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A Multi-Layer Architecture Based on MCDM Methods to Select the Best E-Readiness Assessment Model According to SWOT Analysis

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***Abstract* — E-readiness is one of the major prerequisites for effective implementation of e-government. For the correct implementation of e-government, it is needed to accurately assess the state of e-readiness in desired community. In this regard, there are models to assess, but the correct choice of model is one of the most important challenges in this area. The process of evaluating and selecting the appropriate options in the implementation of e-government due to the involvement of different groups of decision-makers, existence of interrelationships between technology and desired community as well as existing platforms is a complex process. In recent decades, with access to computational methods and powerful decision making systems selecting more accurate options, effective analysis of qualitative and quantitative characteristic and studying the interaction between them are provided. This article tries to examine the performance of e-readiness assessment models and multi criteria decision making methods and introduces the best selection of the e-readiness model for effective implementation of e-government. In order to reach this purpose, we introduced a layered architecture based on multi-criteria decision making methods and SWOT Analysis. The proposed layered architecture, reduces decision making errors and increases the accuracy in choosing the appropriate e-readiness assessment model.**

***Index Terms* — E-government, E-Readiness Assessment Models, Multi-Criteria Decision Making Methods, Layered Architecture.**

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I. INTRODUCTION

As defined by the Economist Intelligence Unit, e-readiness is countries' ICT status in terms of needed infrastructure and the ability of government consumers and the business environment, in this regard consumers' sources including government, public or private sectors are examined [1]. To achieve accurate assessment of e-readiness level of a community, it needs choosing a single and standard model and its assessment in consecutive years, since only the drop-in ratings cannot provide the status of the community growth, and this requires choosing an appropriate model, so based on that model, the evaluations are done.

Therefore, evaluation of the current state in terms of e-readiness in any place would be an introduction to plan and achieve the ideal situation. If we consider the progress of IT in a community in three stages: identification of the current state, designing the ideal situation, and planning the transition from the current state to the desired state, in the first stage, the status of a place in terms of e-readiness can be identified, and the assessment of strengths and weaknesses in four areas of e-readiness (businesses, citizens, infrastructures and government) can be worked on. When the e-readiness in a community exists in a desired state, it can be the base of effective implementation of e-government, because in e-government all of the needed services of residents are funded through information networks, and by using information technology and communication, their services are offered quickly, accessible and safe to citizens.

Thus, according to expectations in the field of information technology and e-government and providing accessible and efficient technologies, following questions come to mind: How can the most suitable models, methods and solutions be considered to implement e-government? Based on what qualitative and quantitative factors, the most appropriate methods and technologies according to the needs of the material, moral, technical and cultural of the chosen community can be selected and categorized? Is it enough to only consider the quantitative measures or qualitative measure is also important? In what way, can qualitative and quantitative criterions be compared and evaluated?

In fact, the success of e-readiness study is the results of the surveys of e-readiness assessment models, since different models of e-readiness assessment in terms of objective, strategies and results are not similar, and in fact, it can be said that the accuracy and adequacy of each model should be analyzed according to the target.

As a result, choosing an appropriate model to implement e-government is one of the main factors. In this regard, the proposed layered architecture in this article, which is based on multi-criteria decision making methods selects the most suitable e-readiness model considering the conditions of the desired community.

The second section of this article, is assigned to the concepts of e-government, e-readiness and e-readiness assessment models. In the third section the proposed layered architecture is presented, and in the fourth section the proposed architecture is compared with other methods used to e-readiness model selection and finally in the fifth section the article is concluded.

II. BACKGROUND

1. E-government

There is a growing consensus among governments across the world of the need to revitalize public administration to facilitate customer-cantered, cost-efficient, and user friendly delivery of services to citizens and businesses, thereby improving the quality of governmental functions [1]. E-Government is widely recognized as fundamental to the reform, and as a modernization and improvement of government [2]. The implementation of e-government projects is becoming increasingly significant in both public and private organizations [3, 4].

For one to understand the idea of E-government, must first understand government in general. Government is actually a dynamic mixture of goals, structures and functions. E-government is more than a website, email or processing transactions via the internet. E-government becomes a natural extension of the technological revolution that has accompanied the knowledge society. The E-government added new concepts such as: transparency, accountability, citizen participation in the evaluation of government performance [5].

