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Investigating electronic government maturity models

Investigación de modelos de madurez de gobierno electrónico

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Resumen: El gobierno electrónico es uno de los fenómenos más importantes en el uso de la tecnología de la información y las comunicaciones, cuya implementación tiene un cambio profundo en la forma de vida, administración y liderazgo de los países y es una combinación de tecnología de la información y red de información web, que tiene como objetivo proporcionar servicios directos a ciudadanos, empleados gubernamentales, empresas y otros departamentos gubernamentales. El propósito de este estudio es investigar los modelos de madurez del gobierno electrónico. En el presente estudio, el método de revisión se ha utilizado para investigar diferentes modelos de madurez del gobierno electrónico. Luego de revisar todos los modelos, se determinó que en la mayoría de ellos se han considerado cuatro factores, que son: 1) presencia a nivel web, 2) la interacción de gobierno y ciudadanos, 3) transacción y 4) integración.

Palabras clave: Gobierno electrónico, modelo de madurez, tecnologías de la información y la comunicación.

Abstract: Electronic government is one of the most important phenomena in the use of information and communication technology, the implementation of which has a profound change in the way of life, administration and leadership of countries and is a combination of information technology and web information network, which aims to provide direct services to citizens, government employees, businesses and other government departments. The purpose of this study is to investigate the maturity models of electronic government. In the present study, the review method has been used to investigate different models of e-government maturity. After reviewing all the models, it was determined that four factors have been considered in the majority of them, which are: 1) presence at the web level, 2) The interaction of government and citizens, 3) transaction and 4) integration.

Keywords: Electronic government, maturity model, information and communication technology.

1.INTRODUCTION

At present, information technology has had a profound effect on a variety of phenomena, including government and public institutions, so that with the understanding of the need to establish e-government, the provision of e-services is seriously on the agenda of governments. Thus, the concept of e-government has been widely studied in recent decades. E-government has the potential to reshape the public sector and re-establish the relationship between government and citizens. In this case, government agencies will be required to regulate their relationships with citizens, businessmen, government employees, and other public and private institutions (Kim and Grant, 2010). Governments need to find a newer and more creative perspective on people who are to be served and have real power in their hands, as an integral part of their approach to e-government, and to expand freedom of information so that they can increase accountability, and take steps to achieve their goals (Reddick, 2011). Increasingly, people's expectations of services, as well as the way and quality of its delivery, are changing, and the government must meet these needs and expectations. The form of government for these expectations is now e-government (Waseda, 2013). They want the working hours of government institutions to be increased, don't procrastinate in queues, get better and cheaper services and products, and things like that the most responsible government employees can do their job simply and efficiently, just like employees in the business world (Van der Mero, 2014). An effective establishment e-government strategy will lead to significant improvements, such as the following in government; Facilitate service to citizens, eliminate categories of public administration (government size reduction), facilitate the acquisition of information and services by citizens and companies, as well as government-affiliated organizations, facilitate organizations work processes and reduce costs by integrating and eliminating additional and parallel systems. Parallel (Holman, 2015).

The growth and development of e-government is a very complex social, cultural, political and technical issue. The quality of an e-government depends on several factors, such as the government information policy, the number of users and their motivation, and the level of education across the country and the government body (Tohidi, 2011). The readiness to accept e-government in different countries varies considerably. The desire for a national e-government depends on factors such as the accessibility of the economy, human resources, technological resources, the government's desire to understand and meet the needs of the people, language, trust and confidentiality (Khalil, 2011). Numerous factors contribute to the maturity of e-government, all of which are due to the growth of technology and the complexity of human life. Governments have to respond to e-government to address this complexity. The most important factors in the need to create maturity in e-government are:

1- Widespread Global Network Growth: Today there is talk of global broadband in museums, radio, television, magazines, articles, etc. Most organizations now have websites and try to do their daily work by connecting to this network.
2- Network-Based Growth: In industrialized countries, most people have access to the network at home, at work, at school, and elsewhere. With the expansion of citizens' use of networks, it is essential that government services be made available to them.
3- Reduce costs: Advancing things in the traditional way costs more than using the Internet and the network, and is cheaper in terms of time and the use of office supplies such as paper. Of course, Internet interactions are cheaper, but the costs associated with the Internet may increase before full utilization of communication networks.
4- Rising public expectations: The development of e-commerce and its increasing use also increases citizens' expectations of governments in doing related things (Ghorbanizadeh et al., 2014).

