

## **A model for implementing sustainable e-government with a structural interpretative modeling approach**

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### **Abstract**

In today's world, considering the concept of e-government with the aim of increasing the efficiency of public management and the necessity of providing a foundation for balancing in the economic, social and environmental fields, presentation of a suitable model for the realization of a sustainable e-government in the context of the situation of a country's needs. In this regard, the purpose of this study was to identify the factors affecting the implementation of sustainable e-government in Iran, as well as designing an interpretive structural model based on the knowledge of experts on the phenomenon studied. To do this, after studying the literature and identifying the factors affecting the implementation of sustainable e-government, a matrix questionnaire was designed and distributed among 15 experts selected by targeted sampling. By analyzing the data, the factors affecting the implementation of sustainable e-government were classified in 7 levels (level one: legal requirements; second level: cultural management and strategic management; third level: financial management; fourth level: infrastructure management and human resource competence management; fifth level: service management, electronic information management and event management; sixth level: citizenship e-readiness; and seventh level: citizens' communication management).

**Keywords:** E-government, sustainability, sustainable e-government, Structural-Interpretive Modeling

### **1- Introduction**

Since organizations are not formed in a vacuum, they must be accountable for gaining legitimacy in their institutional patterns (environment) (Frumkin & Galaskiewicz, 2004). Accountability includes social, economic, and environmental responsibilities. For the same purpose, the concept of sustainability (Saha & Dahiya, 2015), which claims to change the pattern of consumption of societies and businesses, has been formed (Too & Bajracharya, 2015). Sustainability is the basis of improvement of the present and future human condition; therefore, it is claimed that human beings have the ability to create sustainable development to ensure that they meet their needs without harming the needs of future generations (Glasser, 2016). This is why organizations are increasingly demanding that they take on more ecological, social, and economic responsibilities in their field of activity (Knoll & Jastram, 2018). Sustainability has played a role in shaping missions and decisions in government agencies (Marconatto, Barin-Cruz, Pozzebon, & Poitras, 2016).

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If such a belief as a function governs effectively on the bodies of government agencies, then the productivity increases, improving the quality of service provision, increasing national competitiveness, reducing corruption and social benefits (Dwivedi et al., 2017; Krishnan, Teo, & Lymm, 2017).

On the one hand, following the widespread use of information technology, tendency toward computer systems of organizations to the institutional environment of the organizations is inevitable and a necessity. Therefore, government organizations that are constantly looking for ways to improve their service tend to be e-government (Al-Mashari, 2007; Mohammed, Ibrahim, Nilashi, & Alzurqa, 2017; Winkel, 2007). Governments can use the capacity of information technology to adapt to social, economic, and ecological changes (Anderson, Wu, Cho, & Schroeder, 2015; Krishnan et al., 2017). In the same way, paper-based methods and the presence of on line government in society has led governments to tend in form of e-information sharing, e-consultation, and e-decision-making (Krishnan et al., 2017).

Confluence of the two concepts of sustainability and the e-government, both of which aspires from the institutional environment, forms the concept of a sustainable e-government. The sustainable e-government in the environmental dimension through the management of environmental impacts of products and services (Coppola & Ianuario, 2017; Hartmann, 2011), in the social dimension, with fairness between generations and the promotion of living conditions (Song, Wang, & Zhu, 2018; White, 2009), and in the economic dimension, through the creation of digital-Internet-based economy and cost-management (Flynn, Yu, Feindt, & Chen, 2016), could lead to increased accountability and gain public confidence and, consequently leading to a priority in national policy-making (Souter & Maclean, 2012). In this study in accordance to the needs of Iran and based on the method of interpretive structural modeling factors on which the implementation of a sustainable e-government depends what relationship between these factors exists is investigated.

## **2- Research literature**

### **2-1- Electronic government**

Since the emergence of Information technology until today, information technology has been the first priority of government development in all countries (Yildiz, 2007). With the development of these technologies, government e-government services were developed in various social, economic, cultural and political areas (Gomes & Laureano, 2018). as a result The evaluation of users' satisfaction from the available e-Government services is a very important factor for the e-Government evolution (Bournaris, 2020). Governments started moving with new advances in technology to provide online services to citizens (Lallmahomed, Lallmahomed, & Lallmahomed, 2017; Mohammed et al., 2017). As the process progressed, in the early 1980s, e-government became a tool to strengthen governance (Lee & Desai, 2017). Of course, the term e-government seem to be used for the first time in the United States in 1995 (Heeks & Bailur, 2007).

In e-government, information technology is used to provide the necessary facilities to individuals in order to ensure their proper access to government information and services, and to improve the quality of services and provide wider opportunities for participation in processes (Goldkuhl, 2011). This lead to easy and transparent interactions between government and citizens, government and the private sector, government organizations and their collaboration with government agencies (Chourabi & Mellouli, 2011; Mellouli & Bouslama, 2009). If the goals of e-government are to improve service quality, to increase the productivity of administrative processes, to create government capabilities for more efficiency and sharing with service users (Alenezi, Tarhini, & Sharma, 2015). As Betanaeg and Apical state (2006), IT has dramatically changed public services, business models, and people's expectations of the quality and efficiency of sharing information and providing services (Bhatnagar & Apikul, 2006).

On the other hand, at the national level, the promotion and development of e-government needs a national policy for the use of information and communication technology (Sorn-In, Tuamsuk, & Chaopanon, 2015). By meeting the needs of citizens, obstacles to the realization of e-government could be met (Zhao, Shen, & Collier, 2014) as well as the success of the government in providing online

services with increased reliability is guaranteed (Ozkan & Kanat, 2011). On the other hand, at the organizational level, taking in consideration that e-government is beneficial in promoting good governance, increasing democracy and expanding outcomes for the growth and development of developing countries is useful (Nkohkwo & Islam, 2013; Waller & Genius, 2015), it is a must that government managers play a role in the implementation of e-government (Brewer, Neubauer, & Geiselhart, 2006).

Meanwhile, Adu et al. state, the main barriers to the realization of e-government, are infrastructure, economic, legal, and human resources challenges in developing e-government (Adu, Patrick, Park, & Adjei, 2018).

Building trust in e-government is not easy, especially in a Countries that faces many contextual, technological, and social challenges (Capistrano, 2020). As Norris and Moon have shown in their studies, one of the main obstacles to the effective implementation of e-government services is budget constraints and human resources, lack of technology, lack of information about government programs and lack of support for elected officials (Norris & Moon, 2005).