Like other concepts of contemporary there are multiple definitions of E-government among researchers and specialists, but most of them agreed to define Electronic government as government use of information communication technologies to offer for citizens and businesses the opportunity to interact and conduct business with government by using different electronic media such as telephone touch pad, fax, smart cards, self-service kiosks, e-mail/Internet, and EDI. It is about how government organizes itself: its administration, rules, regulations and frameworks set out to carry out service delivery and to co-ordinate, communicate and integrate processes within itself [6].

2. E-readiness

Based on Rizk research (2004), the purpose of e-readiness is ability to accept the use and deployment of applications related to its in community. Several factors influence how the use of IT and e-readiness level of communities that it is necessary be carefully studied and identified [7]. With regard to the issue that digital divide between developing countries is increasing, governments and businesses to use ICT know as a priority.

In order to further the effectiveness of information and communication technology a country and consequently businesses in terms of telecommunications infrastructure, access to information and communication technologies must have legal framework for the use of ICT e-readiness. If it is considered to reduce the digital divide, it is necessary above all needs with a coherent and achievable strategy that takes into consideration country local needs, have appropriate. National governments can set measurement of e-readiness in order to assess their current state in the agenda and to identify areas that need government support [8]. Infrastructure needed for e-commerce include:

- Connection and IT infrastructure
- Social and cultural environment
- Business environment

Organizations of public and private [9].

3. E-readiness Assessment Models

There are different models to E-readiness assessment such as CSPP, CID, APEC, MOSAIC, EIU and ITU that indexes and different methods have been proposed to assess E-readiness. In superficial look at each of these models show level of readiness of a community to the exploitation of information technology and e-business. On closer look, these models have very wide and varied definitions and different measurement methods [10]. Table (I) shows e-readiness assessment models at different levels [11].

TABLE I
E-READINESS ASSESSMENT MODELS AT DIFFERENT LEVELS [11]

E-readiness Assessment Models	Level
CID،APEC،CSPP،McConnell،EIU،ITU، USAID ، CIDCM، NRI	Information infrastructure
CID،APEC،CSPP،McConnell،EIU،CIDCM،NRI	Deliverability and availability of the Internet
CID،APEC،CSPP،McConnell،EIU،ITU،USAID ، NRI	Network speed and quality
CID، APEC، CSPP، McConnell،EIU،NRI	Hardware and software of network
CID، EIU	ICT Service and Support
CID،APEC،CSPP،McConnell،EIU،ITU،ESAID،NRI	Human Resources and Skills (Information Literacy)
CID،APEC،CSPP،McConnell،EIU،ITU،NRI	People and organizations online (employee and departments)
CID،APEC،EIU	Appropriate local content
McConnell،EIU،NRI ،ITU، USAID	Financial support and investment for the development of ICT
CID،APEC،CSPP،EIU	Information and Communication Technology in the Workplace
CID،EIU	ICT job opportunities
CID،APEC،CSPP،EIU	E-commerce B2C (relationship with consumer)
CID،APEC،EIU	E-commerce B2B (relationship with other business)
CID،APEC،McConnell،USAID، NRI	Electronic Government
CID،APEC،McConnell،EIU،USAID،NRI	Legal and regulatory environment (such as copyright law…)
CID،CSPP،EIU،CIDCM	Information Technology Policy and Management
APEC،ITU	Benefits of electronic services (expenses and charges…)
APEC،CSPP،McConnell،EIUUSAID	Security encryption (such as public infrastructure, digital signature, Privacy Statement...)
EIU، CSPP	Degree of Innovation
EIU،APEC	Industry standards (for developing ICT)

4. MCDM Methods

The multiple criteria decision making (MCDM) can be generally described as the process of selecting one from a set of available alternatives, or ranking alternatives, based on a set of criteria, which usually have a different significance. During the second half of the 20th century, MCDM was one of the fastest growing areas of operational research and because of them many MCDM methods have been proposed [12]. From many of the proposed MCDM methods, we shall state some of the most prominent, such as: AHP and TOPSIS.

4-1. Analytical Hierarchy Process (AHP)

AHP is a multi-criteria decision making technique that can help express the general decision operation by decomposing a complicated problem into a multilevel hierarchical structure of objective, criteria and alternatives [13]. AHP performs pairwise comparisons to derive relative importance of the variable in each level of the hierarchy and / or appraises the alternatives in the lowest level of the hierarchy in order to make the best decision among alternatives.