The aim of this study is to investigate the maturity models of e-government inside and outside Iran. The field of e-government today has made it possible for governments to use new information technologies to provide the information and services needed by society easily, quickly and efficiently in the shortest time and at the lowest cost. The Internet is the best way to provide services and information (Phala, 2012). As a result, this study examines the maturity models of e-government.

2. REVIEWING THE LITERATURE

Given the importance of e-government, many researchers have researched this issue, some of which are discussed below. In their research, Townsend et al. (2016) identified the electronic city as an advanced and compact city with high technology that brings people, information, and urban elements with new technologies to create a sustainable, greener city, innovative and competitive business, and a High-quality life connects considered. In his paper, Ojo et al. (2015) stated that e-government is understood as a specific intellectual ability that addresses various dimensions of innovative socio-economic and technical-social development (green and connected). These dimensions lead to the concept of e-government So that "green" referring to urban infrastructures to protect the environment and reduce greenhouse gas emissions, and "interconnected" to the development of a broadband economy. Albino (2015) attempts to describe the characteristics of four-dimensional e-government, from the research done, we can see that increasing citizen satisfaction, reducing energy consumption, increasing efficiency, productivity, reducing the digital divide and increasing speed and quality and the accuracy of providing services to citizens are among the advantages of e-government maturity. In a study, Mosananzadeh and Teratob (2014) conclude that despite widespread debate about e-cities, there is no

consensus on the definition of these cities. He has started all the settlements that have made conscious efforts to invest in information and communication technologies and look at strategic ways. Anastasya (2012) points out in her study that the advances in broadband network greatly affect the interaction potential of different actors by providing access to information and knowledge resources throughout the city, as well as a wide range of tools to connect locally and globally, is affected.

3. Research method

This research is both fundamental and applied. In the present study, the review method has been used to examine different models of e-government maturity and to collect the required data, library resources and internet search including books and articles and Persian and Latin case studies have been used and different e-government maturity models have been studied.

4. Data analysis method

Activities for e-government projects can be categorized according to the stages of development. It may take a long time to evolve and evolve due to a variety of political, economic, and technological reasons, the creation of e-government, and the completion of related projects and activities. It may take a long time and evolve for political, economic, and technological reasons to create e-government and complete related projects and activities. That's why some e-government experts have decided to draw a clear vision for the e-government by designing a step-by-step model, and by clarifying the implementation steps, public sector agents will help to more accurately assess the progress of the implementation. Although the patterns differ in the number of deployment steps, they are inherently common, which has led them all to pay attention to the implementation of e-government.

- Study of different models of e-government maturity
  The following to study of different models of e-government maturity:

Table 1- Maturity models of e-government

Model name / steps	**Step 1**	**Step 2**	**Step 3**	**Step 4**	**Step 5**	**Step 6**
Layne and lee	Catalog	transaction	Vertical integration	Horizontal integration		
Andersen and Henriksen	Cultivation	Development	Maturity	Revolution		

United nations	The emergence of intelligence services	Development of intelligence services	Transaction services	Connected services		
Alhomod	Web presence	Interaction between citizen and government	Full transaction on the web	Services integration		
Hiller and Belanger	Information	Bilateral communication	transaction	Integration	Cooperation	
Almazan and Gil-Garcia	Presence	Information	Transaction interaction	Integration	Political participation	
Cisco	Information interaction	Transaction efficiency	Citizen-centered transformation			
Gartner Group	Web presence	Interaction	transaction	Transformation		
West	billboard	Provide part of the service	portal	Interactive democracy		
Moon	Simple information distribution	Bilateral communication	Service and financial transactions	Integration	Political participation	
World Bank	Release	Interaction	transaction			
Deloitte and Touche	Dissemination of information	Official bilateral transactions	Multifunctional portals	Personalize portals	Category of similar services	Complete integration and organizational transactions
Howard	Release	Interaction	transaction			
Shahkooh	Online presence	Interaction	transaction	The government is completely integrated and transformed	Digital Democracy	The government is interconnected
Chandler and Emanuel	Information	Interaction	transaction	Integration		
Kim and Grant	Web presence	Interaction	transaction	Integration	Integrated recovery	
Chen	Catalog	transaction	Integration			

