Effective Development of Mobile Government; Governance Approach

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Abstract:
Recent advances in wireless and mobile communications infrastructure are enabling governments to deliver and manage services to citizen efficiently and economically. Mobile government provides this ability to governments. This paper presents the ggovernance approach in effective development of mobile government. The objective is reviews(identify and ranking) of public service concept (Included: Political and strategic factor ,Effectiveness of governance and public services factor) in effective development of mobile government. The data was analyzed using fuzzy Delphi method (to identification) and fuzzy AHP (to ranking the identified Factors). Results indicated that effectiveness of governance and public services factor has a higher priority than political and strategic factor.
Keywords: Mobile government, Effective development, Effectiveness of governance and public services factor, political and strategic factor.

1. Introduction

Many governments have been moving towards electronic government (e government) in the last decade. Some of these governments have noted the high penetration of mobile devices which have surpassed personal computer (PC) adoption in many countries and have started moving naturally towards mobile government as a next step to improve their interaction with constituents. Thus, these governments are moving to improve their services by adding mobile government (m-government) as a new delivery channel utilising the available wireless infrastructure installed by private mobile operators (Al-khamayseh, Lawrence and Zmijewska, 2007). The concept of m-Government (attendant government) is hidden in the application of wireless mobile communication technologies of public sector organization and provision of services and

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sharing information to other organizations and citizens (Sandy & McMillan, 2005).

Mobile communications and Internet technologies are enabling access to new e-government services at any time and from anywhere. M-government is considered as a subset of e-government comprising another channel to provide governmental information and services (El Kiki et al., 2005; Ntaliani et al., 2008).

Mobile Government (m-Government) may be viewed as a subset of eGovernment. Mobile services such as short messages (SMS) have the advantage of immediate and reliable access when land-based telecommunication is disrupted during crisis (Aloudat and Michael,2011). General goals of m-Government can be considered as:

1) increasing added values of e-government services (providing specific facilities, appropriateness of services, privatization of services) (Carroll, 2005; El-Kiki & Lawrence, 2006b; Fidel et al., 2007)

2) implementing public services by creating convergence between internet services and wireless services (Curbera, et al., 2003).

From citizen points of view, m-Government is a symbol of full-scale access to services of public sector and relevant sectors (Kushchu & Kuscu, 2003; Carroll, 2005; Trimi & Sheng, 2008). However, m-government is still in its infancy and very few governments have implemented full mobile government services. In Iran, m-Government initiative was launched as a part of the country's overall information technology plan (for instance: e-Government) focused on ICT as a tool to reform public organizations. Considering that effective development of m-Government policies has no long history in Iran, we have tried to evaluate the public service concept (Included: Political and strategic factor, Effectiveness of governance and public services factor) in effective development of mobile government in Iran.

2. Towards a Mobile Government

Governments around the world have long been exploring the utilization of different channels, including proprietary solutions and private infrastructures, for the purpose of delivering information and services to public. In this context, recent advances in wireless and mobile communications infrastructure are enabling governments to deliver information and services to citizen efficiently and economically (Al-Hujran, 2012). The use of Pocket PCs, tablets, handheld terminals, short

message service (SMS), personal digital assistants (PDA's) and mobile or cellular telephones has yielded benefits for government practitioners and citizens alike. Some of these benefits are shown in table 1 below.

Table 1: Benefits of M-government Service (Afshar Jahanshahi et al. 2011)

Benefit	Reference
Increasing channels in order to improve interactions	Faya, 2001; Centeno et al., 2004; Heeks, 2004; Capgemini, 2007
Service presentation for the public in place	Rannu, 2003; Kwon, 2004; Tomas et al., 2008; Kaliannan et al., 2009
Easier access to the necessary information for citizens	Sandy & McMillan, 2005; Hossan et al., 2005; Suomi, 2006
On time and quick update of data and information	Donegan, 2000; Clark, 2001; May, 2001; Capgemini, 2007
Increase productivity of public sector services	Heeks, 2004; Tomas et al., 2008; Rannu et al., 2010

In addition, through m-government, governmental organizations can deliver other information and services to public such as information on civil affairs, small financial transaction, and electronic identification (Kim et al. 2004). In developing countries where wireless communication penetration is high and already surpassed the internet penetration rates, m-government also becomes a good option (Ghyasi and Kushchu, 2004).

