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A hybrid fuzzy MCDM approach to prioritize an organization's activities based on fuzzy analytic hierarchy process and fuzzy DEMATEL

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Abstract

Decision makers need to prioritize the organization's activities in order to allocate resources optimally. Prioritization of activities is a multi-criteria problem that includes both quantitative and qualitative factors. The C4ISR framework is a well-known and widely used framework that describes the activities of the organization using the Activity Model (OV-5) product. In this paper, a new fuzzy hybrid methodology is proposed to describe and prioritize the activities of the organization in fuzzy conditions. First, the activities of the organization are described in a fuzzy format. Then, Activities are prioritized by the use of a hybrid method based on fuzzy DEMATEL and fuzzy AHP. Fuzzy AHP is used to calculate the weight of each activity and Fuzzy DEMATEL is used to calculate the interdependencies between activities. Finally, the Science and Technology Parks of Iran as an empirical study is presented to illustrate the application of the proposed method.

Keywords: Fuzzy AHP, Fuzzy DEMATEL, Enterprise Architecture, Decision making
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1 Introduction

The enterprise Architecture Process is defined as moving an enterprise architecture from its current condition to its optimal condition. This process is composed of the following three phases: IT strategic planning, enterprise architecture planning, and implementation of enterprise architecture. Each phase is a prerequisite to the next one. Although enterprise architecture framework almost defines the policy of an enterprise, awareness of decision makers, helps them to avoid wasting time and money by making correct decisions [4, 16]. Enterprise architecture is a complex process that covers all parts of an enterprise and requires different people with different expertise, control, and management of such an extensive process will not be possible without a predefined pattern and a coherent structure. One of the successful methods in such an extensive process would be to use enterprise architecture frameworks [17]. In fact, an architect can make use of a framework in order to control the complexity of an enterprise architecture [4, 16]. A lot of

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frameworks have been suggested for enterprise architecture (for example Zachman, C4ISR, FEAF, TEAF, etc.). Some of them have been new original ideas whereas some others have been modified versions of a reference model. There has also been a lot of research in the area of enterprise architecture frameworks [4, 17, 27, 32], et al. Although frameworks almost define the policy of an enterprise, enterprise decision-makers can affect the course of an enterprise-making two similar enterprises very different following the implementation of an architecture. Therefore, accurate analysis and careful consult play important roles in enterprise implementation, management, and supervision. One good piece of advice to decision-makers of an enterprise would be to identify and prioritize the activities and sub-activities according to their importance. In the C4ISR framework, the hierarchy of activities and sub-activities is described by the activity model (OV-5)[16]. The C4ISR framework uses Unified Modeling Language (UML) to model the enterprise architecture. Applying the UML modeling approach brings a number of advantages: (1) as a standard modeling language, the UML models are understandable for most engineers; (2) it offers multiple viewpoints for different stakeholders to model an integrated architecture; (3) it has an extension mechanism so that the modelers can tailor the modeling language for their specific usage [47]. For the purpose of prioritizing activities in a real organization with fuzzy and uncertain relations, both qualitative and quantitative factors of activities must be considered. Thus, Prioritization activities are a kind of multiple criteria decision-making (MCDM) problem and we need to employ MCDM methods to handle it appropriately. Here the emphasis is placed on the relationships of activities which can be handled by Fuzzy AHP [5, 7, 31] effectively. Also, Fuzzy Decision Making Trial and Evaluation Laboratory (Fuzzy DEMATEL) method [11] is used to extract the mutual relationships of interdependencies within criteria and the strength of interdependence. Briefly, much research has been done on Enterprise Architecture frameworks. Many frameworks have been proposed by inspired reference frameworks Also, Fuzzy AHP [5, 7, 31] and fuzzy DEMATE [11] approaches used by several authors. There is a lot of research that has used FAHP [7, 34, 38, 42], et al. Also, there is a lot of research that has used fuzzy DEMATE with other MCDM methods [1, 2, 6, 8, 9, 12, 13, 26, 28, 29, 30, 33, 35, 37, 39, 40, 41, 45] et al. Because by applying these theories, it can be easy to discover things inside the complex problem. In two last years, there are some works on a combination of FAHP and Fuzzy DEMATEL [2, 8, 19, 21, 22, 23, 36, 37] to solve problems, but there is not any research that combines these two methods (F-DEMATEL, FAHP) together for prioritizing activities in enterprise architecture. Also, none of the proposed frameworks for organizational architecture has a format with the ability to describe fuzzy connections between activities. In this paper, we describe enterprise architecture activities in a fuzzy Hierarchical format. When the dependence and relationship are mutual and fuzzy, and one element affects the other elements in Hierarchical order, the issue has a hierarchical model. In this case, fuzzy AHP should be used to calculate the weight of elements. In this study, also, the Fuzzy Decision Making Trial and Evaluation Laboratory (fuzzy DEMATEL) method are used to extract the mutual relationships of interdependencies within the criteria and the strength of the interdependence. Finally, the results of both fuzzy AHP and fuzzy DEMATEL methods are combined and the final result, which is the main priority of the activities, is measured. This hybrid method is applicable to all real organizations. The use of fuzzy concepts in all stages brings the final results very close to reality. Implementation of the proposed method in the Organization of Science and Technology Parks of Iran as a real organization showed that this method is applicable in real organizations in fuzzy conditions. The rest of this paper proceeds as follows. In Section 2, the proposed method is described. In Section 3, implementation of the method in a real organization is illustrated. Finally, according to the findings of this research, conclusions, and suggestions are presented 4.