## **2-2- Sustainability**

In the past theories and concepts of economic development failed to meet human needs. This led to the introduction of new approaches and for solving the issue sustainability was designed (Čiegis, 2003). Sustainability means the ability to maintain and sustain the opportunity for life along the time (Tiboris, 2017). This means meeting the current needs without compromising the ability of future generations to meet their own needs. Sustainability of the total natural and human resources predicts future that the welfare and prosperity of the next generation will not be reduced (Tang et al., 2018; Restrepo, 2017). On this basis, the sustainability of individuals in society considers the environment and their economics (Muralidharan & Pathak, 2018).

In most cases, researchers in three pivotal dimensions have considered sustainability issue (Muralidharan & Pathak, 2018). One of these dimensions is environmental sustainability, referred to as "environmental discourse" (Drexhage and Murphy, 2010). In the frame of this dimension of sustainability, since climate change has become one of the major threats to the earth, people, government and organizations are concerned about climate changes, pollution and global warming (Sharma et al., 2016). Regarding this many organizations face constant environmental changes and are pushed by legal and social institutions to adapt themselves to environmental sustainability (Hahn and Scheermesser, 2006). The purpose of economic sustainability is the ability of the organization considering profit, financial performance and managing the environmental and social assets (Doane and MacGillivray, 2001). Economic Validity is the core of economic sustainability, in which organizations provide contribution to social welfare by providing services to the community, profit making and creating jobs (Cella-de-Oliveira, 2013). Social sustainability "is the process of creating sustainable and successful places for life and work that promotes people's well-being through understanding their needs in those places" (Woodcraft, 2015: 133). This concept of social sustainability combines the design of the physical realm with the design of the social world (Woodcraft, 2015); on this basis, maintaining social sustainability depends on the wellbeing of individuals through having a suitable physical and social environment for life and work (Vallance et al., 2011).

Many managers have believed that strategies related to sustainability are necessary for the present and future (Katiyar, Meena, Barua, Tibrewala, & Kumar, 2018). Meanwhile, organizations have taken sustained action to secure social legitimacy (White, 2009).

## **2-3- Sustainable e-government**

Although e-government can be a tool to improve sustainability (Bernhard & Wihlborg, 2015), it is not always sustainable; it may endanger the environment, impose a high cost on the government and people, or endanger the people's prosperity. A sustainable e-government must be able to achieve the necessary standards in all three environmental, economic and social spheres. This way, while paying attention to environmental, economic and social issues, it provides them with better quality services by increasing

citizens' participation (Aniscenko, Robalino-López, Rodríguez, & Pérez, 2017; Baker, 2009; Choi, Park, Rho, & Zo, 2016). Of course, the experience of implementing e-government in many developed countries such as Korea, the UK, Denmark, France and Sweden shows that many of the strategies implemented by these countries are acceptable and can serve as an example for other countries to strengthen sustainability (Bonsón, Torres, Royo, & Flores, 2012; Zhang, Xu, & Xiao, 2014). This means that the implementation of a sustainable e-government depends on the factors that need attention.

As e-government plays an important role in promoting public trust and transparency, the development of e-government services is essential for the pursuit of sustainable e-government goals (Myeong, Kwon, & Seo, 2014; Tolbert & Mossberger, 2006). Thus, E-Governance is successful if it is sustainable and future-oriented (Hooda & Singla, 2020).

**Citizenship communication management:** This concept is a kind of management strategy that by using technology and a great deal of focus on citizens to maintain and optimize relationships and is done to strengthen new types of citizens' participation in government (Schellong, 2005). This relationship between government and citizen, by increasing accountability and promoting the disclosure of information, plays a key role in the development of e-government (Alcaraz-Quiles, Navarro-Galera, & Ortiz-Rodríguez, 2015). It can also be achieved through citizens' trust (AlAwadhi & Morris, 2009), active electronic participation (Amran & Keat Ooi, 2014; Birrer, 1999), citizens' reception and receipt of complaints, makes communication between government officials and citizens more transparent (Joshi & Islam, 2018). In this connection, it is essential that citizenship orientation (Sorn-In et al., 2015), citizenship privacy (Dwivedi et al., 2017), the existence of appropriate administrative relationships (Aggoune, Imache, Khadraoui, & Mezghiche, 2011), and citizen accountability (Galpin, Whittington, & Bell, 2015) taken in regard.

**Infrastructure management:** Under the sustainable IT infrastructure the stable e-government skeleton is formed. Implementing sustainable strategies is limited without the creation of appropriate infrastructure, which supports sustainability strategy (Galpin et al., 2015). Information technology is a two-way coin; it can be either an opportunity or a threat. Sustained e-government must consider the standard of end-to-end information technology so that it can provide long-term value to its stakeholders without compromising the needs of future generations (Windolph, Schaltegger, & Herzog, 2014). This technology, while being cost effective and cost-cutting (Mohammed et al., 2017), can provide state-of-the-art services in a safe and collaborative way with the use of new efficient technology (Beynon-Davies, 2007).

**Service provision management:** In e-government, services determine the satisfaction level of people and indicate the maturity of e-government (Kumar, Baishya, Sadarangani, & Samalia, 2020). The purpose of this element is to use, measure, evaluate and improve the performance of the public sector using electronic devices to improve government performance in achieving strategic goals and enhancing its mission and values (Brown, Delbaere, Eeles, Johnston, & Weaver, 2005; Fitzsimmons & Fitzsimmons, 2006; Hefley & Murphy, 2008; Wolfson, Tavor, & Mark, 2013). An e-government cannot operate sustainably without improving its procedures and programs (Al-Mashari, 2007). These programs, which demonstrate achievement of predetermined standards, are an answer to the citizens' rational needs and expectations. The survival of an organization depends on the willingness of the stakeholders to evaluate the qualitative measurement of the electronic service plans. Quality planning with the creation of Psychological customer satisfaction and quick response (Sheryazdanova et al., 2016), Facilitating Sustainable Conditions (AlAwadhi & Morris, 2009), Unlimited Use of Services (Hadidi & Carter, 2016), Easy Access to Services (Anthopoulos, Reddick, Giannakidou, & Mavridis, 2016), improving the quality of information systems (Sorn-In et al., 2015), creating an opportunity for interaction (Knoll & Jastram, 2018) and creating learning capability (Verkijika & De Wet, 2018). They can play an important role in delivering e-services through sustainable e-government.