Windley	Simple web site	Government on the line	Integrated government	The government has changed		
Reddick	Catalog	transaction				
Accenture	Presence on the initial capability line	Availability of services	Provide adult service	Transformation of services		
The UK National Audit	Simple site	Electronic publishing (providing one-way information)	Electronic publishing (receiving and sending bilateral information)	Transaction	The government is interconnected	

Since e-government implementation models are based on the strategies of each government, they play a very important role in the success and failure of an e-project, so here is a brief description of implementation models and approaches.

- **Howards three-step model**

Howard proposed a model based on which in the first stage of creation, information about government activities is made available online, and in the second phase, citizens will be able to engage in simple interactions such as sending e-mails or using chat rooms. In the third stage, citizens can benefit from fully useful transactions on the Internet, such as the use of application software, licenses, purchase of licenses and other services (Howard, 2001).

- **Layneh and Lee four step model**

According to layneh and Lee famous article, four steps are necessary for the implementation of e-government based on the Internet and new digital methods. Innovations of this model are used at both local and central government levels. This model is based on a series of technical, organizational and managerial feasibility studies, and in each step, in addition to a precise definition, challenges and problems are addressed. Considering that this model has been used frequently in the literature, especially in the implementation of electronic municipalities, and considering the applicability and adaptation of its concepts to the situation of the municipal system in Iran, in this study, this model was one of the main foundations used in analysis and interviews.

The first stage, Listing: Having a government website at this stage is essential to responding to the growing demand of citizens and the enormous pressure of information technology requests, so that these requests are transmitted to the network and government information is searched instead of scattered spots, Located on an official and government website. Usually on the site, topics are categorized and listed

based on the tasks and list of ministries. At this stage, from the electronic point of view, only a number of forms and requests are provided to the clients, and it is still possible to have both physical and electronic access.

The second stage: Transaction: In this step, communication methods are set up in such a way that the relationship is two-way. In this case, the ability of citizens to play a more active role and more direct communication is increased. At this stage, instead of downloading the forms and permissions, it is possible to complete and send the forms online, and the government is responsibly present on the other side. Vehicle registration, tax payments, and other transaction-based services take place at this stage.

The third stage is vertical integration: the goal of this stage is the integration of systems at different local, regional and national levels. Physically, at this stage, a central database is created, or at least different databases are able to communicate with each other, and scattered systems are integrated at different local, provincial, and national levels.

Technological change will inevitably lead to organizational change at this stage. For example, at this stage, as soon as a citizen completes a form to obtain a government license. The information in this form will be automatically recorded in the database of other states, and if this license is heavy for drivers of vehicles, for example, it will be possible to travel elsewhere. G2B or G2G transactions are performed at this stage. The fourth stage, horizontal integration: Citizens can best meet the various needs of education, health, education, housing, food, etc, with the help of e-government at this stage. The integration of different functional areas is done at this stage. System integration does not appear in part, but in its entirety. A transaction that takes place in one enterprise can be automatically accessed by another state-owned enterprise. From the citizens' point of view, access to integrated horizontal government services in crossing different functional walls to achieve a complete IT Petancel (Layneh and Lee, 2001).

- **Gartners four step model**

To measure the progress of e-government initiatives and create a roadmap for accessing the levels of the Gartner e-government four-step model, the Gartner Research Group's services conducted a study that is more complex than ever before and enters a new phase. The first step is to provide simple information through a website with a static and inactive nature that becomes a pamphlet and plays a role on the same paper level as the offices. In the second stage, simple interactions between government and citizens (G2C), government with jobs (G2B) or government departments with each other (G2G) take place. At this stage, websites provide e-mail services and create forms to meet the needs of users. In the transaction stage, using reengineering and customer relationship management as well as portfolio management, it has entered a more advanced phase and while maintaining security

and privacy, the necessary resources for investment, tax payment and financial transactions have been made while re-creating business processes increase cooperation and coordination between organizations and departments. At the stage of transformation, which is the highest stage, they are closest to e-government, and government innovations and practices are fully organized and integrated. Thus, the greatest achievement of this phase is the formation of new processes and practices and the move towards digital democracy for the participation of citizens in democratic processes (Baum and Di, 2002).