AHP is an effective decision making method especially when subjectivity exists and it is very suitable to solve problems where the decision criteria can be organized in a hierarchical way into sub-criteria [14]. AHP is used to determine relative priorities on absolute scales from both discrete and continuous paired comparisons in multilevel hierarchic structures [15].

The prioritization mechanism is accomplished by assigning a number from a comparison scale (see Table II) developed by Saaty (1980, 1996) to represent the relative importance of the criteria. Pairwise comparisons matrices of these factors provide the means for calculation of importance [13].

TABLE II
PAIRWISE COMPARISON SCALE [13]

Intensity of Importance	Explanation
1	Two criterion contribute equally to the objective
3	Experience and judgment slightly favor one over another
5	Experience and judgment strongly favor one over another
7	Criterion is strongly favored and its dominance is demonstrated in practice
9	Importance of one over another affirmed on the highest possible order
2,4,6,8	Used to represent compromise between the priorities listed above

The AHP method is based on three principles: first, structure of the model; second, comparative judgment of the criteria and/or alternatives; third, synthesis of the priorities.

In the first step, a decision problem is structured as a hierarchy [16]. AHP initially breaks down a complex multi-criteria decision making problem into a hierarchy of interrelated decision elements (criteria, decision alternatives). With the AHP, the objectives, decision criteria and alternatives are arranged in a hierarchical structure similar to a family tree [17].

The second step is the comparison of the criteria and/or the alternatives. Once the problem has been decomposed and the hierarchy is constructed, prioritization procedure starts in order to determine the relative importance of the criteria. In each level, the criteria are compared pairwise according to their levels of influence and based on the specified criteria in the higher level [17].

In AHP, multiple pairwise comparisons are based on a standardized comparison scale of nine levels.

Let C = {C_j | j = 1, 2, . . . , n} be the set of criteria. The result of the pairwise comparison on n criteria can be summarized in an (n x n) evaluation matrix A in which every element aij (*i, j* = 1, 2, . . . , n) is the quotient of weights of the criteria. This pairwise comparison can be shown by a square and reciprocal matrix, (see Eq. (1)).

$$A = (a_{ij})_{n\times n} = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{bmatrix} \qquad (1)$$

At the last step, each matrix is normalized and be found the relative weights. The relative weights are given by the right eigenvector (w) corresponding to the largest eigenvalue (λ max), as:

$$A_W = \boldsymbol{\lambda_{max}}.\mathrm{W} \qquad (2)$$

If the pairwise comparisons are completely consistent, the matrix A has rank 1 and $\lambda_{max} = n$. In this case, weights can be obtained by normalizing any of the rows or columns of A [18]. It should be noted that the quality of the output of the AHP is related to the consistency of the pairwise comparison judgments. The consistency is defined by the relation between the entries of A: $a_{ij} \times a_{jk} = a_{ik}$ [16]. The Consistency Index (CI) can be calculated, using the following formula [19]:

$$CI = \frac{\lambda_{max} - n}{n-1} \qquad (3)$$

Using the final consistency ratio (CR) can conclude whether the evaluations are sufficiently consistent. The CR is calculated as the ratio of the CI and the random index (RI), as indicated in Eq. (4). The number 0.1 is the accepted upper limit for CR. If the final consistency ratio exceeds this value, the evaluation procedure has to be repeated to improve consistency [20].

$$CR = \frac{CI}{RI} \qquad (4)$$

TABLE III
RANDOM INDEX [20]

N	1	2	3	4	5	6	7	8	9	10
RI	0.00	0.0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

4-2. TOPSIS Method

TOPSIS is one of the famous classical Multi-Criteria Decision Making (MCDM) method, which was initiated for the first time by Hwang and Yoon [21] that shall be used with both normal numbers and fuzzy numbers [22, 23]. Furthermore, TOPSIS is more applicable in that limited subjective input is required from decision makers. The only subjective input required is weights.

The TOPSIS procedure is shown in Figure 1 in five main steps.