**Management of human resources competencies:** This is a description of various activities for equipping the organization by capable employees and ensuring satisfaction from desirability of using their talents. Sometimes employees in government organizations do not have enough information about information technology and have not seen adequate training for effective use of this technology; consequently, they resist the relevant changes. Meanwhile, government sector personnel to implement their update e-government capabilities need to have the necessary skills and capabilities to use sustainable IT e-government (Sorn-In et al., 2015). Hence, HRM requires the deployment and development of technical staff and their awareness of appropriate knowledge of e-government services for generating general value through the provision of innovative services (Aniscenko et al., 2017). Human resource management supports conceptually e-government like an umbrella so that it can be effectively implemented (Nam, 2018).

**Event management:** Event management refers to control events in government organizations and respond to what is predefined (Jones & Thompson, 2012). The aim is to minimize human health endangering, controlling and decreasing pollution and paying importance to environmental sustainability (Amini & Bienstock, 2014). On the other hand, with this aim through proper optimization of resources and facilities and proper selection of the means of implementing programs with the greatest benefit and in the shortest time, the economic and social dimensions of sustainable e-government are also strengthened (Yildiz, 2007). Because, it causes improvement in administrative efficiency and productivity gains (Galpin et al., 2015), reducing the cost of service delivery (Katiyar et al., 2018), growth of inclusive safety systems (Winkel, 2007) and promotion of ecological citizenship (Sá, Rocha, & Cota, 2016).

**Electronic information management:** In sustainable e-government, the information systems needed to support the activities of a government organization are associated with social evolution, that is, to ensure the existence of quality information (AlAwadhi & Morris, 2009), security (Al-Mashari, 2007), citation capability, accuracy and high integrity (Sorn-In et al., 2015), increasing the access to information on the Web, and the completeness and timeliness of information on websites, initiates an information society (Alzahrani, Al-Karaghoul, & Weerakkody, 2017; Bailey, Strezhnev, & Voeten, 2017). In this regard, the quality of information should be improved with particular attention to security and privacy, in order to increase the amount of public trust and to reduce resistance to change (AlAwadhi & Morris, 2009).

**Legal requirements:** Rules are the core of the government and affect the processes and behavior of the system (Corradini, Polzonetti, & Riganelli, 2018). As the implementation of e-government requires government law and law enforcement administrators (Sorn-In et al., 2015), the implementation of sustainable e-government also needs such support.

Rules and regulations by creating a constructive role in resolving, related challenges, improving coordination between related sectors, providing technical facilities, helping to implement infrastructure projects and strengthening institutional goals (Whitehead, 2017), is an effective factor in the implementation of sustainable e-government.

**Financial management:** The purpose of financial management is the financial structure of the government and the ability to fulfill its obligations and pay off debt through it in order to achieve national goals especially economic goals of the government. Investing through Easy Payment Systems (Cordella & Tempini, 2015), Cost Efficiency (Amini & Bienstock, 2014) and providing government incentives (Galpin et al., 2015) are among the steps taken by financial management to implement Sustained e-government and attention should be given to them. In addition financing is also a vital factor in starting government programs (Aras & Crowther, 2008), including sustainable e-government programs.

**Strategic management:** Strategic management is a group of government management activities that address the macro and tactical goals of the public sector (Adu & Ngulube, 2016). Strategic plans and ensuring their effective implementation can ensure the success of a sustainable e-government in the long

run. On this basis, administrators adopted the organizational structure (Whitehead, 2017), strategy and appropriate perspective to e-government services (Altameem, Zairi, & Alshawi, 2006) and change management (Altameem et al., 2006; Sorn-In et al., 2015), In the framework of sustainability considerations, can move towards the realization of a sustainable e-government.

**Cultural management:** Culture has a major impact on the initiatives and successes of the public sector (Nam, 2018). One of the cultures in e-government is showing values, beliefs and working together to develop e-government (Schein, 2010). Not only the implementation of e-government requires attention to cultural considerations, innovative sustainability strategies depend on leaders' commitment in building a sustainable culture (Denning, 2011), p. As can be done through institutionalized programming, changing the direction of Culture towards sustainable values (Schein, 2010),cultural management can be cause of institutionalization of support values of the sustainable e-government.

**E-citizenship readiness:** Government agencies that intend to implement sustainable e-government should focus their activities on citizens. This is the basic factor for the adoption of e-government (Beynon-Davies, 2007).The more the electronic readiness of citizens, the more the possibility ofproviding implementation of effective sustainable e. government. The purpose of this factor is the ability of citizens or working groups to join users and users of information and communication technology capacities that is, the ability to use effectively the information and communication technology and to have citizens ready to use Network-based opportunities, especially the Internet, and the transformation of traditional methods into new ways (Joshi & Islam, 2018). Citizens 'e-readiness is characterized by citizens' e-empowerment, citizenship electronic acceptance and citizen information technology literacy (Schlæger & Stepan, 2017).

### 3- Research methodology

The present study is conducted within the framework of an interpretive structural modeling approach. Warfield (Warfield, 1974) proposed the interpretive structural modeling approach to investigate the conceptual relationship between the elements or variables of a system.

This approach, by using mathematics and the participation of professionals, is designed to design large and complex systems, especially social and economic systems. In addition the discontinuous and non-transparent mental patterns are transformed into well-defined observational utility patterns. It can also act as a tool for arranging and directing the complexity and confusion of relationships between variables. Of course, the ISM method has a few constraints, including the fact that the textual relationship among variables always related to the knowledge of users and their familiarity with the government, its operation and its organization (Mathiyazhagan, Govindan, NoorulHaq, & Geng, 2013).

Therefore the bias of the person who is judging the variables might influence the final result. ISM does not give any weighting associated with the variables (Kannan, Pokharel, & Kumar, 2009).

The various steps involved in the ISM methodology are as follows (Kannan et al., 2009):

**Step 1.** Variables (criteria) considered for the system under consideration are listed.

**Step 2.** From the variables identified in step 1, a contextual relationship is established among the variables in order to identify as to which pairs of variables should be examined.

**Step 3.** A structural self-interaction matrix (SSIM) is developed for variables, which indicates pairwise relationships among variables of the system under consideration.