3. Research Goal

As mentioned, in this study we followed analysis of public service concept in effective development of mobile government. Thus, the research goals are:
1- Identification factors of public Services concept and indicators of each factor;
2- Ranking factors of public Services concept and indicators of each fuzzy AHP factor.

4. Research Methodology

The aim of this research is investigating the public service concept in effective development of mobile government. So, initially research conducted in this field is reviewed. After a review of previous research, factors and indicators identified by Fuzzy Delphi method and are ranked by Fuzzy AHP method. The research structure is shown in Figure 1.
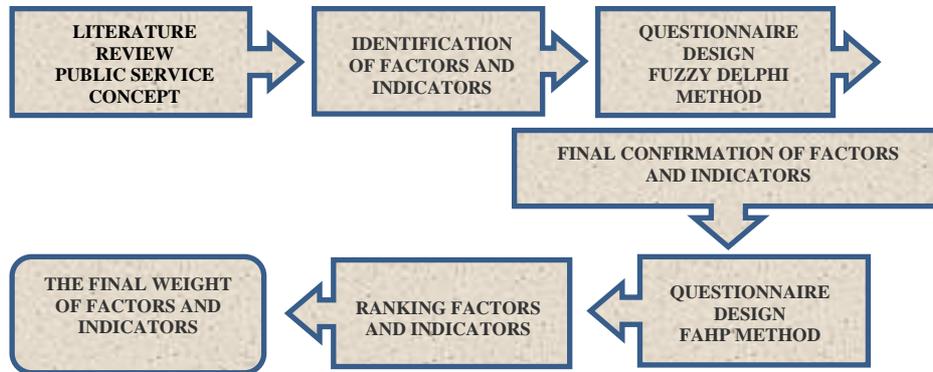
Figure 1. Research Structure

4.1. Research Model

After consideration of previous studies, the factors and indicators of public service concept was identified. The research model is shown in Figure 2.
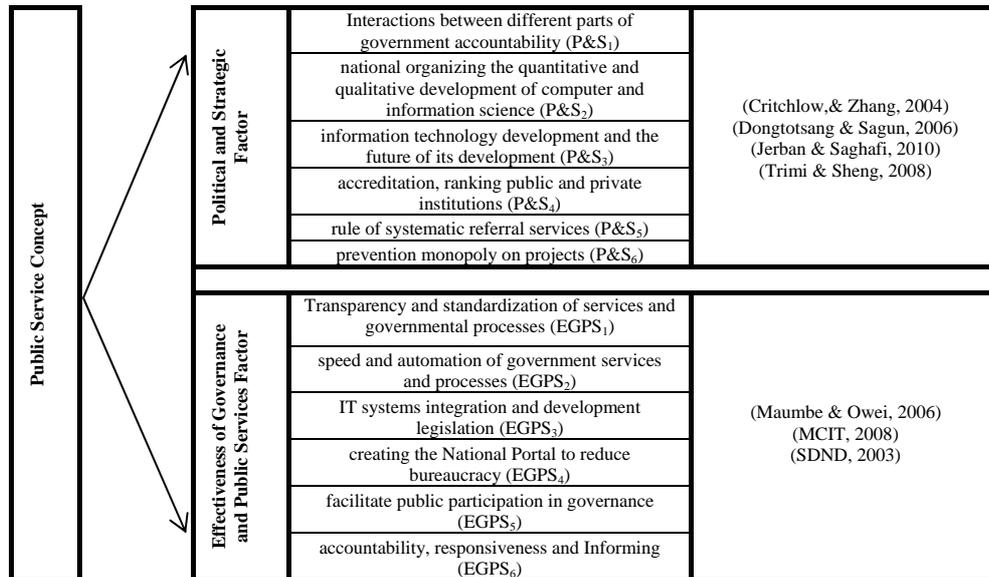

Public Service Concept	Political and Strategic Factor	Interactions between different parts of government accountability (P&S$_1$)	(Critchlow,& Zhang, 2004) (Dongtotsang & Sagun, 2006) (Jerban & Saghafi, 2010) (Trimi & Sheng, 2008)
		national organizing the quantitative and qualitative development of computer and information science (P&S$_2$)	
		information technology development and the future of its development (P&S$_3$)	
		accreditation, ranking public and private institutions (P&S$_4$)	
		rule of systematic referral services (P&S$_5$)	
		prevention monopoly on projects (P&S$_6$)	
	Effectiveness of Governance and Public Services Factor	Transparency and standardization of services and governmental processes (EGPS$_1$)	(Maumbe & Owei, 2006) (MCIT, 2008) (SDND, 2003)
		speed and automation of government services and processes (EGPS$_2$)	
		IT systems integration and development legislation (EGPS$_3$)	
		creating the National Portal to reduce bureaucracy (EGPS$_4$)	
		facilitate public participation in governance (EGPS$_5$)	
		accountability, responsiveness and Informing (EGPS$_6$)	