- **The four-stage IBM model**

While citizens are constantly learning how to raise their expectations of government, e-government must become a set of organizations that are fully flexible and focus on the outcome and outcome of its activities. To do this, governments have to increase their capacities to meet the growing needs of citizens. An environment that can meet the demand and needs of such needs requires an open and scalable infrastructure, new technologies, and a completely dedicated and targeted implementation with re-engineering processes. According to this model, the evolution of e-government can have 4 stages or 4 waves of change. The first step, automation: This step focuses on the citizens and the creation of the website, and is really simple and straightforward. Second step, upgrade: expand access and be useful. To achieve this, governments must not make many changes to existing policies and practices. Third stage, integration: Progress towards the third wave of evolution is difficult, and governments must have a scheduled and integrated program to transform business processes and integration.

The fourth stage: To progress to the fourth wave, which is to become a demand-based model, three aspects of business model transformation, infrastructure conversion, and culture conversion must be considered.

- **The five-stage model of Ghasemzadeh and Safari**

In order to develop and implement e-government in Iran, government must design an executive inter-functional organization such as the management and planning organization to plan and manage e-government development in Iran. The Gartner model has been used with some adaptation and customization in this five-step model.

Step 1: Setting up a portal is the first step towards e-government, creating a public highway that needs to be developed and expanded from the Internet. This portal increases people's access to government websites.

Step 2: Attendance is the second phase of e-government development and setting a time frame for all government agencies that do not yet have a website that during this period, they should prepare a network platform on the internet and

communicate with citizens. At this stage, even creating a home page and entering the address and phone number can be better than not having a government agency present.

Step 3: Interaction in the third phase, e-government implementation creates a two-way communication between the government and users, and government websites provide more advanced services such as downloadable electronic documents and forms, interactive forms, and searchable databases.

Step 4: Transaction, in the fourth phase, people and businesses will be able to receive the full service via the internet using their applications. Such as tax forms, invoice payment, procedures and licenses and credentials.

Step 5: Transformation, at this stage, the development of e-government is recognized by virtual offices that exist only in cyberspace. In this phase, government services appear to be integrated, and citizens do not need to know by which public sector the service is provided.

- **The five-step model of the United Nations**

Based on research conducted by the United Nations, a five-step model has been proposed for the implementation of e-government and the evolution of countries. The emphasis of this model, which has a practical approach, is on users and the type and number of services provided to them. In the first stage, information is created in a static and limited way on the government website. In the second stage, this information will be updated as a rule, and then in the third stage, which will be adjusted based on the needs of users and clients, they will be able to receive forms and search for products and services and interact with relevant organizations and officials.

In the next step, users will be able to perform complete transactions such as obtaining visas, credentials, visas, birth and death registrations, etc., all of which will be done online and in a completely secure manner and in terms of security policies. The fifth stage is the highest level of integration and passing of administrative and managerial boundaries, which leads to the full realization of e-government (United Nations, 2012).

- **Hiller and Belangers five-step model**

Step 1: Dissemination of information is the simplest form of e-government, there are thousands of such sites. The biggest challenge at this stage is to be sure of access, accuracy, and updating.

Step 2: Bilateral communications, at this stage, government websites allow requests and changes to be made by citizens or other agencies. The government's response is not immediate and online, as is the response to e-mails is done at the right time.

Step 3: The transaction, the government is ready to do the transactions completely networked through the web and automatically. Online transactions will be professionally available at this level of e-government.

Step 4: Integration, all government services are integrated. A single portal can provide users with all services regardless of which department or department they belong to. A single portal can provide users with all services regardless of which department or department they belong to.

Step 5: Political Participation, at this stage, government sites offer online voting, online registration, etc., although this seems to be a two-way interaction, however, due to the sensitivities that transactions in this area have in terms of privacy and security, it is considered separately.

- **The six-step model of Delloitte**

According to the delloitte Research Group, the steps for implementing and developing e-government are as follows:

Step 1: creating websites by departments and agencies for one-way communication.

Step 2: Enabling users to interact electronically with government services such as re-credit for TV and ticket purchases, and etc.