2 Methodology

This study proposes a novel hybrid analytic approach based on the Fuzzy Analytic Hierarchy Process (F-AHP), fuzzy DEMATEL, and C4ISR Activity Model (OV-5) product. Figure 1 shows the general phases of the proposed method. The proposed method includes five general phases:

Phase I: Describing the Activity Model (OV-5) of the organization.

Phase II: Preparing a Matrix of Experts' Opinions on the Importance and Effectiveness of Activities on One Another. Then the results matrix of expert opinions will be aggregated and normalized.

Phase III: The weight of each activity will be calculated using the Fuzzy Analytic Hierarchy Process (F-AHP) method.

Phase IV: The interdependence between activities will be determined using the fuzzy DEMATEL method.

Phase V: The final priority of activities will be calculated by combining the results of the third and fourth phases.

We firstly mention the base techniques in subsections, and then in section 3 (application of the method) present the computation steps of the new method using a case study.

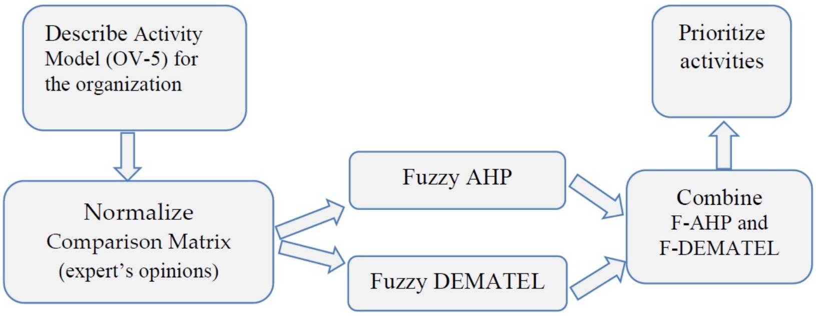

Figure 1: General phases of the proposed method

2.1 Fuzzy Analytic Hierarchy Process

The analytic hierarchy process (AHP) is a powerful method to solve complex decision problems. But the AHP method does not take into account the uncertainty associated with the mapping of human judgment to a number by natural language; the ranking of the AHP method is rather imprecise; and the subjective judgment by perception, evaluation, improvement, and selection based on the preference of decision-makers have a great influence on the AHP results. To overcome these problems, several researchers integrate fuzzy theory with AHP to improve the uncertainty. Buckley [5] used the evolutionary algorithm to calculate the weights with the trapezoidal fuzzy numbers. The fuzzy AHP is based on the fuzzy interval arithmetic with triangular fuzzy numbers and confidence index with interval means approach to determine the weights for evaluative elements. This research employs fuzzy AHP to fuzzy hierarchical analysis by allowing fuzzy numbers for pairwise comparisons and finding the fuzzy preference weights. In this section, we briefly review concepts for fuzzy hierarchical evaluation. Then, the methodology section will introduce the computational process of fuzzy AHP in detail using a case study.