Figure 2. Research Model

5. Data analysis and finding
5.1. Fuzzy Delphi Method

Fuzzy Delphi method was developed in the 1980s by Kaufman and Gupta . Application of this approach to decision-making and consensus on issues that goals and parameters are not clear is a very significant progress. This feature provides a flexible framework that is covered many of the barriers related to lack of precision. Implementation of the fuzzy Delphi method combines the Delphi method and analysis on the data with definition of fuzzy set theory. Expert opinions often are offer in the form of minimum, most likely value (triangular fuzzy numbers), then the average of the experts (number given) and the difference is calculated as the sum of the average person, and then it's going to take reviews Experts with new posts. Then each expert based on data from the previous stage, offers a new view or modifies his previous comment. This process continues until it is stable enough for average fuzzy numbers.

5.2. Definition of Linguistic Variables

As noted, the objective of the questionnaire is awareness from opinions of experts about the identify factors in the effective development of mobile government in Iran. Therefore, Experts should express "amount" values through the variables. Qualitative variables, gives more freedom to the Experts. The use of qualitative variables such as "low", "medium", "high" can be solve the problem to some extent. Individuals comments to qualitative variables are not the same. Since the experts have different features and different mentality, if they answered to options based on different mentality, analysis of variables is worthless. But by definition the range of qualitative variables, experts will answer questions with the same mentality. So, qualitative variables are defined trapezoidal fuzzy numbers in Figure 3.
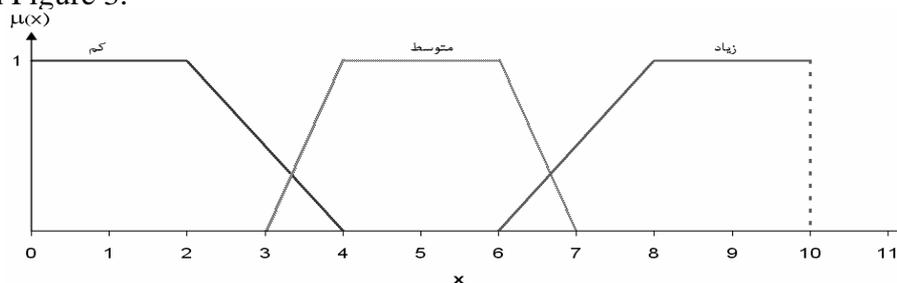

Fig 3. Membership function of linguistic variables

5.3. Analysis of Public Service Concept in Effective Development of Mobile Government

The questionnaire was designed according to the proposed options and define linguistic variables. The results of the survey questionnaire responses expressed in table 2.

The average amount of each factors and indicators of public service concept that may affect on development of mobile government in Iran is shown in table 2. It is calculated according to the following equations and is shown in Table 2.

$$A^{(i)} = \left(a_1^i, a_2^i, a_3^i, a_4^i\right), \quad i = 1,2,3,\ldots, n \qquad (1)$$

$$A_m = \left(a_{m1}^i, a_{m2}^i, a_{m3}^i, a_{m4}^i\right) = \left(\frac{1}{n}\sum a_1^{(i)}, \frac{1}{n}\sum a_2^{(i)}, \frac{1}{n}\sum a_3^{(i)}, \frac{1}{n}\sum a_4^{(i)}\right) \qquad (2)$$

At this stage, the amount effectiveness of each factors and indicators, have been asked from the exports.

