CONCEPTUALIZATION OF ELECTRONIC GOVERNMENT ADOPTION

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ABSTRACT :

E-government facilitates provision of relevant government information in electronic form to the citizens in a timely manner and better service delivery to citizens. Information Technology today is recognized as an effective tool for turning the economic activity in efficient governance and in developing human resource. E-government is a kind of governmental administration which is based on ICT Services. The essence of e-government is using information technology to break the boundary of administrative organizations, and build up a virtual electronic government. E-government initiatives are common in most countries as they promise a transparent, citizen-centric government and reduce operational cost. Emerging with E-government, theories and practices of public administration have stepped into a new knowledge era. E-government presents a tremendous impetus to move forward with higher quality, cost-effective, government services and a better relationship between citizens and government. This paper discusses the different issues, challenges, adoption factors for e-government implementation, conceptual demarcation on these factors and, presents a conceptual framework for better e-government performance.

KEYWORDS :

e-government, definitions, services, adoption factors, and challenges.

1. INTRODUCTION

ICT is a key element of reform efforts that can help dramatically reshape government to improve performance and reduce costs. The current society had a phenomenal transformation due to the advance of Internet. It has opened a new medium of communication for individuals, business, and government organization, providing more opportunities to communicate and get information in an entirely new way. It has made governmental information and services accessible in ways that could not have been conceived two decades ago [1]. In the past, government organizations paid little attention to service quality or responsiveness to clients, but this changed with the approach of E-Government. E-government refers to the use by state authorities of ICT, in particular, the Internet and web-based technology, to deliver information and services and to encourage civic participation [2]. E-government is simply a facility using Information Technology (IT) to deliver public services directly to the customer, where the customers are citizens, business or other

government entity [3, 4]. This phenomenon of e-government is increasingly attracting the attention of community citizens including politicians, economists, decision and policy makers amongst others. It has improved managerial effectiveness, and promoted democratic values of public services. It has the promise of increasing accessibility to information, enhancing efficiency and facilitation of greater access to government officials [5, 6]. It is the medium of delivering improved services to citizens, businesses, and other constituents of society through drastically changing the way governments manage information. However, the e-Government challenge is not a technological one. Rather, the challenge is to use technologies to improve the capacities of government institutions, while improving the quality of life of citizens by redefining the relationship between citizens and their government [1]. The development of e-government also means increased electronic co-operation within and among public organizations which even puts demands on development that is not technology oriented. The development towards e-government involves social changes of work roles, attitudes and new competence needs [7].

2. E-GOVERNMENT

E-Government initially began as an intra-governmental communication tool. Initially the government organizations developed websites with information, then developed to online transactions - which made the citizens to engage in online participation that connect citizens and decision-makers [8–11]. E-government represents a fundamental change in the whole public sector structure, values, culture and the ways of conducting business by utilizing the potential of ICT as a tool in the government agency [12]. The Internet is indeed the most powerful and popular means of delivering the services to the customers or citizens. Hence, Web sites have been employed as a platform for delivering a wide range of government services electronically. E-government websites help citizens to gain information on government processes and services and hence participating in democratic processes from anywhere at any time. E-Government improves the efficiency and effectiveness all government operations, with citizens, as well as with other organizations.

Table 1: E-government Definitions

Citations	Definition
[16, 17]	E-government is defined as the use of ICT to make government more accessible, effective, and accountable.
[13, 18, 19]	E-Government refers to the delivery of [government] information and services online through the Internet or other digital means.
[20]	E-government refers to strategies, organizational forms and processes, as well as information technology employed so as to enhance access to and delivery of government information and services to citizens, businesses, government employees and other agencies.
[21, 22]	E-Government is the use of ICTs in public administrations combined with organizational change and new skills in order to improve public services and democratic processes and strengthen support to public policies.
[23]	E-government is the process of offering better government service to the public.

[13, 14]	E-government is defined as the combination e-administration and e-democracy to achieve the objective of balanced e-government.
[13, 18]	E-Government is the delivery of fast services to citizens, businesses, and other members of the society.
[24–26]	E-Government refers to the strategic application of ICT to "provide citizens and organizations with more convenient access to government information and services; and to provide delivery of public services to citizens, business partners and suppliers, and those working in the public sector"
[15, 27]	E-government is the continuous optimization of service delivery channel, citizen's participation and governance.
[15]	E-government can be defined as a way for governments to use the most innovative information and communication technologies, particularly web-based Internet applications, to provide citizens and businesses with more convenient access to government information and services, to improve the quality of the services and to provide greater opportunities to participate in democratic institutions and processes.