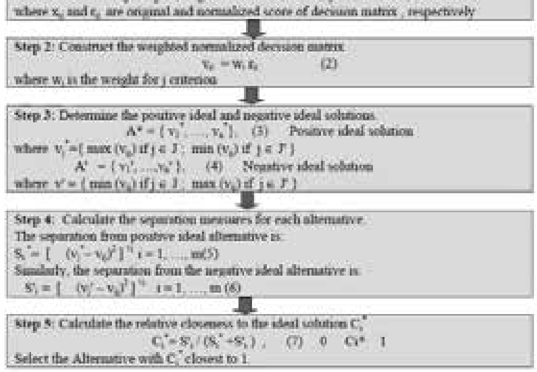

Fig. 1. Procedure of TOPSIS Method [32]

Using entropy method, objective weights were calculated. The following equation calculates entropy measure of every index.

$$E_j = -k \sum_{i=1}^{m} [n_{ij} Ln(n_{ij})] \Rightarrow \begin{Bmatrix} \forall_j = 1,2,\dots,n \\ k = \frac{1}{Ln(m)} \end{Bmatrix} \quad (5)$$

The degree of divergence d_j of the intrinsic information of each criterion C (*j*= 1, 2, …, n) may be calculated as [24]:

$$d_j = 1 - E_j \quad (6)$$

The value d_j represents the inherent contrast intensity of c_j. The higher the d_j is, the more important the criterion c_j is for the problem. The objective weight for each criterion can be obtained. Accordingly, the normalized weights of indexes may be calculated as [24, 32]:

$$W_j = \frac{d_j}{\sum_{k=1}^{n} d_k} \quad (7)$$

4-3. SWOT Analysis

The internal and external factors most considerable for the company's future are referred to as strategic factors. In SWOT analysis, these factors are grouped into four parts called SWOT groups: strengths, weaknesses, opportunities, and threats. By applying SWOT in strategic decisions, the purpose is to select or constitute and implement a strategy resulting in a good fit between the internal and external factors [25]. Moreover, the chosen strategy has also to be in line with the current and future purposes of the decision makers [26].

SWOT involves systematic thinking and comprehensive diagnosis of factors relating to a new product, technology, management, or planning. SWOT matrix is a commonly used tool for analyzing external and internal environments concurrently in order to support for a decision situation [27, 28]. Figure 2 shows how SWOT analysis fits into an environment scan. The SWOT matrix contains 4 strategic homes [29, 30]:

- SO: the strategies for applying environmental opportunities using organization's strength;
- WO: the strategies for compensating weaknesses applying potential advantages of environmental opportunities;
- ST: the strategies for treatments prevention applying strengths and
- WT: the strategies to minimize disadvantages of treatments and weaknesses [31].

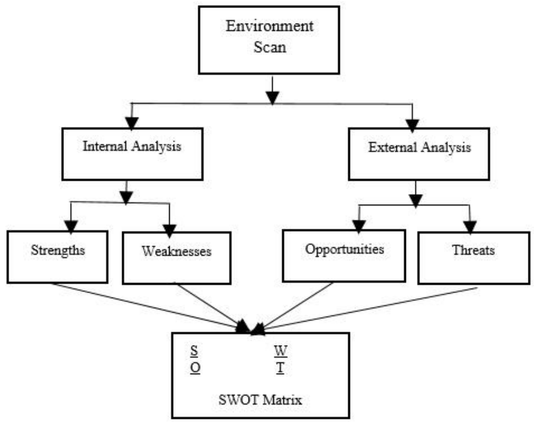

Fig. 2. SWOT Analysis Framework [30]

III. PROPOSE LAYERED ARCHITECTURE

In this research, in order to achieve the main objectives, which are to decrease the ranking error and subsequently to decrease the decision-making error, a layered architecture based on multi-criteria decision-making method is presented.

The layered architecture consists of four major layers called data layer (input layer), data analyzer layer, decision-maker layer, and output layer. The third layer of this architecture consists of two sub-layers called criteria weighing sub-layer and options ranking sub-layer. In the following, each of these layers and their functions are explained.

In this architecture, each layer's input is the upper layer's output. The final output is equal to choosing the fittest option which in that choice is the fittest e-readiness assessment model. In fact, applying this layered architecture, the final option will have the highest adjustment to the current conditions of the information and communication technology (e-readiness).