2.1.1 Establishing fuzzy number

Fuzzy sets are sets whose elements have degrees of membership. Fuzzy sets have been introduced by Zadeh in [46] as an extension of the classical notion of set. In classical set theory, the membership of elements in a set is assessed in binary terms according to a bivalent condition – an element either belongs or does not belong to the set [24, 44]. The mathematics concept is borrowed from Hsieh et al. [18] and Liou et al. [24]. A fuzzy number A on R to be a TFN if its membership function $u_{\widetilde{A}}(x) : R \longrightarrow [0,1]$ is equal to following eq. (2.1):

$$u_{\widetilde{A}}(x) = \begin{cases} (x-l)/(m-l), & l \le x \le m \\ (u-x)/(u-m), & m \le x \le u \\ O, & \text{otherwise} \end{cases} \tag{2.1}$$

As shown in Equation (2.1), l and u mean the lower and upper bounds of the fuzzy number $\widetilde{A}$, and m is the modal value for $\widetilde{A}$ (as Figure 2).

2.1.2 Determining the linguistic variables

Linguistic variables take on values defined in its term set: its set of linguistic terms. Linguistic terms are subjective categories for the linguistic variable. A linguistic variable is a variable whose values are words or sentences in a natural or artificial language. Qualitive variables and fuzzy numbers used to perform paired comparisons are included in Table 1.

Table 1: Variables and corresponding fuzzy numbers.

Quality	Fuzzy number
Effect less	(1,1,1)
Very little effect	(2,3,4)
Little effect	(4,5,6)
High effect	(6,7,8)
Very high light	(8,9,9)

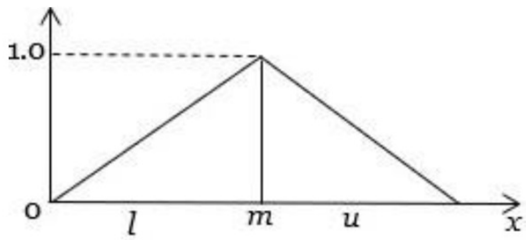

Figure 2: The membership functions of the triangular fuzzy number.

The Fuzzy Analytic Hierarchy Process (Fuzzy AHP) carry out in following steps:

Step 1: Construct pairwise comparison matrices among all the elements/criteria in the dimensions of the hierarchy system. Assign linguistic terms to the pairwise comparisons by asking which is the more important of each two dimensions.

$$\widetilde{A} = \begin{bmatrix} 1 & \widetilde{a}_{12} & \cdots & \widetilde{a}_{1n} \\ \widetilde{a}_{12} & 1 & \cdots & \widetilde{a}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \widetilde{a}_{n1} & \widetilde{a}_{n2} & \cdots & 1 \end{bmatrix} = \begin{bmatrix} 1 & \widetilde{a}_{12} & \cdots & \widetilde{a}_{1n} \\ \frac{1}{\widetilde{a}_{12}} & 1 & \cdots & \widetilde{a}_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \frac{1}{\widetilde{a}_{n1}} & \frac{1}{\widetilde{a}_{n2}} & \cdots & 1 \end{bmatrix}$$

Step 2: To use geometric mean technique to define the fuzzy geometric mean and fuzzy weights of each criterion by Hsieh et al. [18] using (2.2),(2.3).

$$\widetilde{r}_i = (\widetilde{a}_{i1} \bigotimes \cdots \bigotimes \widetilde{a}_{ij} \bigotimes \cdots \bigotimes \widetilde{a}_{in})^{-1} \tag{2.2}$$

$$\widetilde{w}_i = \widetilde{r}_i \bigotimes [\widetilde{r}_1 \bigotimes \cdots \bigotimes \widetilde{r}_i \bigotimes \cdots \bigotimes \widetilde{r}_n]^{-1} \tag{2.3}$$

2.2 Fuzzy DEMATEL method

DEMATEL is an effective method for analyzing the relationships between system factors by aggregating group knowledge. The most important feature of this approach is in the field of multi-criteria decision making and its function in creating a relationship and structure between factors [32]. Due to the ambiguity in the judgment of the experts, the combination of this method with the fuzzy concept will be beneficial. In this paper, the DEMATEL method was used for two purposes. First, to calculate the matrix of dependencies, between the main factors and then to identify the causative factors. The steps to do this are as follows [20]:

Phase I: Provides a matrix of direct relationships between system factors. At this stage, using expert oversight and using the language variables in Table 1, they express their view of the direct effect of each of the factors on each other. By converting linguistic estimates into fuzzy numbers, the matrix is obtained by a direct primary relationship in which A is an invariant matrix, and is a triangular fuzzy matrix representing the direct effect i on the factor j. Where $i = j$, the components of the diagonal matrix are zero [20].

$$A = \begin{bmatrix} a_{l1} & \cdots & a_{1j} & \cdots & a_{1n} \\ \cdots & & \cdots & & \cdots \\ a_{i1} & \cdots & a_{ij} & \cdots & a_{in} \\ \cdots & & \cdots & & \cdots \\ a_{n1} & & a_{nj} & & a_{nn} \end{bmatrix} \tag{2.4}$$

Phase II: primary direct matrix defuzzification based on the CFCS method: For primary defuzzification of matrix, the CFCS method is used. Suppose, which, is the fuzzy evaluation that the K expert has provided about the effect of factor i on the factor j. Based on the CFCS method, de-fuzzing is done in five Steps.