E-government applications include online payment of tax, bills, filling and submission of applications for several purposes; e-voting etc. e-Government gives citizens more control on interaction with the government; citizens can avail of the governmental services from anywhere and anytime [1]. E-Government is considered as tool for easy administration of governmental activities. Its success depends on its vast usage and management of its infrastructure. Utilization of e-government will provide benefits to the management philosophy of governments. Thus the citizens can collaboratively participate in decision making [13, 14]. Initially E-Government incurs a great cost in building infrastructure but gradually it implementation results in vast savings towards government's activities. It also increases transparency, and reduce corrupt activities in public service delivery. Table 1 depicts E-Government defined by various related study in the near past.

3. E-GOVERNMENT SERVICES

Like any other electronic services, e-government also constitutes various types of services. According to Fang [15] different types of e-government services are categorized in to eight types. 1) Government-to-Citizen (G2C); 2) Citizen-to-Government (C2G); 3) Government-to-Business (G2B); 4) Business -to-Government (B2G); 5) Government-to-Employee (G2E); 6) Government-to-Government (G2G); 7) Government-to-Nonprofit (G2N); 8) Nonprofit-to-Government (N2G). Table 2 gives definition for these of e-government services.

4. DISCUSSION : E-GOVERNMENT ADOPTION FACTORS

The adoption factors for e-government services should be thoroughly known before any adoption model is constructed. . Many researchers have understood the initiatives that encourage the adoption of e-government services in different environments. These studies have shown that despite different environments having different characteristics, there are general initiatives that promote e-government adoption by ordinary citizens. However, it is worth mentioning that certain situations have unique factors which may either impend or aid the adoption of e-

government services. In order to have a basic understanding of these varying factors, this study review's the adoption models that have been studied in different locations. The factors that influence the adoption of e-government websites are in-formation quality, system quality and service quality. Information quality is concerned with the measure of the information that the system produces and delivers i.e., characteristics of information produced by e-government Web sites. Quality of information is believed to be the most salient factor for predicting customer decision-making behavior and user intention to use a particular system [30]. The fundamental dimensions of information quality are composed of five dimensions: accuracy, timeliness, relevance, understandability, and completeness [31–33].

Table 2: E-Government services

Types	Definition
Government-to-Citizen (G2C)	It is an e-government service, from government to citizen in the form of offering valuable information and know-how's.
Citizen-to-Government (C2G)	It is an e-government service, offered for payment of bills and other valuable feedback from the citizen to government.
Government-to-Business (G2B)	It is an e-government service providing transactions and procurement facilities for government purchases and call for tenders.
Business -to-Government (B2G)	It is an e-government service providing communication, collaboration, transactions and procurement of goods and services for business initiatives.
Government-to-Employee (G2E)	It is an e-government initiative that will facilitate the management of the civil service and internal communication with governmental employees to encourage paperless office.
Government-to-Government (G2G)	It is an e-government initiative to provide the Government's departments or agencies cooperation and communication online. It includes internal exchange of information and commodities.
Government-to-Nonprofit (G2N)	It is an e-government initiative that provides information and communication from government to nonprofit organizations, political parties and social organizations, Legislature, etc.
Nonprofit-to-Government (N2G)	It is an e-government initiative that enable exchange of information and communication from non-profit organization to government organizations, political parties and social organizations, Legislature, etc.

System quality refers to the features and performance characteristics of e-government Web sites regarding the quality in use or the citizen's view of quality. It is an important determinant of user acceptance, user satisfaction and system use. In order for the citizens to continually use the e-government website or for the successfulness of e-government website system quality should be high. Service quality refers to the quality of personal support services provided to citizens through e-government Web sites, such as answering questions, taking requests, and providing sophisticated solutions to citizen's problems. It is an important determinant of customer satisfaction and is needed as citizens differ in knowledge, education and experience [30]. Quality