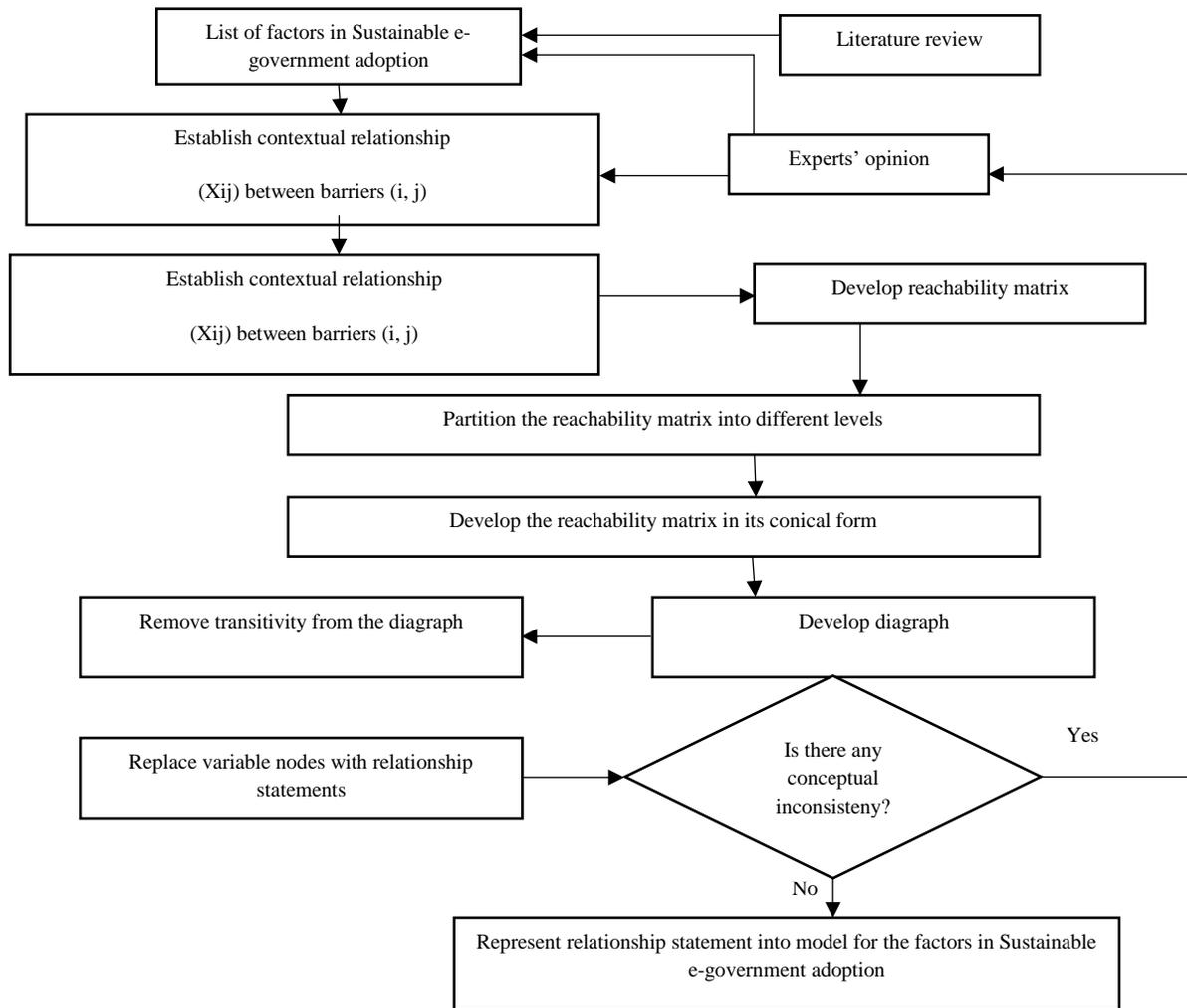
**Step 4.** Reachability matrix is developed from the SSIM and the matrix is checked for transitivity. The transitivity of the contextual relation is a basic assumption made in ISM. It states that if a variable A is related to B and B is related to C, then A is necessarily related to C.

**Step 5.** The reachability matrix obtained in step 4 is partitioned into different levels.

**Step 6.** Based on the relationships given above in the reachability matrix, a directed graph is drawn and the transitive links are removed.

**Step 7.** The resultant digraph is converted into an ISM, by replacing variable nodes with statements.

**Step 8.** The ISM model developed in step 7 is reviewed to check for conceptual inconsistency and necessary modifications are made. The above steps are shown in figure 1.



**Fig. 1.** Flow diagram for preparing the ISM model

### 3-1- Data collection

By studying the literature of the research, 67 components were identified in 11 dimensions as effective factors in the implementation of sustainable e-government (table 1). Considering the fact that this study was conducted with a national perspective, due to the situation in Iran, these factors were shared through interviews with expert and informed. The experts were a group of university professors who knew the two concepts of e-government and sustainability, in addition they very well recognized them Iran. For better identification of experts, a bullet sampling method was used (Creswell, 2012). In total, 15 experts were ready to participate in the study. The proportion of participants in the research by gender was 66/66% male and 33/33% female and was between 28 and 56 years old. The results of the interview with experts confirmed the components identified and added eight other components. The eight components are: reducing traffic (in event management), infrastructure localization (in infrastructure management), two-way exchange of information with citizens, information comprehensiveness and transmission time ( In the

electronic information management), adherence to the ethical and normative aspects of the community (in cultural management), and creating the ability to provide citizenship feedback and creating the ability to promote public supervision (in strategic management).