Table 2: The results of the first questionnaire responses

Row	Factors					Indicators				
						Row	Impact of efective indicators			The average of expert opinion in the first questionnaire
							Low	medium	high	
1	Political and Strategic Factor	Impact of effective factors	high	37	The average of expert opinion in the first questionnaire (2.8,3.7,5.7,6.8)	(P&S₁)	51	51	31	(2.5,3.4,5.4,6.5)
						(P&S₂)	47	61	25	(2.5,3.3,5.3,6.5)
			medium	51		(P&S₃)	41	55	37	(2.9,3.8,5.9,6.9)
						(P&S₄)	49	58	26	(2.5,3.3,5.3,6.5)
			Low	45		(P&S₅)	37	57	39	(3,4,6,7)
						(P&S₆)	35	60	38	(3,4,6,7)
2	Effectiveness of Governance and Public Services Factor	Impact of effective factors	high	35	The average of expert opinion in the first questionnaire (2.7,3.6,5.6,6.7)	(EGPS₁)	41	49	43	(3,4,6,7)
						(EGPS₂)	38	53	42	(3,4.1,6.1,7)
			medium	51		(EGPS₃)	43	52	38	(2.9,3.8,5.8,6.9)
						(EGPS₄)	34	56	43	(3.2,4.3,6.3,7.3)
			Low	47		(EGPS₅)	31	57	45	(3.2,4.3,6.3,7.3)
						(EGPS₆)	21	51	61	(3.9,5.2,7.2,7.9)

According to the table 2 opinion disagreement of each the experts based on equation (3) is calculated. In fact, based on the equation each experts can compare and adjust his/her opinions with average opinions.

$$e = \left(a_{m1} - a_1^{(i)}, a_{m2} - a_2^{(i)}, a_{m3} - a_3^{(i)}, a_{m4} - a_4^{(i)}\right)$$
$$= \left(\frac{1}{n}\sum a_1^{(i)} - a_1^i, \frac{1}{n}\sum a_2^{(i)} - a_2^i, \frac{1}{n}\sum a_3^{(i)} - a_3^i, \frac{1}{n}\sum a_4^{(i)} - a_4^i\right) \tag{3}$$

Using equation (3) the difference between experts opinion were calculated and adjusted in the questionnaire.The results of the second stage of fuzzy Delphi are shown in Table 3.

Table 3: The results of the second questionnaire responses

Row	Factors						Row	Impact of efective indicators			The average of expert opinion in the second questionnaire
								Low	medium	high	
1	Political and Strategic Factor	Impact of effective factors	high	49	The average of expert opinion in the second questionnaire	(3.3,4.4,6.4,7.3)	(P&S₁)	43	57	33	(2.8,3.7,5.7,6.8)
							(P&S₂)	40	62	31	(3.9,5.3,7.2,7.9)
			medium	47			(P&S₃)	34	57	42	(1.4,3.6,5.6,6.7)
							(P&S₄)	51	44	38	(2.7,3.6,5.6,6.7)
			Low	37			(P&S₅)	32	56	45	(3.3,4.4,6.4,7.3)
							(P&S₆)	28	62	43	(3.3,4.4,6.4,7.3)
2	Effectiveness of Governance and Public Services Factor	Impact of effective factors	high	43	The average of expert opinion in the second questionnaire	(3,4,6,7)	(EGPS₁)	35	47	51	(3.4,4.5,6.5,7.4)
							(EGPS₂)	34	49	51	(3.4,4.5,6.5,7.4)
			medium	49			(EGPS₃)	36	56	41	(3.1,4.1,6.1,7.1)
							(EGPS₄)	29	53	51	(3.5,4.7,6.7,7.5)
			Low	41			(EGPS₅)	24	55	54	(3.7,4.9,6.9,7.7)
							(EGPS₆)	19	38	76	(4.3,5.7,7.7,8.3)

At this stage, the difference between stages 1 and 2 is calculated by using equation 4. If the calculated difference was be less than 0.2 fuzzy Delphi process stops. The difference between steps 1 and 2 fuzzy Delphi is shown in Table 4.

$$S(A_{m2}, A_{m1}) = \left| \frac{1}{4}\left[(a_{m21} + a_{m22} + a_{m23} + a_{m24}) - (a_{m11} + a_{m12} + a_{m13} + a_{m14}) \right] \right| \tag{4}$$

According to the results, the differences between the average is more than 0.2, So it can be concluded that there isn't reasonable agreement between the Experts. Therefore, after calculating each Experts disagreement opinions than the average according to equation 3, the third questionnaire was distributed.

