing in the Public Sector

D. Security Perceptions of Cloud-Based E-Government Services

A number of e-government challenges noted in the survey influence the security perception of citizens towards cloud services. These were ranked based on the percentage of responses that indicated either strongly agree or agree (see Table 4).

TABLE IV. SECURITY BARRIERS TO ACCEPT CLOUD-BASED SERVICES

Rank	Barrier	Agreement
1	High level of security concerns regarding "cloud-based e-government" services are inspired by *non-technical* aspects (e.g. culture and awareness)	83.6%
2	Social relations and culture have a significant influence on the security of "cloud-based e-government" services	81.1%
3	Lack of security awareness is one of the main determinants of the user's perception regarding the security of "cloud-based e-government" services.	76.3%
4	Perceived security is a significant resource for public users' trust of "cloud-based e-government" services.	70.6%
5	The design of the "cloud-based e-government" website influences the users' perception of its security.	60.1%
6	There is a lack of security guidelines for using "cloud-based e-government" services, on the government website, social media or other media channels.	56.8%
7	There is a lack of regulations and policies to use cloud public services.	44.9%

Succeeding cultural inertia is one of the major difficulties of e-government use and adoption in developing countries [15]. This cultural issue has a different effect in developing and developed nations. Illustrating this, the percentage of respondents in Jordan and other developing countries *"who prefer to conduct online transactions*" is unequal to those in developed nations (see Fig. 3). The responses indicate that the primary reason is cultural differences, one of the participants living in Jordan commented: "*I've heard about many people whose money was stolen when they tried to buy online*" while a second said: "*Electronic transactions are not guaranteed, I prefer to contact the other person face-to-face and have a chance of discussion".* Therefore, it is important to train and educate citizens and draw their attention to the advantages, benefits and the facts about online transactions, in particular, cloud-based services for the government sector, through many promotional ways.

Figure 3. Preference for Using Online Transactions

VIII. CONCLUSION AND FUTURE WORK

Cloud-based service use is a current trend for e-government systems around the world. Governments, particularly in developing countries, can refer to the findings of this research to design and promote their services. For example, they can design various promotional programs for various users.

It is suggested to invest money in attractive and widespread awareness campaigns to encourage effective acceptance of cloud services. Also, people who conduct governmental transactions using cloud-services would have a discount on the transaction fees. This will help to increase the usage rate, especially for those who still refuse to use e-government services in general. The main objective of this paper is to draw upon the current perspectives of Jordanian citizens regarding the way in which e-government challenges affect the acceptance of cloud services in the public sector and to what extent these challenges influence the perceived security. This was conducted to support the decision-making process by the stakeholders of e-government, and to enhance cloud-based e-government services outcomes for Jordanian society. The challenges were identified through a relevant literature review and investigated by carrying out a survey. One of the significant findings is that security concerns play an important role in the acceptance of cloud-services in the government context (second rank), and hence an acceptance model would be required to take this into account. In addition, the non-technical aspects have a prominent importance among other security issues in the context of the study. Therefore, consideration of these challenges and their integration into the technology acceptance model is required for future research work. Due to its high explanatory power compared to the previous models and theories of IT acceptance, and also its appropriateness to e-government cloud-based services, the UTAUT2 model would be a superior selection as the base for the future proposed theoretical model to address the acceptance of these services.

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