of service is composed of five dimensions: tangibles, empathy, reliability, responsiveness and assurance [34]. Choudrie and Dwivedi [35] found that citizens' awareness as a factor for the adoption of e-government. Citizens with fulltime internet access are more likely to be aware of and adopt e-government services. These authors also add that the demographic characteristics of citizens such as the age, gend-er, education, and social class have an imperative role in explaining the citizen's awareness and adoption of e-government services. While, Warkentin [36] proposed a e-government adoption conceptual model with citizen trust as the underlying catalyst. The author proposes perceived risk, perceived behavioral control, usefulness, and perceived ease of use. Perceived risk is normally defined as a fear of losing personal information or money, and fear of being spied on the Internet. Warkentin states that Perceived risk is negatively related to adoption. The author posits that the perception that an individual has of control over how personal information will be used, and control over how and when information can be acquired, could encourage adoption. Perceived usefulness on the other hand is simply defined as the utility of the system to the user, and perceived ease of use is termed as a system that is easy to use [36].

Alomari, Woods and Sandhu [37] attempted to identify the main factors that influence citizens' intention to adopt e-government websites in Jordan, using a theoretical framework consisting of Diffusion of Innovation Theory (DOI) and the Technology Acceptance Model (TAM) and, they found that Trust in government, website design, beliefs, complexity and perceived usefulness were significant factors in Jordanian citizens' intention to use e-government websites. Deltor and Hupfer [38] identified internal factors within government that affect the adoption and use of government websites and suggest that Partner cooperation, Ability to change internal work processes, IT workforce, funding, citizen participation in design, portal strategies and policies, leadership, marketing and governance as factors for e-government adoption. Chen et.al [39] uses UTAUT model to study on the factors affecting e-government adoption and found that performance expectancy, effort expectancy, social influence, and facilitating conditions impact citizen satisfaction. Rokhman [40] Conducted citizen's willingness to accept and adopt e-government services and found that relative advantage and compatibility proven as useful factors to predict intention to use e-government services. Gilbert and Balestrini [41] bring attitude-based and service-quality-based approaches together. They propose perceived (confidentiality, ease of use, safety, reliability, visual appeal and enjoyment) and perceived relative benefits as the adoption factors for e-government. Phang et al., [25] made a study on senior citizen's adoption of e-government and they found that compatibility, personal image, perceived ease of use and internet safety perceptions are the main factors for e-government adoption. Table 3 shows brief classification of the adoption factors. These adoption factors of e-government were not classified properly in previous literatures. This study demarcates the adoption factors as technological, financial, website quality, user/human, managerial and political perspectives as described in table 3

Table 3: E-government adoption factor

Factors	Items	Description	Studies
Technological	Standardization procedures, technical infrastructure, security measures[data and software protection, data transfer over networks, safety of electronic payments	The degree of Technological ability achieved for Effective E-Business adoption.	[10, 13, 43–45]

Financial	Appropriate budget allocation, commitment of funding	The degree of Technological ability achieved for Effective E-Business adoption.	[20, 45]
Web site quality	Information quality, system quality, service quality, perceived usefulness, perceived ease of use, user friendliness of the system, scope of the system, Multi-lingual and multi-cultural Issues, protection of information assets, maintain integrity of electronic records, compatibility, internet safety perceptions.	The degree of Web site quality ability achieved for Effective E-Business adoption.	[46, 47]
Human or user	ICT skills, technology expertise, perceived behavioral control, age, Perceived risk ,Uncertainty avoidance, trust, Security, privacy, Fears for job loss by the adoption of new technologies and procedures, Past experience specific to the project, Communication skills, ease of access to the system, cost of use of the system, local language, personal image.	The degree of user ability achieved for Effective E-Business adoption.	[36, 41]
Managerial	Technology culture of management Personnel, Project familiarization of management Personnel, project management, appropriate hierarchy in management, qualifications of the officials, active support from management, Lack of IT knowledge staffs, lack of IT full time employees, staff, Awareness and training	The degree of Managerial ability achieved for Effective E-Business adoption.	[45]
Political	Long-term, unified support, Technology culture of political leadership, Project familiarization of political leadership, Jurisdiction conflict resolution between government agencies, statutory/legislative requirements, Regulatory barriers; regulatory support.	The degree of Political ability achieved for Effective E-Business adoption.	[45]