Step 1: Standardize fuzzy numbers:

$$xl^k_{ij} = (l^k_{ij} - \min l^k_{ij})/\Delta^{\max}_{\min} \tag{2.5}$$

$$xm_{ij}^k = (m_{ij}^k - \min l_{ij}^k)/\Delta_{\min}^{\max} \tag{2.6}$$

$$xr_{ij}^k = (r_{ij}^k - \min l_{ij}^k)/\Delta_{\min}^{\max} \tag{2.7}$$

$$\Delta_{\min}^{\max} = \max r_{ij}^k - \min l_{ij}^k \tag{2.8}$$

Step 2: Calculate the normal left and right values:

$$xls_{ij}^k = xm_{ij}^k/(1 + xm_{ij}^k - xl_{ij}^k) \tag{2.9}$$

$$xrs_{ij}^k = xr_{ij}^k/(1 + xr_{ij}^k - xm_{ij}^k) \tag{2.10}$$

Step 3: Calculate the totalized normalized value:

$$x_{ij}^k = [xls_{ij}^k/((1 - xls_{ij}^k) + xrs_{ij}^k) + xrs_{ij}^k xrs_{ij}^k]/(1 + xrs_{ij}^k - xls_{ij}^k) \tag{2.11}$$

Step 4: Obtain the crisp number of K's expert:

$$BNP_{ij}^k = \min l_{ij}^k - x_{ij}^k \Delta_{\min}^{\max} \tag{2.12}$$

Step 5: To obtain a cumulative number, by means of the interpolation of crisp numbers, all k Estimation:

$$a_{ij} = \frac{1}{k} \sum_{k}^{1 \le k \le K} BNP_{ij}^k \tag{2.13}$$

After defuzzification and aggregation of experts' opinions, the matrix of the direct initial relationship is aggregated, with crisp numbers representing the direct impact of i on the j factor.

Phase III: Normalize the Direct Relationship Matrix: At this stage, the initial direct-relation matrix becomes normal. The normalized matrix is obtained directly from equation (2.11).

$$X = S \times A \tag{2.14}$$

$$S = \min \left[\frac{1}{\max_i \sum_{j=1}^n |a_{ij}|}, \frac{1}{\max_j \sum_{i=1}^n |a_{ij}|} \right] \tag{2.15}$$

Phase IV: Generate General Matrix.

The sum of an unbroken sequence of direct and indirect effects of elements on each other is calculated as a geometric propagation based on the rules of the graphs. The sum of this progression is the matrix of the general relation T, in which I is a $n \times n$ unit matrix.

$$T = X + X^2 + \ldots + X^k = X(I + X + X^2 + \ldots + X^{k-1})(1 - X)(1 - X)^{-1} = X(1 - X^k)(1 - X)^{-1} \tag{2.16}$$

With the condition that $\lim_{k \longrightarrow \infty} X^k = [0]_{n \times n}$, the general relation matrix is obtained from equation (2.17) [36]:

$$T = X(1 - X)^{-1} \tag{2.17}$$

Phase V: Calculating the Total Rows and Matrix Pillars of the Total Relationship T and Identifying the Causes.

$$cj = \sum_{0 \leq i \leq n} tij \tag{2.18}$$

$$rj = \sum_{0 \leq j \leq n} tij \tag{2.19}$$

3 Result and Discussion

3.1 Iran's Science and Technology Parks

In Iran, science and technology parks provide the ecosystem for knowledge-based and creative businesses to grow and flourish. The success rate of a science and technology park is the number of successful businesses growing and the products and services they produce. Parks contribute to the growth and prosperity of start-ups and knowledge-based companies through a series of activities. The most important activities in science and technology parks in Iran include loan payment, branding, and advertising, marketing and sales, training and consulting, continuous monitoring and evaluation, and office and laboratory (physical establishment). Each of the activities in the Science and Technology Parks, in turn, has an impact on the success of startups and companies. Activities also affect each other. Which activity has the most impact on the success of corporations and science and technology parks? Managers and decision-makers in the Science and Technology Parks need to prioritize their activities and their impact in order to plan more accurately and optimally manage their financial and human resources.