**Table 1.** Factors affecting the implementation of sustained e-government according to the research literature

Row	Dimensions	Components	Reference
1	Citizenship Communication Management (SEG1)	Creating trust for the citizens	(Aggoune et al., 2011; AlAwadhi & Morris, 2009; Alcaraz-Quiles et al., 2015; Amran & Keat Ooi, 2014; Birrer, 1999; Dwivedi et al., 2017; Galpin et al., 2015; Joshi & Islam, 2018; Schellong, 2005; Sorn-In et al., 2015)
2		Promotion of citizen communication management system	
3		Active Public Participation	
4		Citizens' acceptance	
5		Citizens' complaint	
6		Cooperation capability	
7		Citizen oriented	
8		Citizens' privacy	
9		Appropriate office relationship, ,interactive and intelligent	
10		Commitment to Citizens and Responsibility	
11	Infrastructure management (SEG2)	Sustainable Infrastructure of Information Technology	(Amini & Bienstock, 2014; Beynon-Davies, 2007; Galpin et al., 2015; Lee & Desai, 2017; Mohammed et al., 2017; Sorn-In et al., 2015; Verkijika & De Wet, 2018; White, 2009; Windolph et al., 2014)
12		to be economical	
13		Sustainable IT Standards	
14		Senior management commitment and support	
15		Readiness to accept the software	
16		Use of New Efficient Technology	
17		Sustainable National Information Infrastructure	
18		Online supportive service	
19		Reengineering the work process	
20		Unification	
21		Different communication channels	
22	Network Security		
23	Service provision management (SEG3)	Process development and appropriate planning	(Agarwal, Shankar, & Tiwari, 2007; Al-Mashari, 2007; AlAwadhi & Morris, 2009; Brown et al., 2005; Fitzsimmons & Fitzsimmons, 2006; Hadidi & Carter, 2016; Hefley & Murphy, 2008; Knoll & Jastram, 2018; Sheryazdanova et al., 2016; Sorn-In et al., 2015; Verkijika & De Wet, 2018; Wolfson et al., 2013)
24		Quality upgrade programs	
25		fast response	
26		Facilitate Sustainability conditions	
27		Use of services without borders	
28		Creating ability and easy access to services	
29		Quality of information systems, websites and e-government services	
30		Creating interactive opportunity	
31		Usability and easy learning	
32	Human resource competence Management (SEG4)	Staff training appropriate to sustainable e-services	(Aniscenko et al., 2017; Nam, 2018; Sorn-In et al., 2015; Too & Bajracharya, 2015; Verkijika & De Wet, 2018; White, 2009; Windolph et al., 2014)
33		Staff awareness tailored to sustainable e-services	
34		Applying technical staff familiar with the suitable knowledge of electronic service	
35		Up to date service	
36		Development	
37	Event Management (SEG5)	Electronic Pollution Control	(Amini & Bienstock, 2014; Galpin et al., 2015; Jones & Thompson, 2012; Katiyar et al., 2018; Sá et al., 2016; Winkel, 2007; Yildiz, 2007)
38		Optimizing Government Resources	
39		Responsiveness and sustainability	
40		administrative efficiency improvement and increase productivity	
41		Reduce the cost of service delivery	
42		Promoting ecological citizenship	
43		The growth of inclusive security networks	
44	Electronic information management	Information Quality	(Al-Mashari, 2007; AlAwadhi & Morris, 2009; Alzahrani et al., 2017; Bailey et al., 2017; Sorn-In et al., 2015)
45		Information security	
46		Citation ability	

**Table 1.** Continued

Row	Dimensions	Components	Reference
47	(SEG6)	Information accuracy	
48		Data exchange	
49		Information ensuring and sustainable information systems	
50		Information sharing	
51	Legal requirements (SEG7)	Data protection law	(Corradini et al., 2018; Katiyar et al., 2018; Sorn-In et al., 2015; Whitehead, 2017)
52		Information freedom law	
53		Laws and Legal Issues	
54		Updating government rules	
55	Financial Management (SEG8)	Investment	(Amini & Bienstock, 2014; Aras & Crowther, 2008; Cordella & Tempini, 2015; Galpin et al., 2015)
56		Easy financial payment systems	
57		Cost Efficiency	
58		Government incentives	
59	Strategic Management (SEG9)	An appropriate organizational structure with e-government services	(Adu & Ngulube, 2016; Altameem et al., 2006; Galpin et al., 2015; Jones & Thompson, 2012; Sorn-In et al., 2015; Whitehead, 2017)
60		Appropriate strategies with Sustainable Electronic Government Services	
61		Change management tailored to sustainable e-government services	
62		Appropriate Comprehensive vision with e-government services	
63	cultural management (SEG10)	Changing the culture of e-government services	(Denning, 2011; Nam, 2018; Schein, 2010; Schlæger & Stepan, 2017; White, 2009)
64		Empowering for Cultural Diversity	
65	Citizens Electronic Readiness (SEG11)	Citizens' Electronic ability	(Al-Mashari, 2007; Beynon-Davies, 2007; Joshi & Islam, 2018; Schlæger & Stepan, 2017)
66		Citizens' Electronic Acceptance	
67		Citizens' Information Technology Literacy	

Finally, a questionnaire with a matrix structure based on interpretive structural modeling was used to get expert opinions about the type of relationship between identified dimensions. To analyze the effective factors, a "lead to" text-based relationship was selected; that is one factor leading to another factor. On this basis, the textual relation between the factors was developed.

## 4- Data analysis

### 4-1- Structural self-interaction matrix (SSIM)

After identifying the factors, they were entered in a matrix called structural matrix the internal relations of the variables (self-interactivity). The above matrix is matrix based on the factors that are mentioned in the first row and column of these factors respectively (Agarwal et al., 2007). Then, the two sided relationships of the variables are determined (Ravi & Shankar, 2005).

V: The factor in row i can be the foundation for reaching the factor in row j.

A: The agent of column j can be the bases for reaching the factor in row i.

X: There is a two-way relationship between the factors of column i and column j, and both can be the basis for reaching each other.

O: There is no relationship between the two elements i and j

The SSIM for the factors in Sustainable e-government adoption is given in table 2. The following section explains the use of the symbols V, A, X, and O in the SSIM.

**Table 2. Structural matrix of internal relations**

(SEG1)	(SEG2)	(SEG3)	(SEG4)	(SEG5)	(SEG5)	(SEG7)	(SEG8)	(SEG9)	(SEG10)	(SEG11)	b a
	A	A	O	A	A	A	A	A	A	A	(SEG1)
		V	O	V	V	A	A	A	A	O	(SEG2)
			A	A	X	A	A	A	A	V	(SEG3)
				V	V	A	A	A	O	V	(SEG4)
					A	A	A	A	A	V	(SEG5)
						A	O	A	O	V	(SEG6)
							V	V	V	V	(SEG7)
								A	A	V	(SEG8)
									X	V	(SEG9)
										V	(SEG10)
											(SEG11)

**4-2- Initial reachability matrix**

To obtain the initial access matrix, the SSIM matrix relations symbols according to the rules and regulations below need to be converted to zero and one(Nishat Faisal, Banwet, & Shankar, 2006).