The successful adoption of e-government can be achieved by developing a set of e-government competencies/adoption factors and investigating the significant relationships of those factors on its performance. The support from the top management for the implementation of e-government process is an important factor.
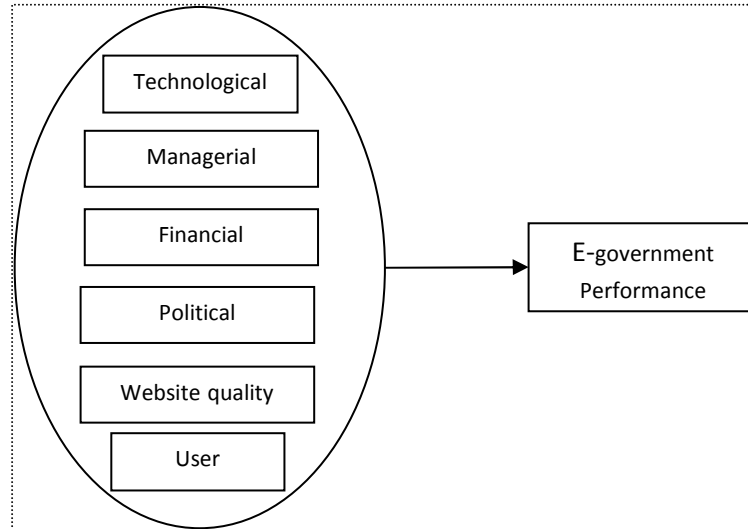

Figure 1: E-government adoption: A Conceptual Competency Framework

The IT manger must consider all the newly developed technologies and should choose the best one which is more flexible and suitable to particular system. But using a modern system which is more expensive must be given a second thought; i. e, if the system gives much improved efficiency and helps to cut cost in other way, then it should be considered , because adoption of e-government aims at decrease in coordination cost too. As far as citizens are concerned, they play a major role in e-government success. Hence when an e-government project is implemented it should take care of the factors influencing the end user's willingness to use that particular system. Attainment of trust of the end user is important and also risk and security related problems should be considered and eliminated. Also the language of the website is important; local language should be preferred when it is to be used by the common man. Integration of the back office is another concern for success. If there is no integration then it will lead to overloading of the users and hence multiple collection of same information by different departments which is a wastage of efficiency and time of public services. Figure 1 is the conceptual framework for e-government adoption which shows the major competences to achieve the best E-government performance.

5. DISCUSSIONS: E-GOVERNMENT CHALLENGES

Implementation of e-government projects can cause number of challenges as it is the redefining of complete government processes. There are a number of impediments that potentially block e-Government adoption. Barriers can be any factors that cause hindrance to government in developing new or further improving the existing e-government applications. Initial use of e-government Web sites is an important indicator of e-government success. Some information system research indicated that its eventual success depends on its continued use rather than first-time use [17, 28, 29]. However, the desired outcome is not achieved unless a significant number of citizens move beyond the initial adoption and use e-government web sites on a persistent basis

[17]. According to case studies from different countries, there are many challenges and issues that need to be addressed for successful implementation of e-government. There are distinct factors that command the adoption of e-government, and these factors depend on the local context of any country. But there is no clear classification of these adoption factors. Warkentin et al [36] describes e-government adoption as the citizen intention to participate in government activity electronically to receive information and request services from the government. According to Carter and Belanger [42] it is intent to use, while Gilbert and Balestrini [41] measure it as willingness to use e-Government services. Altogether it can be stated as a simple decision to use, or not to use, e-governement services. The next level of challenge of e-government is to make it frequently used by the citizen. Using e-government service once in a year would not be considered as a meaningful usage of its application. Citizens technical awareness – on how to adapt to frequent technical changes in the services – is another very important challenge of adoption. The successful adoption of e-government can be achieved by developing a set of e-government competencies/adoption factors and investigating the significant relationships of those factors on its performance.

6. CONCLUSION

Advances in ICTs are giving organizations a new competitive edge. Growing impact of ICT, surge in the usage and adoption of E-government services. The globalization of organizations facilitated by the advent of telecommunications and internet technologies has promoted adoption of E-government. The best practices of E-government are revolutionizing not just technology itself but the whole process through which services are provided. This study helps better understand E-government and identifies various competence factors like technological, managerial, political, user and website quality for E-government adoption. This study presented a conceptual framework which can be empirically tested to understand and measure the E-government performance. This study would provide researchers to do an empirical examination on the identified factors of E-government with its performance .This study would also help managers decide to what extent their organizations should invest in E-government by matching the E-government attributes to their own organization's characteristics. Our investigation of E-government adoption factors may help both researcher and potential adopters.