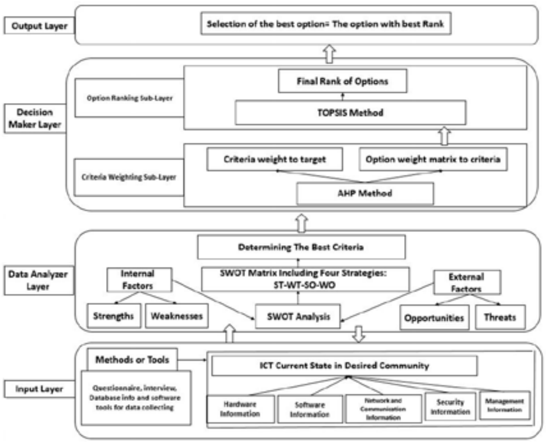

Figure 3 illustrates the recommended architecture of this research.

1. Input Layer

In this layer, the data or the relevant and required information are collected based on the goal. In order to collect information, different tools and methods, such as questionnaire, interview, extracting data from databases, data collecting software tools and etc. can be used.

2. Data Analyzer Layer

In this layer, the data collected in the previous layer (data layer) is analyzed by using the method of analyzing the strengths, weaknesses, opportunities and threats (SWOT). The objective of this layer is to choose the fittest criteria to do the best decision-making. These criterions should be chosen in a way that in the end, the chosen e-readiness assessment model covers these criterions in the best way. So, the goal of inserting this layer in the recommended architecture is to investigate the chosen criteria according to the environmental analysis of the target, and the conditions of information and communication technology.

3. Decision Maker Layer

Decision maker layer is based on two multi-criteria decision making methods: AHP and TOPSIS.

For this reason, two distinct sub-layers in this layer are considered. The first sub-layer called weighting used AHP method to achieve options' weight matrix to criteria and also to achieve the weight of criteria to target. Then the output of first sub-layer is sent as input to the second sub-layer. In the second sub-layer, options' weight of matrix to criteria and criteria weighting ratio of target are used for ranking options, this ranking is done by using TOPSIS method.

4. Output Layer

The highest layer of proposed architecture is the output layer. In the output layer, the objective of decision making issue will be determined. Output is equaled with an option that has gained the highest score in the ranking. In fact, the output of this architecture is equaled with the most appropriate option (the most appropriate e-readiness assessment model).

IV. EXPERIMENT AND RESULTS

In this section, the proposed architecture is used for a province that includes 56 organizations. The architecture is selecting the best e-readiness model for this area. The results of each layer are given below.

1. The Results of Data layer

In this layer, the ICT status of 56 organizations was gathered. These information were as follow:

- Information related to the hardware infrastructures.
- Information related to the software infrastructures.
- Information related to the network and communication infrastructures.
- Information related to the security infrastructures.
- Information related to management procedures.

2. The results of Data Analyzer layer

In this layer, first of all according to gathered information in the first layer, the strengths, weaknesses, opportunities and threats were determined, and after that SWOT analysis was done. The output of SWOT matrix is given in table IV.

TABLE IV
THE RESULT OF SWOT MATRIX

SO Strategies	WO Strategies
SO_1: provide new solutions in the field of intelligent building and increase productivity. SO_2: Development and support of information technology at macro level. SO_3: Development and empowerment of management in the implementation of e-government services. SO_4: Development of the e-business and knowledge-based in organizations. SO_5: Use of frameworks, standards, methodology and management tools and international monitoring of ICT to enhance organizations' IT readiness. SO_6: Design and development of services based on IT to subscribers.	WO_1: Improve and develop the necessary and appropriate infrastructure in order to improve the performances. WO_2: Raising the level of competitiveness. WO_3: Create communication infrastructure and secure communication platform for the exchange of information in the value chain organizations. WO_4: Standardization and development of integrated systems in the field of software systems (general and basic) and functional (technical and operational) for organizations. WO_5: Using superior experience of foreign countries in e-government projects.
ST Strategies	**WT Strategies**
ST_1: Standardization, automation of activities and crisis management ST_2: Educational and cultural training ST_3: Raising the level of customer satisfaction	WT_1: Improvement and development of human resources of information and communication technology WT_2: Localization of e-government services WT_3: Motivating and foster a culture of using IT among users

According to the results of SWOT matrix presented above and the plan acquired from it, six basic criterions (all which may include different sub-criterions) can be extracted, in order to choose a suitable e-readiness model. It's been tried that the selected criterions cover all the cases above. The basic criterions include:

- accessibility
- cost
- reliability
- transference quality
- supportability
- impediments

The standpoint and views of the experts is also included in the validation process of the presented criterions above.