- A) If the house (i, j) in the SSIM matrix has the symbol V, then the related house in the reachability matrix is the number 1 and its corresponding house is zero.
- B) If the house (i, j) is in the SSIM matrix A, then the house in the reachability matrix is zero and its corresponding house is one.
- C) If the house (i, j) in the SSIM matrix has the X symbol, the home in the matrix of reachability is number one and its corresponding house gets number one.
- D) If the home (i, j) in the SSIM matrix has the symbol O, then the home in the reachability matrix is zero and its zero-corresponding house is zero (table3).

**Table 3. Primary Reachability Matrix of Factors**

Row	Dimensions	1	2	3	4	5	6	7	8	9	10	11
1	Citizenship Communication Management	1	0	0	0	0	0	0	0	0	0	0
2	Infrastructure management	1	1	1	0	1	1	0	0	0	0	0
3	Service provision management	1	0	1	0	0	1	0	0	0	0	1
4	Human resource competency management	0	0	1	1	1	1	0	0	0	0	1
5	Event Management	1	0	1	0	1	0	0	0	0	0	1
6	Electronic information management	1	0	1	0	1	1	0	0	0	0	1
7	Legal requirements	1	1	1	1	1	1	1	1	1	1	1
8	Financial Management	1	1	1	1	1	0	0	1	0	0	1
9	Strategic Management	1	1	1	1	1	1	0	1	1	1	1
10	cultural management	1	1	1	0	1	0	0	1	1	1	1
11	Citizens' Electronic Readiness	1	0	0	0	0	0	0	0	0	0	1

The final reachability matrix for the barriers, shown in table 4, is obtained by incorporating the transitivity as enumerated in Step 4 of the ISM methodology. The final reachability matrix will then consist of some entries from the pair-wise comparisons and some inferred entries.

**Table 4.** Final matrix of the main dimensions

Row	Dimensions	1	2	3	4	5	6	7	8	9	10	11
1	Citizenship Communication Management	1	0	0	0	0	0	0	0	0	0	0
2	Infrastructure management	1	1	1	0	1	1	0	0	0	0	1*
3	Service provision management	1	0	1	0	1*	1	0	0	0	0	1
4	Human resource competency management	1*	0	1	1	1	1	0	0	0	0	1
5	Event Management	1	0	1	0	1	1*	0	0	0	0	1
6	Electronic information management	1	0	1	0	1	1	0	0	0	0	1
7	Legal requirements	1	1	1	1	1	1	1	1	1	1	1
8	Financial Management	1	1	1	1	1	1*	0	1	0	0	1
9	Strategic Management	1	1	1	1	1	1	0	1	1	1	1
10	cultural management	1	1	1	1*	1	1*	0	1	1	1	1
11	Citizens' Electronic Readiness	1	0	0	0	0	0	0	0	0	0	1

### 4-3- Level partitions

The reachability and antecedent set (Warfield, 1974) for each factors in Sustainable e-government adoption from the final reachability matrix. The reachability set for a particular variable consists of the variable itself and the other variables, which it may help achieve. The antecedent set consists of the variable itself and the other variables, which may help in achieving them. Subsequently, the intersection of these sets is derived for all variables. The variable for which the reachability and the intersection sets are the same is given the top-level variable in the ISM hierarchy, which would not help achieve any other variable above their own level. After the identification of the top level element, it is discarded from the other remaining variables.

In this study, 11 factors, along with their reachability, reachability set, pre-requisite set and levels are presented in table 6. The process of identifying these factors has been completed in seven levels. .So, after determining the sets of reachability, pre-requisite and sharing, it is time to determine the level of the factors. For each set of factors, in the first table, the factors are of the highest level and sum of their reachability and sharing sets is same. After determining these factors, they were removed from the table and formed with other remaining elements of the next table. In this table too like the previous table the procedure was followed, and this process continued until the levels of all factors were determined. The results are shown in table (5).

**Table 5.** Determining the levels of factors in the hierarchy of Interpretative Structural Modeling (Phase I)

Row	Dimensions	Reachability set	Antecedent set	Intersection set	Iteration no. & level
1	Citizenship Communication Management	1	1,2,3,4,5,6,7,8,9,10,11	1	1
2	Infrastructure management	1,2,3,5,6	2,7,8,9,10	2	4
3	Service provision management	1,3,5,6,11	2,3,4,5,6,7,8,9,10	3,5,6	3
4	Human resource competency management	1,3,4,5,6,11	4,7,8,9,10	4	4
5	Event Management	1,3,5,6,11	2,3,4,5,6,7,8,9,10	3,5,6	3
6	Electronic information management	6,11,3,5	2,3,4,5,6,7,8,9,10	3,5,6	3
7	Legal requirements	1,2,3,4,5,6,7,8,9,10,11	7	7	7
8	Financial Management	1,2,3,4,5,6,8,11	7,8,9,10	8	5
9	Strategic Management	1,2,3,4,5,6,8,9,10,11	7,9,10	9,10	6
10	cultural management	1,2,3,4,5,6,8,9,10,11	7,9,10	9,10	6
11	Citizens' Electronic Readiness	1,11	2,3,4,5,6,7,8,9,10,11	11	2

#### 4-4- Formation of ISM based model

From the final reachability matrix, the structural model is generated and is given in figure 3. The relationship between the factors j and i is shown by an arrow pointing from i to j. The resulting graph is called a digraph. Removing the transitivity as described in the ISM methodology, the digraph is finally converted into the ISM model.