Step 3: Enabling users and citizens to access government services and information from a single point.

Step 4: Provide business opportunities for citizens by customizing the portal according to their needs.

Step 5: By upgrading and improving portals, government agencies and departments will overtake and compete to deliver public services.

Step 6: Government organizations are out of multiplicity and disappear from the eyes of users and complete integration takes place and all operate under one name. Some organizations that retain their former name have been completely redesigned internally and become identical with others.

- **The nine-step model of Zarei et al**

This model was proposed in 2008 by Zarei et al, according to the process of developing e-government in Iran.

Step 1: Strategy Development: At this stage, the government and IT developers need to expand e-government strategies. To this end, the government should consider a set of priorities for the development of G2G, G2B and G2C.

Step 2: Build Infrastructure: In this phase, telecommunications infrastructures needs to be addressed, including the development of intra-organizational networks, local network updates, employee-friendly hardware, and the design of a new organization for infrastructure management. The next important factor at this stage is

convincing senior executives to allocate the financial resources needed to build the infrastructure.

Step 3: Building trust:

The trust is the main rule for implementing e-government. To build the right infrastructure and, given the successful experience of e-government projects in the past, mutual trust between government officials and experienced e-government-related IT professionals is crucial.

The third step is to build trust: trust is the key to implementing e-government. To build the right infrastructure and, given the successful experience of e-government projects in the past, mutual trust between government officials and experienced e-government-related IT professionals is crucial. To build the right infrastructure and, given the successful experience of e-government projects in the past, mutual trust between government officials and experienced IT professionals associated with e-government is crucial.

- **Southeast Asia and Oceania**

In this model, the stages of maturation of e-government in Southeast Asia and Oceania are presented in the following six stages:

1) Launching an e-mail system and an internal network, 2) Enabling public and inter-organizational access to information, 3) Enabling two-way communication, 4) Enabling value sharing, 5) Digital democracy, and 6) Integrated government.

- **Nolan Information Technology Development Stage Model**

In 979, Nolan introduced six stages of development of information systems in organizations.

These six steps are (4):

1. Elementary, 2. Development, 3. Control, 4. Integration, 5. Data management, and 6. Maturity.

- **Missra and Dingra model**

Misra and Dingra have proposed a model that has an organizational perspective on the maturity of e-government. The emphasis of this model is on the steps that organizations take in implementing e-commerce. This model introduces six levels for electronic maturation, which are:

First level, closed: At this stage, the organization does not use information and communication technology in the management of affairs and does not even have any plans or programs to use it in the near future.

This may be due to a lack of familiarity with communication and information technologies, a lack of sufficient resources, and a lack of strategic thinking. As a result, the organization is in a closed position in terms of the extent to which it

communicates with others and participates in e-government information. As a result, the organization is in a closed position in terms of the communication rate and sharing others in the e-government information.

- **Second level, introductory:**

At this level, the organization takes the first steps to automate its processes, but the basis is lacking in overall vision and generality. At this level, no organized effort is made to make arrangements for e-government. Due to the lack of a general plan and systematic leadership, many of the efforts made have not been completed and are generally left unfinished. Among the sporadic actions taken, some may be successful, but in general, the organization does not have the commitment to create e-government as a planned action. Third level, scheduled stage: In this stage, a systematic approach is used. At this level, the organization clearly has a defined vision, general objectives and sub-objectives for e-government. In addition, the needs assessment study is conducted at this stage. Then, through extensive planning, policies, strategies, various executive activities, maps, responsibilities, and resources are defined in terms of time, money, and manpower to implement electronic management optimally.

Fourth level, the realized stage:

In this level, according to the plans, an integrated system is implemented that according to which all the internal processes of the organization are done by computer and the exchange of information between all units is done integrated. Organization, in addition to effectively providing services to its employees, the organization also effectively starts providing services to foreign customers at this stage.

Fifth level, institutionalization: In this level, organizations have established their true status and are more concerned with eliminating the gaps between what is in the program and what has happened. In other words, at this stage, the results of all the projects that have been implemented have been reviewed and compared with the standards developed in the programs. The result of this study is the identification of deviations and attempts to correct them. This reform will continue until e-government becomes part of the organization's work culture. At this stage, e-government is effectively accepted by all domestic and foreign users.