3.2 The computational steps of the method

Phase I: To begin with, the activity model (Fuzzy Activity Model), for Science and Technology Parks in Iran, is shown in Figure 3. The most important activities in science and technology parks of Iran include Loan Payment, Branding and Advertising, Marketing and Sales, Training and Consulting, Continuous Monitoring and evaluation, and Dedicated office, and Lab (physical establishment). Instead of the full name of the activity, their acronym is used as follows:

LP=Loan Payment

BA=Branding and Advertising

MS=Marketing and Sales

TC=Training and Consulting

ME=Monitoring and Evaluation

OL=Office and Lab

Phase II: In this phase, taking into account the fuzzy activity model of Figure 3, we are asking experts for

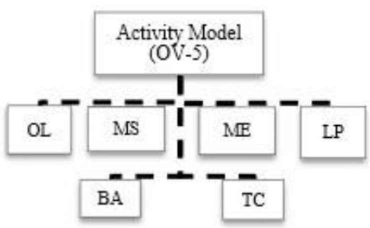

Figure 3: The membership functions of the triangular fuzzy number.

The priority and importance of each activity and sub-activity. In the first step, experts' opinions are aggregated. Akzél and Saaty in [3] introduced the use of geometric meanings as the best method for combining paired comparisons. Because the number of respondents is more than one person, the final matrix results from the geometric mean of the number of respondents. The table for comparison of the fuzzy activity model (case study) is presented under Table 2. In order to consider the opinion of all experts, we get arithmetic mean as shown in (3.1).

$$\widetilde{Z} = \frac{\widetilde{x}^1 \bigoplus \widetilde{x}^2 \bigoplus ... \bigoplus \widetilde{x}^p}{p} \tag{3.1}$$

As shown in (3.1), p is the number of experts and, respectively, the pair comparison matrix expert activities, general ICOM lists, and specific features that are recorded on these models. Expert 1, expert 2, and expert p, and the fuzzy number is triangular. Table 2 shows the average of expert opinions based on the geometric mean. The next step is normalization Comparison matrix of activities form Table 2 using Equation (3.1). Table 3 shows the normalized matrix.

Table 2: Comparison matrix of activities (Geometric mean of expert opinions).

	OL			**MS**			**BA**			**TC**			**ME**			**LP**		
OL	1	1	1	3	4	5	2	3	4	3	4	5	1.5	2	2.5	7	8	8.5
MS	6	7	8	1	1	1	4	5	6	2	3	4	4	5	6	5	6	7
BA	7	8	8.5	6	7	8	1	1	1	4	5	6	2	3	4	8	9	9
TC	2	3	4	2	3	4	4	5	6	1	1	1	4	5	6	6	7	8
ME	7	8	8.5	6	7	8	4	5	6	6	7	8	1	1	1	7	8	8.5
LP	2	3	4	4	5	6	2	3	4	6	7	8	4	5	6	1	1	1

Table 3: Normalized Matrix.

	OL			**MS**			**BA**			**TC**			**ME**			**LP**		
OL	1	1	1	0.07	0.1	0.12	0.05	0.07	0.1	0.07	0.1	0.12	0.04	0.05	0.06	0.17	0.2	0.21
MS	0.15	0.17	0.2	1	1	1	0.1	0.12	0.15	0.05	0.07	0.1	0.1	0.12	0.15	0.12	0.15	0.17
BA	0.17	0.2	0.21	0.15	0.17	0.2	1	1	1	0.1	0.12	0.15	0.05	0.07	0.1	0.2	0.22	0.22
TC	0.05	0.07	0.1	0.05	0.075	0.1	0.1	0.12	0.15	1	1	1	0.1	0.12	0.15	0.15	0.17	0.2
ME	0.17	0.2	0.21	0.15	0.17	0.2	0.1	0.12	0.15	0.15	0.17	0.2	1	1	1	0.17	0.2	0.21
LP	0.05	0.07	0.1	0.1	0.12	0.15	0.05	0.07	0.1	0.15	0.17	0.2	0.1	0.12	0.15	1	1	1

$$C.R. = \frac{C.I.}{I.I.R.} = 0.014 \tag{3.2}$$

By calculating the inconsistency rate of 0.014, the matrix of compiled paired matrices is consistent and less than 0.1. Table 3 is the normalized Comparison matrix of activities.