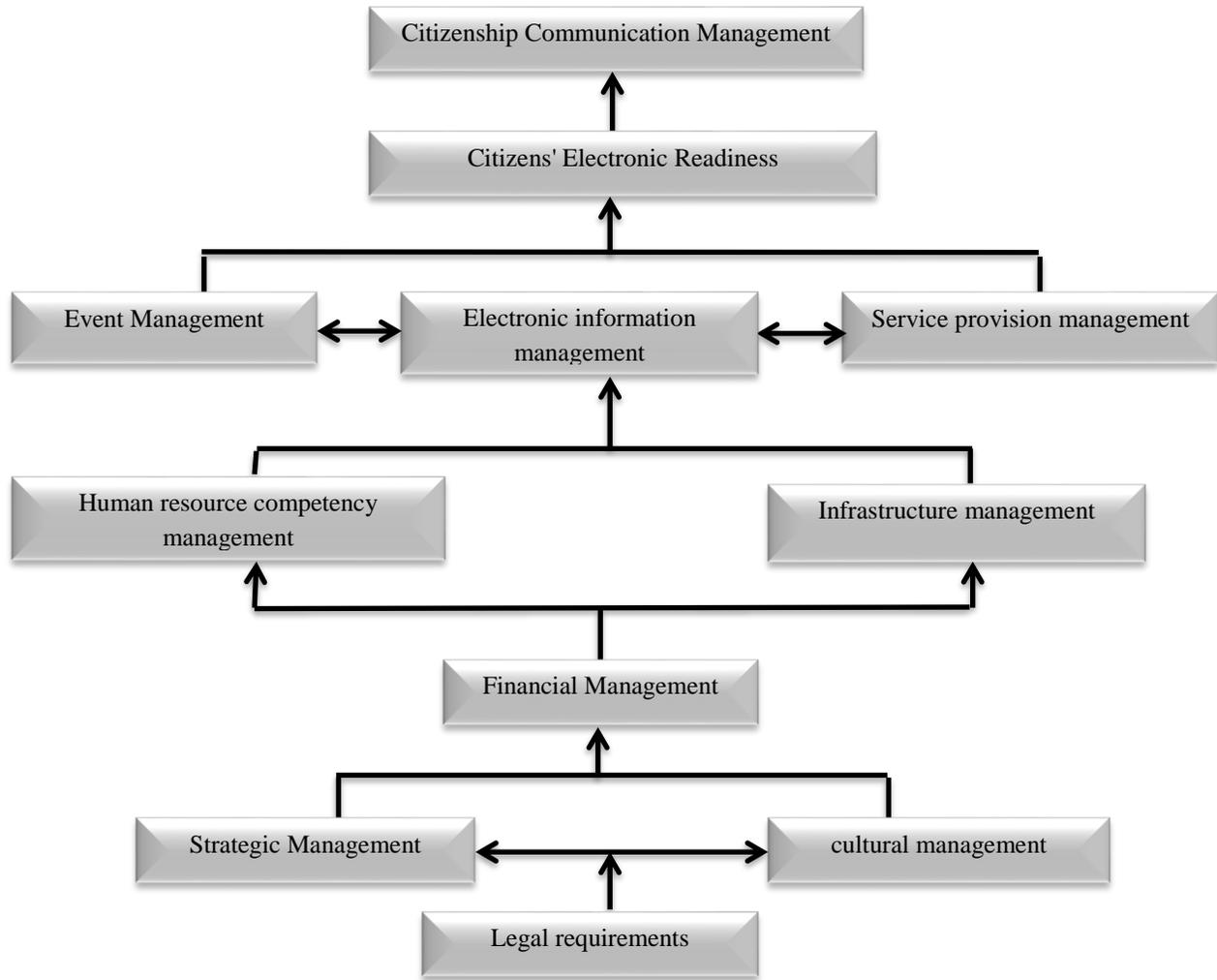


Fig 2. Interpretative Structural Modeling factors affecting the implementation of sustained e-government in Iran

#### 4-5- MICMAC analysis

The purpose of MICMAC analysis is to detect and analyze the power of guidance and dependence of variables. In the analysis of MICMAC, the importance of variables is measured by the indirect relationship between them. In this analysis, the variables are divided in terms of the power of guidance (stimulus intensity) and the degree of dependence on the four following categories.

The first group consists of autonomous variables (region 1), which have a weak influence and weakness. These variables are somewhat separate from other variables and have less dependence. In this research, the factors of infrastructure management and human resource competency management are

considered in different categories of autonomous variables articles and these variables have the least dependence and power of influence on other

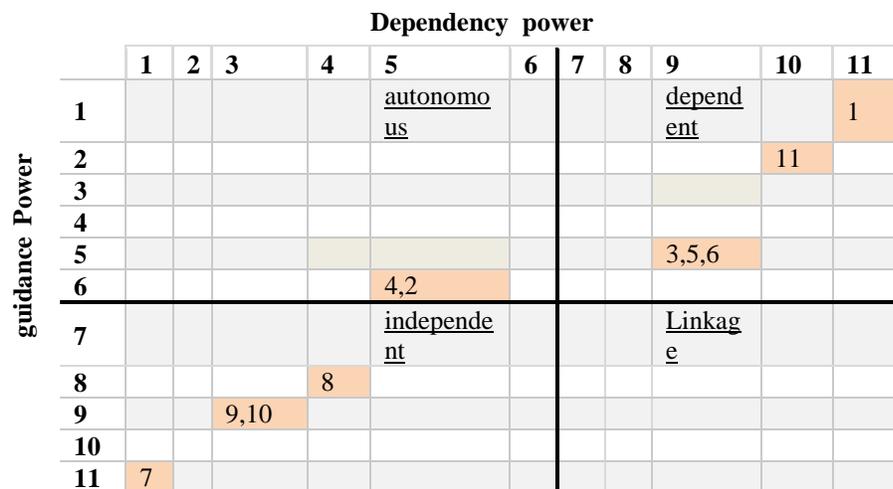
The second group includes dependent variables (region 2) which have a weak influence but a high dependence. In the present study, the factors of citizen communication management, service management, event management, e-information management and e-citizenship are dependent variables, that is, variables that are sustainable before more effective and effective than the etiquette that is effective variables which before being the basis of the emergence of a sustainable e-government, they themselves are effective and influencing.

The third group is the transitive variables (region 3). These variables have a strong influence and dependence. In fact, any action can be done on these variables. In this study, none of the factors are included in this category.

The fourth group is the independent variables (area 4). These variables have high influence and low dependence. Variables that are highly influential are called key variables. Independent variables (legal requirements, financial management, strategic management, and cultural management) are among the most basic variables for the emergence of effective factors in creating a sustainable e-government. It is clear that these variables fall into one of two groups of independent or transitive variables. By collecting inputs "1" in each row and column, the power of influence and the degree of dependence of the variables are obtained (table6). On the same basis, the influence-dependency-strength chart is plotted (Badurdeen et al., 2014; Rao & Goldsby, 2009). The results are shown in figure 3.

**Table 6.** Degrees of power and dependency of factors affecting the implementation of sustained e-government

Variables Row	1	2	3	4	5	6	7	8	9	10	11
<b>guidance Power</b>	1	6	5	6	5	5	11	8	9	9	2
<b>Dependency power</b>	11	5	9	5	9	9	1	4	3	3	10



**Fig 3.** Guidance strength and dependency characteristics of factors influencing the implementation of sustained e-government

## 5- Discussion

The main purpose of this research was to identify the factors affecting the implementation of sustainable e-government in the form of interpreting structural model design based on the opinion of a group of experts on this phenomenon. The findings of the research showed that the basis of implementation of sustainable e-government in Iran is legal requirements. The basis of this could be due to the novel practical attention to two concepts of e-government and sustainability in the country. Hence, in the most fundamental actions, steps must be taken to formulate and implemented the laws of sustainable e-government at the national level and government agencies. Since regulating laws are systematic behaviors (Corradini et al., 2018), government rules should be updated to implement e-government and, in particular, the laws of data protection and the freedom of information and should be modern and operational.