Sixth level, Optimization: At this stage, the organization commits itself to continuous improvement and optimization of efforts. At this level, the organization seeks to innovate in technology, work processes, organizational culture, and so on, mainly for the full realization of e-government.

- **Utah State Model**

Wendley designed a mature model for the state in 2002, based on the needs of the state of Utah in the United States. According to this model, e-government maturity has the following steps:

First level, simple website: The first level of maturity in this model is a simple website. A simple website contains a number of pages whose information is static and non-dynamic.

The second level, the state in time: This level of maturity is called the state in time. The most important difference between this level and the previous level is that it is possible to do transactions at this level.

The third level, the integrated state: The third level is called the integrated government. At this level, the circles are perfectly integrated in the work. One of the key points at this level is to complete the transaction electronically.

The fourth level, the transformed state: The fourth level of the maturity model is called the transformed state. At this stage, e-government processes are carried out in a way that has greatly changed the nature of government work. At this level, services are provided based on the needs of each citizen and their point of view is taken into account.

- **Touche Consulting Group Model**

The Deloitte Consulting Group and the Touche Research Team provided a model for e-government maturity in 2000. In this model, the stages of e-government maturity are considered as a six-step continuum. The description of each of these steps is as follows:

First stage: Publish / Share Information: In this step, government organizations create a website and put their information on the website for public use.

Second stage, formal bilateral exchanges: In this stage, with the help of legal and valid digital signatures, the client will be able to provide his personal information to the website of government organizations and make monetary exchanges. At this stage, the client must be convinced of the organization's ability and power to maintain the personal and confidential information they provide to the website.

Third stage: Multifunctional Portals: At this stage, a customer-centric government achieves great success in providing customers' service. At this stage, the government uses a portal to send and receive information and process money transactions to various government agencies.

The fourth stage: Personalize the portal: In the third step, the client accessed a wide range of services through a single website. At this stage, the government allows the client to change the portal according to their desired characteristics. To achieve this stage, the government needs more sophisticated web programming capabilities so that users can apply the desired changes in the portal. At this stage, the owners see government services as a single package, and their perception of government agencies as separate segments is greatly diminished.

- **The fifth stage: Integrate Common Services:**

In this step, real changes in government structure are formed. At this stage, the client sees government services as a single package, and their perception of government organizations as separate segments is greatly diminished. At this stage, exchanges and services are provided to the client in groups.

The sixth stage, complete cohesion and transformation of the institution: what was first presented as a handbook and encyclopedia, at this stage, it becomes a center that provides all government services that are tailored to the personal needs and preferences of each clients. At this stage, all the walls that separated the different services are destroyed, and the new technology integrates and eliminates the gap between the administrative support units and the service provider to the client (Touche, 2000).

- **Electronic Democracy Model**

In 2003, Williamson introduced a five-dimensional model for the electronic maturity of society. This model is a nonlinear model that can be used to assess the ability and status of technology maturity in society. These steps are:

1. Access, 2. Education, 3. Contents, 4. Creating and 5. Sharing and publishing.

5. CONCLUSION

The e-government has attracted a great deal of attention from the scientific community because of the many benefits it offers to each country. Necessities such as transparency, agility, ease of access to services, and time and cost savings are things that make governments interested in this important endeavor and the hardware and software implementation of e-government. An adult e-government that is integrated and flexible, and users with access to an e-portal can access all the services provided by the government and, if necessary, pay their fees online, that to achieve these benefits, governments must take certain steps to achieve maximum capacity in e-government. These steps and paths have been presented by various researchers under the heading of e-government maturity models, and in this study, we have tried to identify the factors of higher importance by studying the models that have already been developed and approved by the elites. During the investigation it was found that most e-government maturity measurement models are four-step, and by examining the titles of each level of maturity measurement models, after merging the synonymous titles, it was found that the four levels had the most repetition and were of higher importance. Which are as follows:

1) Web presence, 2) Interaction of government and citizens, 3) transaction and 4) integration.

6. RECOMMENDATION

1) Identify and select the most important indicators of the four factors of presence at the web level, interaction of government and citizens, transaction and integration.
2) Modeling the e-government maturity measurement model according to the four factors of presence at the web level, interaction of government and citizens, transaction and integration.

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