$$\widetilde{H}_{ij} = \frac{\widetilde{z}_{ij}}{r} = \left(\frac{l'_{ij}}{r}, \frac{m'_{ij}}{r}, \frac{u'_{ij}}{r}\right) = (l''_{ij}, m''_{ij}, u''_{ij}) \tag{3.3}$$

Where r is calculated in (3.4).

$$r = \max_{1 \le i \le n} (\sum_{j=1}^{n} u_{ij}) \tag{3.4}$$

Phase III: calculation of weights matrix:

To calculate the weight of each activity, we use the normalized matrix from phase II. The matrix of weights (Table 5) is calculated using Equation (2.12). Table 3 shows the fuzzy geometric mean base on equation (2.12). Table 4 shows the fuzzy wights based on equation (2.12). To calculate the weight of each activity, we use the formula $(l+m*2+u)/4$. Table 5 shows the weight of each activity based on the FAHP method.

Phase IV: After calculating the normal matrix, the matrix of the total fuzzy relations (Table 10) is obtained in (3.5),(3.6).

$$T = \lim_{k \longrightarrow \infty} (\widetilde{H}^1 \bigoplus \widetilde{H}^2 \bigoplus ... \bigoplus \widetilde{H}^K) \tag{3.5}$$

Each fuzzy number is calculated as follows:

Table 4: $\widetilde{r}_i$ based on equation (2.12).

OL	0.11075423	0.139908	0.165771
MS	0.14520956	0.177012	0.207034
BA	0.17239376	0.204819	0.228794
TC	0.12464414	0.157699	0.188597
ME	0.20247734	0.231299	0.254377
LP	0.12464414	0.157699	0.188597

Table 5: fuzzy wights based on equation (2.12).

OL	0.089813	0.130947	0.18835
MS	0.117753	0.165673	0.235233
BA	0.139797	0.1917	0.259956
TC	0.101076	0.147598	0.214285
ME	0.164192	0.216484	0.289025
LP	0.101076	0.147598	0.214285

Table 6: Weight of each activity based on FAHP method

Activity	**weight**
OL	0.135014
MS	0.171083
BA	0.195788
TC	0.152639
ME	0.221546
LP	0.152639

$$\begin{aligned}[l_{ij}^t] &= H_l \times (l - H_l)^{-1} \\ [m_{ij}^t] &= H_m \times (l - H_m)^{-1} \\ [u_{ij}^t] &= H_u \times (l - H_u)^{-1}\end{aligned} \tag{3.6}$$

In these formulas, l is single matrix and $H_l,\ H_m,\ H_u$ each are $n*n$ matrixes, in which the forms contain the lower number, the middle number and the upper number of the fuzzy triangular numbers of the matrix H. Their results are presented in Table 5, Table 6 and Table 7, respectively. At this point the de-fuzzy matrix is calculated using Matrix of Fuzzy Total Relationships using center of gravity method (equation (3.6)).

$$C_{i,\mathcal{J}} = \frac{l_{i,\mathcal{J}} + m_{i,\mathcal{J}} * 2 + u_{i,\mathcal{J}}}{4} \tag{3.7}$$

Table 9 shows de-fuzzy Matrix of Fuzzy Total Relationships matrix. By use of de-fuzzy matrix, internal dependency calculated by Equations ((3.7), (3.8)).

$$threshold = \frac{\sum_{i=1}^{n} \sum_{\mathcal{J}=1}^{n} C_{i,\mathcal{J}}}{n*n} \tag{3.8}$$

$$W_{2_{i,\mathcal{J}}} = \begin{cases} 0, & if\ (C_{i,\mathcal{J}}) < threshold \\ 1, & if\ (C_{i,\mathcal{J}}) \geq threshold \end{cases} \tag{3.9}$$

Where R denoted Relationships Achieved between Activities and c denoted the value of de-fuzzy Matrix (Table 9). W_2 shows the internal dependence of product activity (OV-5) as follows:

$$W_2 = \begin{bmatrix} 1 & 0 & 1 & 0 & 0 & 1 \\ 1 & 1 & 0 & 0 & 1 & 0 \\ 1 & 1 & 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 1 & 1 & 0 \\ 1 & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 & 1 & 1 \end{bmatrix}$$

Phase V: in this phase the final activities priority are calculated by taking into account their interdependencies ($W_2 \times$ FAHP's output).

$$W_2 \times \text{output of FAHP (Table 5)} = \begin{pmatrix} 0.470 \\ 0.513 \\ 0.488 \\ 0.554 \\ 0.347 \\ 0.512 \end{pmatrix}$$

According to the result, priority of each activity: Loan Payment=0.512, Branding and Advertising=0.488, Marketing and Sales=0.513, Training and Consulting=0.554, Monitoring and Evaluation=0.347, Office and Lab=0.470. Training and Consulting has most priority in the science and technology parks of Iran. Therefore, the decision makers of the organization should formulate their executive policies based on these priorities.