REFERENCES

[1]   Kumar, V., Mukerji, B., Butt, I., Persaud, A.: Factors for Successful e-Government Adoption: a Conceptual Framework. The Electronic Journal of e-Government. 5, 63 – 76 (2007).
[2]   Luk, S.C.Y.: The Impact of E-government in Greater China: Case Stu-dies of Hong Kong,Taiwan, and Singapore. Presented at the 17th Bienni-al Conference of the Asian Studies Association , Australia July (2008).
[3]   Ghapanchi, A., Albadvi, A., Zarei, B.: A framework for e-government planning and implementation. Electronic Government, An International Journal. 5, 71–90 (2008).
[4]   Metaxiotis, K., Psarras, J.: A conceptual analysis of knowledge man-agement in e-government. Electronic Government, An International Journal. 2, 77–86 (2005).
[5]   Koh, C., Ryan, S., Prybutok, V.: Creating Value Through Managing Knowledge in an E-Government to Constituency(g2c) Environment. Journal of Computer lnformation System. 45, 32–41 (2005).
[6]   Groznik, A., Kovacic, A., Trkman, P.: The Role of Business Renovation and Information in E-Government. Journal of Computer lnformation System. 81–89 (2008).
[7]   Grundén, K.: A Social Perspective on Implementation of e-Government - a Longitudinal Study at the County Administration of Sweden. Elec-tronic Journal of e-Government. 7, 65–76 (2009).

[8]   Calista, D., Melitski,, J.: e-Government and E-governance: Converging Constructs of Public Sector Information and Communications Technologies. Public Administration Quarterly. 31, (2007).

[9]   Holzer, M., Melitski, J., Rho, S.-Y., Schwester, R.: Restoring Trust in Government: The Potential of Digital Citizen Participation. IBM En-dowment for the Business of Government., Washington, DC (2004).

[10]   Schwester, R.: Examining the Barriers to e-Government Adoption. Elec-tronic Journal of e-Government. 7, 113–122 (2009).

[11]   Moon, M..: The Evolution of E-Government Among Municipalities: Rhetoric or Reality? Public Administration Review. 62, 424–433 (2002).

[12]   Alshehri, M., Drew, S., Alfarraj, O.: A Comprehensive Analysis of E-Government Services Adoption in Saudi Arbaia: Obstacles and Chal-lenges. International Journal of Advanced Computer Science and Appli-cations. 3, (2012).

[13]   Bwalya, K..: Factors Affecting Adoption of E-Government in Zambia. The Electronic Journal on Information Systems in Developing Countries. 38, 1–13 (2009).

[14]   Coleman, S.: African e-Governance – Opportunities and Challenges. Ox-ford University Press, University of Oxford (2006).

[15]   Fang, Z.: E-Government in Digital Era: Concept, Practice, and Devel-opment. International Journal of The Computer, The Internet and Man-agement. 10, 1–22 (2002).

[16]   InfoDev and CDT: The E-government Handbook for Developing Coun-tries. InfoDev and The Center for Democracy & Technology (2002).

[17]   Wangpipatwong, S.: Quality Enhancing the Continued Use of E-Government Web Sites: Evidence from E-Citizens of Thailand. Interna-tional Journal of Electronic Government Research. 5, 19–35 (2009).

[18]   Kumar, V., Mukerji, B., Butt, I., Persaud, A.: Factors for Successful e-Government Adoption: a Conceptual Framework. The Electronic Journal of e-Government. 5, 63 – 76 (2007).

[19]   Muir, A., Oppenheim, C.: National Information Policy developments worldwide in electronic government. Journal of Information Science. 28, 173–186 (2002).

[20]   Kefallinos, D., Lambrou, M.., Sykas, E..: An Extended Risk Assessment Model for Secure E-Government Projects. International Journal of Elec-tronic Government Research. 5, 72–92 (2009).

[21]   Akesson, M., Skalen, P., Edvardsson, B.: E-government and service orientation: gaps between theory and practice. International Journal of Public Sector Management. 21, 74–92 (2008).

[22]   Commission of the European Communities: The Role of eGovernment for Europe's Future. Communication No. 567, The Commission, Brus-sels. (2003).

[23]   Sridhar, S.: E-Government - a Proactive Participant for E-Learning in Higher Education. Journal of American Academy of Business,. 7, 258–268 (2005).

[24]   Gronlund, A.: Introduction. Electronic Government: Design, Applica-tions & Management,. Idea Group Publishing, PA, Hershey, US, (2001).