Table 4:The differences between the average of opinions Experts in the first and second questionnaire

Row	Factors	The differences between the average of Experts opinions in the first and second questionnaire	Indicators	The differences between the average of Experts opinions in the first and second questionnaire
1	Political and Strategic Factor	0.52	(P&S$_1$)	0.23
			(P&S$_2$)	0.34
			(P&S$_3$)	0.31
			(P&S$_4$)	0.26
			(P&S$_5$)	0.28
			(P&S$_6$)	0.31
2	Effectiveness of Governance and Public Services Factor	0.36	(EGPS$_1$)	0.36
			(EGPS$_2$)	0.37
			(EGPS$_3$)	0.26
			(EGPS$_4$)	0.34
			(EGPS$_5$)	0.42
			(EGPS$_6$)	0.44

The third questionnaire results shown in table (5) and the difference between steps 2 and 3 of fuzzy Delphi is shown in table 6.

Table 5: The results of the third questionnaire responses

Row	Factors						Indicators				
							Row	Impact of effective indicators			The average of expert opinion in the third questionnaire
								Low	medium	high	
1	Political and Strategic Factor	Impact of effective factors	high	47	The average of expert opinion in the third questionnaire	(3.3,4.4,6.4,8)	(P&S$_1$)	43	57	33	(2.7,3.7,5.7,8.2)
							(P&S$_2$)	38	62	33	(2.9,3.8,5.8,6.8)
			medium	51			(P&S$_3$)	33	55	45	(3.3,4.4,6.4,7.3)
							(P&S$_4$)	51	44	38	(2.7,3.6,5.6,6.8)
			Low	35			(P&S$_5$)	30	62	41	(3.2,4.3,6.3,7.4)
							(P&S$_6$)	27	61	45	(3.4,4.5,6.5,7.2)
2	Effectiveness of Governance and Public Services Factor	Impact of efective factors	high	34	The average of expert opinion in the third questionnaire	(2.7,3.6,5.6,8.4)	(EGPS$_1$)	31	57	45	(3.3,4.4,4.4,7.3)
							(EGPS$_2$)	35	49	49	(4.4,5.4,6.4,7.3)
			medium	52			(EGPS$_3$)	33	55	45	(3.3,4.4,6.4,7.3)
							(EGPS$_4$)	26	52	55	(3.6,4.9,6.9,7.6)
			Low	47			(EGPS$_5$)	21	57	55	(3.7,5,7,7.7)
							(EGPS$_6$)	13	43	77	(4.4,6,8,8.4)

Table 6: The differences between the average of opinions Experts In the second and third questionnaire

Row	Factors	The differences between the average of Experts opinions in the second and third questionnaire	Indicators	The differences between the average of Experts opinions in the second and third questionnaire
1	Political and Strategic Factor	0.18	$(P\&S_1)$	0
			$(P\&S_2)$	0.07
			$(P\&S_3)$	0.11
			$(P\&S_4)$	0
			$(P\&S_5)$	0.01
			$(P\&S_6)$	0.03
2	Effectiveness of Governance and Public Services factor	0.03	$(EGPS_1)$	0.05
			$(EGPS_2)$	0.15
			$(EGPS_3)$	0.18
			$(EGPS_4)$	0.18
			$(EGPS_5)$	0.10
			$(EGPS_6)$	0.18

Considering the difference of average is not more than 0.2, So it can be concluded and Interpreted that there is a good agreement among the Experts.

5.4. Fuzzy Analytical Hierarchy Process

FAHP methodology based on the concept of fuzzy set theory was introduced and funded by Professor Lotfizadeh (1965). Fuzzy analytic hierarchy process (FAHP) is developed, AHP through the combination of fuzzy set theory. The fuzzy AHP, a hierarchical structure for the problem that must be solved in order to show the relative importance of factors associated with use of fuzzy measures of relative scales. Thus, a fuzzy judgment matrix is constructed, the final scores of options offered by fuzzy numbers, and choose the best is achieved from ranking fuzzy numbers with using of specific algebraic operators (Duran & Aguilo, 2008). Concepts and definitions of hierarchical analysis fuzzy AHP according to analysis method developed. When decision makers are faced with a complex and uncertain issue of uncertain proportions as their comparative judgments "about twice as important" or "Between two to four times less important" Outlines steps and the standard AHP approach

to prioritization vector can be considered as the special procedures (Duran & Aguilo, 2008).