3. The Results of Decision maker layer

The results of first sub layer are options' weight to criteria matrix, that is calculated by AHP (see Table V), and the weight of criteria to target, that is calculated by TOPSIS (see Table VI).

TABLE V
OPTIONS 'WEIGHT TO CRITERIA

E-readiness Model	Accessibility	Cost	Reliability	Transference Quality	Supportability	Impediments
CSPP	0.3	0.27	0.251	0.289	0.191	0.29
EIU	0.15	0.169	0.084	0.162	0.316	0.119
APEC	0.173	0.2	0.115	0.229	0.158	0.149
CID	0.1	0.163	0.084	0.096	0.105	0.039
WISTA	0.034	0.035	0.114	0.028	0.026	0.276
MCCONELL	0.102	0.088	0.307	0.133	0.103	0.117
CIDCM	0.061	0.04	0.125	0.048	0.038	0.122
MOSAIC	0.049	0.062	0.056	0.067	0.056	0.093

TABLE VI
WEIGHT OF CRITERIA TO TARGET

Criterion	Weight
Accessibility	0.3
Cost	0.2
Reliability	0.1
Transference Quality	0.1
Supportability	0.1
Impediments	0.2

The results of second sub layer is the rank of each model as follow (Table VII):

TABLE VII
THE FINAL RANK OF E-READINESS MODELS

E-readiness Model	Rank
CSPP	0.619
EIU	0.427
APEC	0.55
CID	0.57
WISTA	0.222
MCCONELL	0.419
CIDCM	0.369
MOSAIC	0.28

4. The Results of Output layer

CSPP is selected as the best e-readiness model, because of the highest rank.

According to different distributed questionnaires among managers and experts and their answers, also experts' investigation about the selected model, it was shown the CSPP model has the highest rate of compliance with the current status of ICT in this area.

V. EVALUATION OF PROPOSED LAYERED ARCHITECTURE

The evaluation of operation time and complexity as well as accuracy of the proposed method are done by qualitative-descriptive method.

Since, the operation time and complexity are important factors in selecting a decision making method, it must be mentioned that the proposed architecture is combination of two multi criteria decision-making methods, and also used an environmental analysis by SWOT method needs more and also it is more complex than other available methods.

But, comparison of operation time and complexity in each layer of proposed architecture with other methods shows that operation is performed in each layer in short time with less complexity. Table (IV) shows comparison of the time and complexity of decision making methods with proposed architecture.

making errors in order to selecting the best e-readiness model is less. On the other hand, the proposed method is more preferred than other methods, because of its correct output, not time and complexity.

Thus, to confirm the effectiveness of the proposed method, comparisons are shown in the following tables according to ranking and decision making errors. These tables show disadvantages of existing methods and elimination them by using the proposed method, also all tables show that proposed method selects the best e-readiness model with more accuracy.

TABLE VIII
COMPARISON THE DECISION MAKING METHODS WITH PROPOSED ARCHITECTURE IN TERMS OF OPERATION TIME AND COMPLEXITY

Decision –making method	Operation time and complexity in used decision-making method.	Operation time and complexity in propose architecture
AHP	With a large number of options, the operation time and complexity are very high.	Criteria weighting sub layer performs pair comparisons by using AHP (all steps of AHP method are not followed). Thus, it is performed in short time with less complexity.
TOPSIS	With a large number of options, the operation time and complexity are very high.	Option ranking sub layer only measures the weight of options and ranking by TOPSIS (all steps of TOPSIS method are not followed). Thus, it is performed in short time with less complexity.
AHP-TOPSIS	Time and complexity of the method are equal to Proposed method.	Time and complexity of the proposed method are equal to AHP-TOPSIS method, But its errors in ranking and decision-making processes are less than AHP-TOPSIS method. (See table XI).
ANP	With a large number of options, the operation time and complexity are very high.	Criteria weighting sub layer only performs pair comparisons using AHP method that is as same as ANP method (all of steps of AHP method are not followed). Thus, it is performed in short time with less complexity.
ANP-SWOT	Time and complexity of this method is higher than proposed method. Because all steps of ANP method are performed, completely.	In proposed method Criteria weighting sub layer only performs pair comparisons by ANP. (Pair comparisons are quite same in both ANP and AHP methods). Thus, this operation is performed in short time with less complexity.