Table 7: Generation of the L matrix of general relationships for activities.

HL	**OL**	**MS**	**BA**	**TC**	**ME**	**LP**
OL	1	0.075	0.05	0.07	0.04	0.17
MS	0.15	1	0.1	0.05	0.1	0.12
BA	0.17	0.15	1	0.1	0.05	0.2
TC	0.05	0.05	0.1	1	0.1	0.15
ME	0.17	0.15	0.1	0.15	1	0.17
LP	0.05	0.1	0.05	0.15	0.1	1
$I - HL$	**OL**	**MS**	**BA**	**TC**	**ME**	**LP**
OL	0	−0.07	−0.05	−0.07	−0.04	−0.17
MS	−0.15	0	−0.1	−0.05	−0.1	−0.12
BA	−0.17	−0.15	0	−0.1	−0.05	−0.2
TC	−0.05	−0.05	−0.1	0	−0.1	−0.15
ME	−0.17	−0.15	−0.1	−0.15	0	−0.17
LP	−0.05	−0.1	−0.05	−0.15	−0.1	0
$(I - HL)^{-1}$	**OL**	**MS**	**BA**	**TC**	**ME**	**LP**
OL	6.7	−2.3	0.84	−1.88	−4.4	1.26
MS	2.42	8.21	−14.31	0.28	7.84	−2.24
BA	2.05	0.98	5.83	−4.76	−5.34	0.1
TC	−5.42	−4.15	7.98	5.03	−5.05	−2.84
ME	1.34	−1.33	−0.99	−4.51	4.6	−4.17
LP	−5.3	−1.74	1.26	0.05	0	3.04
$HL * (I - HL)^{-1}$	**OL**	**MS**	**BA**	**TC**	**ME**	**LP**
OL	5.7	−2.3	0.84	−1.88	−4.40	1.26
MS	2.83	7.40	−13.14	−0.67	6.77	−2.22
BA	2.05	0.98	4.83	−4.76	−5.34	0.1
TC	−5.42	−4.15	7.98	4.03	−5.05	−2.84
ME	1.34	−1.33	−0.99	−4.51	3.6	−4.17
LP	−5.3	−1.74	1.26	0.05	−0.66	2.04

Table 8: Generation of the m matrix of general relationships for activities.

HL	**OL**	**MS**	**BA**	**TC**	**ME**	**LP**
OL	1	0.1	0.07	0.1	0.05	0.2
MS	0.17	1	0.12	0.07	0.12	0.15
BA	0.2	0.17	1	0.12	0.125	0.17
TC	0.07	0.07	0.12	1	0.12	0.17
ME	0.2	0.17	0.12	0.17	1	0.2
LP	0.07	0.12	0.07	0.17	0.12	1
$I - HL$	**OL**	**MS**	**BA**	**TC**	**ME**	**LP**
OL	0	-0.1	-0.07	-0.1	-0.05	-0.2
MS	-0.17	0	-0.12	-0.07	-0.12	-0.15
BA	-0.2	-0.17	0	-0.12	-0.12	-0.17
TC	-0.07	-0.07	-0.12	0	-0.12	-0.17
ME	-0.2	-0.17	-0.12	-0.17	0	-0.2
LP	-0.07	-0.12	-0.07	-0.17	-0.12	0
$(I - HL)^{-1}$	**OL**	**MS**	**BA**	**TC**	**ME**	**LP**
OL	4.96	-1.9	-1.78	0.25	-2.19	1.45
MS	3.17	7.6	-1.25	-5.98	-2.54	-1.63
BA	2.44	0.41	5.88	-5.01	-3.51	-2.26
TC	-5.05	-3.77	0.66	7.52	0.71	-2.4
ME	-0.54	-1.44	-2.13	-1.69	4.97	-2.52
LP	-4.84	-1.71	-1.38	1.53	0.99	3.49
$HL * (I - HL)^{-1}$	**OL**	**MS**	**BA**	**TC**	**ME**	**LP**
OL	3.96	-1.9	-1.781	0.25	-2.19	1.45
MS	3.171	6.6	-1.25	-5.98	-2.539	-1.63
BA	2.441	0.41	4.88	-5.01	-3.509	-2.26
TC	-5.05	-3.771	0.66	6.521	0.711	-2.4
ME	-0.54	-1.441	-2.13	-1.691	3.971	-2.52
LP	-4.84	-1.712	-1.38	1.53	0.991	2.491

Table 9: Generation of the u matrix of general relationships for activities.