[25]   Phang, C.., Sutano, J., Li, Y., Kankanhalli, A.: Senior Citizens' Adoption of E-Government: In Quest of the Antecedents of Perceived Usefulness. Presented at the , Hawaii (2005).

[26]   Turban, E.., King, J., Lee, M., Warkentin, M., Chung, H..: Electronic Commerce 2002: A Managerial Perspective. Prentice Hall, Upper Saddle River,NJ (2002).

[27]   Baum, C.., Di Maio, A., Caldwell, F.: What Is E-Government? Gartner's Definitions. (2000).

[28]   Bhattacherjee, A.: Understanding Information Systems Continuance: An Expectation-Confirmation Model. MIS Quarterly. 25, 351–370 (2001).

[29]   Limayem, M., Hirt, S.., Cheung, C.M..: Habit in the Context of Is Conti-nuance: Theory Extension and Scale Development. Presented at the 11th European Conference on Information Systems (2003).

[30]   DeLone, W.., McLean, E..: Information Systems Success: The Quest for the Dependent Variable. Information Systems Research. 3, 60–95 (1992).

[31]   Bailey, J.., Pearson, S..: Developing a Tool for Measuring and Analyzing Computer User Satisfaction. Management Science. 29, 530–545 (1983).

[32]   Doll, W.., Torkzadeh, G.: The Measurement of End-User Computing Sa-tisfaction. MIS Quarterly. 12, 259–274 (1988).

[33]   Wang, R.., Strong, D..: Beyond Accuracy: What Data Quality Means to Data Consumers. Journal of Management information Systems. 12, 5–34 (1996).

[34] Parasuraman, A., Zeithaml, V.A., Berry, L..: SERVQUAL: A Multiple-Item Scale for Measuring Consumer Perceptions of Service Quality. Journal of Retailing. 64, 12–40 (1988).

[35] Choudrie, J., Dwivedi, Y.: A Survey of Citizens Adoption and Awareness of E-Government Initiatives, the Government Gateway: A United Kingdom Perspective. , Brunel University, West London. (2005).

[36] Warkentin, M., Gefen, D., Pavlou, P.., Rose, G..: Encouraging Citizen Adoption of e-Government by Building Trust. Electronic Markets. 12, 157–162 (2002).

[37] Alomari, M.K., Woods, P., Sandhu, K.: Predictors for E-government Adoption in Jordan: Deployment of an Empirical Evaluation Based on a Citizen-centric Approach. Information Technology & People. 25, (2012).

[38] Deltor, B., Hupfer, M.E.: Internal Factors Affecting the Adoption and Use of Government Websites. Electronic Government, an International Journal. 7, (2010).

[39] Chan, F., Thong, J., Venkatesh, V., Brown, S., Hu, P.J.., Tam, K..: Mod-eling Citizen Satisfaction with Mandatory Adoption of an E-Government Technology. Journal of the Association for Information Systems. 11, 519–549 (2010).

[40] Rokhman, A.: E-Government Adoption in Developing Countries; the Case of Indonesia. Journal of Emerging Trends in Computing and Infor-mation Sciences. 2, 228–236 (2011).

[41] Gilbert, D., Balestrini, P.: Barriers and Benefits in the Adoption of E-Government. International Journal of Public Sector Management,. 17, 286–301 (2004).

[42] Carter, L., Bélanger, F.: The Utilisation of E-Government Services: Citi-zen Trust, Innovation and Acceptance Factors. Information Systems Journal. 15, 5–25 (2005).

[43] Andersen, K.V.: e-Government: Five Key Challenges for Management. The Electronic Journal of e-Government. 4, 1–8 (2006).

[44] Azab, N.., Kamel, S., Dafoulas, G.: A Suggested Framework for Assess-ing Electronic Government Readiness in Egypt. Electronic Journal of e-Government. 7, 11–28 (2009).

[45] Smith, S., Jamieson, R.: Determining Key Factors in E-Government In-formation System Security. Information Systems Management. 23, 23–32 (2006).

[46] Pitt, L.., Watson, R.., Kavan, C..: Service Quality: A Measure of Infor-mation Systems Effectiveness. MIS Quarterly. 19, 173−185 (1995).

[47] Reichheld, F.., Markey, R.., Hopton, C.: E-Customer Loyalty – Applying the Traditional Rules of Business for Online Success. European Business Journal. 12, 173–179 (2000).

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