In 1996, a Chinese researcher named "Young Chung" presented Development of analysis methods. In this methodology, the triangular fuzzy numbers to all elements of the judgment matrix and weight vector by this method, is used in most studies due to the simplicity of calculations (Wang, Chu &Wu, 2007).Assuming $\tilde{A} = \{\tilde{M}_{ij}\}$ was be matrix of fuzzy paired comparison, which is defined as follows:

$$\tilde{A} = \begin{bmatrix} 1 & \tilde{M}_{12} & ... & \tilde{M}_{1n} \\ \tilde{M}_{21} & 1 & ... & \tilde{M}_{2n} \\ . & . & . & . \\ . & . & . & . \\ \tilde{M}_{n1} & \tilde{M}_{n2} & ... & 1 \end{bmatrix}$$

Then will be established equation $\tilde{M}_{ji} = \dfrac{1}{\tilde{M}_{ij}}$

Now to solve the model using EA, in each row of a matrix of paired comparisons, the value of S_k that is a triangular fuzzy number is calculated as follows:

$$S_k = \sum_{j=1}^{n} M_{kj} * \left[\sum_{i=1}^{m} \sum_{j=1}^{n} M_{ij} \right]^{-1}$$

In which, k represents the number of rows i and j, indicates options and indicators respectively.

In this way, after the calculation S_k should be achieved their large degree than together. In general, If M_1 and M_2 were be two triangular fuzzy number, large degree is defined as follows:

$$\begin{bmatrix} V(M_1 \geq M_2) = 1 & M_1 \geq M_2 \\ \\ V(M_1 \geq M_2) = hgt(M_1 \cap M_2) \end{bmatrix}$$

And if not, we have:

$$hgt(M_1 \cap M_2) = \frac{u_1 - l_2}{(u_1 - l_2) + (m_2 - m_1)}$$

To calculate the indicators weight in the matrix of paired comparisons we act as follows:

$$W'(X_i) = \min\{V(S_i \geq S_k)\} \qquad k = 1,2,......,n, k \neq i$$

Therefore, the vector of indicators weight as follows:

$$W' = [W'(X_1), W'(X_2),...., W'(X_n)]^t$$

That is the vector of fuzzy AHP abnormal coefficients. Based on the equation $W_i = \dfrac{W_i'}{\sum W_i'}$

normalize weights and achieve index (Azar & Farajy, 2008). The results of the ranking factors using fuzzy AHP are shown in table 7.

Table 7: Ranking factors and indicators of public service concept on effective development of mobile government using fuzzy AHP

Row	Factors	Normalized weight	Indicators	Normalized weight	Final weight
1	Political and Strategic Factor	0.35	(P&S$_1$)	0.221	0.07735
			(P&S$_2$)	0.340	0.119
			(P&S$_3$)	0.113	0.03955
			(P&S$_4$)	0.065	0.02275
			(P&S$_5$)	0.127	0.04445
			(P&S$_6$)	0.130	0.0455
2	Effectiveness of Governance and Public Services Factor	0.65	(EGPS$_1$)	0.188	0.1222
			(EGPS$_2$)	0.138	0.0897
			(EGPS$_3$)	0.168	0.1092
			(EGPS$_4$)	0.113	0.07345
			(EGPS$_5$)	0.171	0.11115
			(EGPS$_6$)	0.233	0.15145

The results of the table 7 shows that the effect of public service concept on effective development of mobile government, effectiveness of governance and public services factor has a higher priority than political and strategic factor. Also, among indicators of effectiveness of governance and public services factor, accountability, responsiveness and informing indicator has the highest priority and among indicators of political and strategic factor, national organizing, the quantitative and qualitative development of computer and information science has the highest priority.

6. Conclusion and Suggestions

This paper has outlined and discussed the public service concept on effective development of mobile government. The first, factors and indicators of public services were identified by the review of previous research. The results of fuzzy Delphi method showed that public service concept is made up of two factors (political and strategic factor and effectiveness of governance and public services factor) and 12 indicators. Results of the analysis fuzzy AHP method indicated that effectiveness of governance and public services factor (Normalized weight: 0.65) and accountability, responsiveness and informing indicator (Final weight: 0.15145) have the highest priority in the research.

Suggestions:

Planning and implementation of projects related to mobile government based on the current research in the public administration is the best way to improve public services; More attention and concentration is also necessary on effectiveness of governance and public services factor, accountability and responsiveness and informing indicator and looking at success factors from respective views and quantitative and qualitative ways of measuring success on effective development of mobile government .

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