But, since selecting the correct e-readiness model is very important in deployment of e-government, the main aim of this research is introducing a comprehensive method with high accuracy (in this research accuracy is defined as less ranking error and subsequently less decision making error), so that the ranking and decision-

TABLE IX
COMPARING AHP METHOD WITH PROPOSED LAYERED ARCHITECTURE

Decision making method	Main weaknesses	Comparing with the proposed method of the research
AHP	1. Doesn't consider positive and negative criteria 2. This method is based on the supervision of experts. At least 5 experts are needed to achieve the correct result. 3. It cannot be done using many criterions and options. 4. It has relatively good accuracy, but it shows the best option and not the most appropriate option. 5. Environmental analysis is not done by this method. 6. With a large number of options, the calculations will be complex and the possibility of error is high.	1. By TOPSIS method in third layer, positive and negative criteria can be considered. 2. By combining TOPSIS and AHP methods, expert opinions can be more reliable. 3. By combining TOPSIS method in the third layer, the problem of having many criterions is resolved. 4. Second layer in layered architecture increases the accuracy of this method. 5. SWOT method in second layer of proposed architecture resolves this flaw. 6. Using the combined method of AHP and TOPSIS in third layer of proposed architecture resolves this flaw, and reduces decision making error.

TABLE X
COMPARING TOPSIS METHOD WITH PROPOSED LAYERED ARCHITECTURE

Decision making method	Main weaknesses	Comparing with the proposed method of the research
TOPSIS	1. Environmental analysis is not considered. Only the ranking is considered. 2. Doesn't do the pairwise comparisons. 3. Has less accuracy comparing to AHP method.	1. Using the SWOT analysis in second layer of proposed method, this weakness will be resolved. 2. Using AHP method, pairwise comparison is done for criterions and also the options. 3. The third layer in layered architecture by combining TOPSIS and AHP resolves the weakness in decision making error and low accuracy of TOPSIS.

TABLE XI
COMPARING TOPSIS METHOD WITH PROPOSED LAYERED ARCHITECTURE

Decision making method	Main weaknesses	Comparing with the proposed method of the research
AHP-TOPSIS	1. Does the ranking and decision making with high accuracy, but presents the best option and not the most appropriate option, because it doesn't do environmental analysis.	1. Using SWOT method solves this flaw.

TABLE XII
COMPARING SWOT METHOD WITH PROPOSED LAYERED ARCHITECTURE

Decision making method	Main weaknesses	Comparing with the proposed method of the research
SWOT	1. Doesn't do the evaluation and measurement of options. 2. Comparisons do not take place	1. Combining AHP and TOPSIS will solve this problem. 2. Weighting sub-layer in the third layer will fix this problem.

TABLE XIII
COMPARING ANP METHOD WITH PROPOSED LAYERED ARCHITECTURE

Decision making method	Main weaknesses	Comparing with the proposed method of the research
ANP	1. This method is a general figure of AHP method which considers the dependence of sub-layers. But doesn't solve two main weaknesses of AHP.	1. TOPSIS method eliminates the problem of criteria numbers and also possible errors of expert opinions in ANP.

TABLE XIV
COMPARING ANP-SWOT METHOD WITH PROPOSED LAYERED ARCHITECTURE

Decision making method	Main weaknesses		Comparing with the proposed method of the research
ANP-SWOT	1. Doesn't do the ranking with high accuracy.		1. Combination of AHP and TOPSIS methods in third layer of proposed method, solves this problem.

VI. CONCLUSION

The concept of e-readiness has been created to form a single framework for evaluating the depth of the digital gap between the developed, developing, and undeveloped countries. The evaluation of the e-readiness in the scale of national, provincial, and the organizations involved in fulfilment of e- government, and identification of the impediments facing the main parameters is very important. By identification of these impediments and removing them, the prerequisites necessary for acquiring the e-government in the desired scale will be made. Consequently, for the proper deployment of e-government, the e-readiness condition of the community should be evaluated. Employing a premier method for all communities with different e-readiness level, is not a good approach. Hence, the decision-making process for selecting a model according to regions capacities is a great challenge that we are facing. In this study, a layered architecture is offered which using two multi criteria decision making methods and also performing a SWOT analyze, helps the managers to choose the most appropriate model according their needs. The proposed architecture reduces the decision-making error to a significant amount and help in picking a more suitable model.

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