Through regulatory requirements, in the second level, two factors of strategic management and cultural management are stimulated. That is on one hand, calls for the legal requirements of law, government and government agencies to adopt long-term measures and strategic planning for the realization of a sustainable e-government and, on the other hand, prescribes them to plan for changing the direction of culture toward the values of e-government. Committed Management requires this concepts of ruling of principles of cultural sustainability with sustainable e-government (Schein, 2010). And these administrators must follow the provisions of the laws of sustainable e-government support for making the necessary changes to implement e-government sustainable, such as designing a strategic plan and reforming the organizational structure (Altameem et al., 2006; Sorn-In et al., 2015; Whitehead, 2017) Strategic management and cultural management are mutually reinforcing, that is, in the light of the strategic management towards sustainable e-government, culture is driven towards where the values are appropriate to e-government and sustainability. In addition mutually reinforcing these cultural foundations, implementation of a sustainable e-government becomes a value, and as a result, an institutional requirement of government management, since, according to the term Nam (2018), culture is the factor influencing initiatives and success in the government sector.

In the third level, strategic management and cultural management influence financial management; sustaining e-government financing and investing security in its support plans (Amini & Bienstock, 2014; Aras & Crowther, 2008; Cordella & Tempini, 2015; Galpin et al., 2015) needs planning, implementation and control of appropriate financial strategies and supporting sustainable e-government. In addition, combining cultural values with the values governing e-government are sustainable, so that the former provides an external commitment and the other an internal commitment to this work. In the fourth level infrastructure management and human resource competence management are effective. Therefore, it is possible to rely on the resources provided for e-government implementation and invest in two areas of physical resources and human resources. In this way, with more reliability new efficient technology needed for easy, secure, cost-effective, and collaborative services is provided (Beynon-Davies, 2007; Mohammed et al., 2017) in a sustainable e-government. In addition, competent and suitable staff are observed in a sustainable e-government organization and necessary training in this regard is provided for them (Anisenco et al., 2017; Sorn-In et al., 2015).

At the fifth level with the support of appropriate physical infra-structure and competent human resource management suitable to the sustainable e-government at the fifth level first with the provision of services, electronic services are provided, measured, evaluated and corrected according to the characteristics of sustainability. The aim of customer psychological satisfaction (Sheryazdanova et al., 2016) is through the easy access without borders to services (Anthopoulos et al., 2016; Hadidi & Carter, 2016). Sustained e-government and the opportunity to interact with the government and Increasing the learning potential is through this way (Knoll & Jastram, 2018; Verkijika & De Wet, 2018). Secondly, with the aim of reducing the risks and pollution (Amini & Bienstock, 2014) and optimizing resources and the way how to use them (Yildiz, 2007) through the control of incidents in government agencies (Amini & Bienstock, 2014), development of inclusive safety networks (Winkel, 2007) and the promotion of ecological citizenship (Sá et al., 2016), event management is carried out. Thirdly, with the management of electronic information, quality, accurate, comprehensive, timely and secure information provided to the citizens (Al-Mashari,

2007; AlAwadhi & Morris, 2009; Alzahrani et al., 2017; Bailey et al., 2017; Sorn-In et al., 2015). If we consider the implementation of a sustainable e-government as a system, this level is the first out level of the system.

On the sixth level, when citizens are exposed to sustainable e-government services, their e-readiness increases. Citizens learn that for the optimal use of sustainable e-government services, they must be updated on their IT literacy and effective empowerment and acceptance of electronics are effective for them (Schlæger & Stepan, 2017). At the seventh level, for the implementation of sustainable e-government, the enhanced capacity of citizens' e-readiness to establish a favorable context for managing citizen communication is changed as a management strategy in attracting and enhancing citizens' electron involvement (Amran & Keat Ooi, 2014; Birrer, 1999; Schellong, 2005).

## **6- Conclusion**

From the synthesis of the two concepts of e-government and sustainability as two institutional requirements and a necessity of a durable, modern life sustainable, e-government is formed , in which descriptive sustainability is for e-government;. That is, e-government, with respect to sustainable environmental, economic and social criteria and standards. Implementing sustainable e-government requires a network of interrelated factors depending on the national requirements of each country. The present study aimed to identify these factors in Iran and investigate their hierarchical linkage in the framework of the research approach of interpretive structural modeling. The results of the research showed that the most fundamental factor for implementation of sustainable e-government in Iran, according to research experts, is legal requirements because the basic framework for planning, implementation and monitoring of appropriate strategies for the realization of sustainable e-government in Governmental organizations as well as the changes of national culture towards sustainable values is e-government. In this case, the government and government organizations will be oriented towards providing financial resources to implement sustainable e-government and investing in related areas. As a result, by strengthening physical infrastructure and appropriate man-power supply with sustainable e-government standards, sustainable e-services ( with quality, easy, without borders, safe, timely and interactive) are presented, measured, evaluated and improved. With the quantitative and qualitative improvement of sustainable electronic services, gradually citizens' e-readiness is also increased and this is a good opportunity for the development of public e-participation with the government in managing providing of the services.

### **6-1-Managerial insight**

As it turned out, the legal requirements are the basis for the implementation of sustainable e-government. However, relying on this factor, Iranian society can achieve the path of justice, order, security, tranquility, equal distribution of facilities and preservation of the ecosystem in social life for the welfare of citizens. Under the influence of this factor and cultural and strategic factors, Iranian society can independently achieve analysis of important and salient issues. Sustainable e-government in this society also helps to develop the national strategy through financial management of IT infrastructures. On the other hand, it should be said that achieving sustainability in e-government in Iran through infrastructure and human resources management maximizes productivity. Delivers. Also in the form of attention to the dimensions of information management, events, services, e-citizen readiness and citizen relations management, sustainable e-government of the Iranian government can increase democratic values, transparency, participation, increase accountability, growth of safety nets, electronic pollution control, optimal Created government resources to change traditional methods and modernize its relationship with stakeholders.

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