HL	**OL**	**MS**	**BA**	**TC**	**ME**	**LP**
OL	1	0.12	0.1	0.12	0.06	0.21
MS	0.2	1	0.15	0.1	0.15	0.17
BA	0.21	0.2	1	0.15	0.1	0.22
TC	0.1	0.1	0.15	1	0.2	0.21
ME	0.21	0.2	0.15	0.2	1	0.21
LP	0.1	0.15	0.1	0.2	0.15	1
$I - HL$	**OL**	**MS**	**BA**	**TC**	**ME**	**LP**
OL	0	-0.12	-0.1	-0.12	-0.06	-0.21
MS	-0.2	0	-0.15	-0.1	-0.15	-0.17
BA	-0.21	-0.2	0	-0.15	-0.1	-0.22
TC	-0.1	-0.1	-0.15	0	-0.2	-0.21
ME	-0.21	-0.2	-0.15	-0.2	0	-0.21
LP	-0.1	-0.15	-0.1	-0.2	-0.15	0
$(I - HL)^{-1}$	**OL**	**MS**	**BA**	**TC**	**ME**	**LP**
OL	5.13	-1.4	-1.42	-0.35	-2.12	0.68
MS	2.3	6.3	-0.55	-4.12	-2.78	-1.39
BA	0.9	0.31	5.65	-2.84	-4.29	-0.66
TC	-4.44	-3.4	-0.51	5.79	1.99	-2.13
ME	-0.4	-1.04	-1.59	-1.47	4.41	-2.45
LP	-3.75	-1.55	-1.57	0.79	1.19	3.1

$HL * (I - HL)^{-1}$	**OL**	**MS**	**BA**	**TC**	**ME**	**LP**
OL	4.131	−1.401	−1.421	−0.349	−2.119	0.68
MS	2.301	5.299	−0.551	−4.119	−2.779	−1.391
BA	0.9	0.31	4.65	−2.839	−4.289	−0.661
TC	−4.439	−3.401	−0.511	4.791	1.991	−2.131
ME	−0.4	−1.04	−1.59	−1.469	3.411	−2.45
LP	−3.75	−1.55	−1.57	0.791	1.192	2.1

Table 10: Normalized Matrix.

	OL			**MS**			**BA**			**TC**			**ME**			**LP**		
OL	5.7	4	4.1	−2.3	−1.9	−1.4	0.8	−1.8	−1.4	−1.9	0.2	−0.3	−4.4	−3	−2.1	1.3	1.4	0.7
MS	2.8	3.2	2.3	7.4	6.6	5.3	−13.1	−1.2	−0.5	−0.7	−5.98	−4.1	6.8	−2.5	−2.8	−2.2	−1.6	−1.4
BA	2	2.4	0.9	1	0.4	0.3	4.8	4.9	4.6	−4.8	−5.0	−2.8	−5.3	−3.5	−4.3	0.1	−2.2	−0.7
TC	−5.4	−5.0	−4.4	−4.1	−3.8	−3.4	8	0.7	−0.5	4.0	−1	4.8	−5.0	0.7	2	−2.8	−2.4	−2.1
ME	1.3	−0.5	−0.4	−1.3	−1.4	−1.0	−1	−2.1	−1.6	−4.5	−1.7	−1.8	3.6	4	3.4	−4.1	−2.5	−2.4
LP	−5.3	−4.8	−3.7	−1.7	−1.7	−1.5	1.3	−1.4	−1.6	0.0	1.5	0.8	−0.7	1	1.2	2.0	2.5	2.1

Table 11: Defuzzification of fuzzy Total Relationship.

	OL	**MS**	**BA**	**TC**	**ME**	**LP**
OL	4.44	−1.87	−1.04	−0.43	−2.72	1.21
MS	2.87	6.48	−4.05	−4.19	−0.27	−1.72
BA	1.96	0.53	4.81	−4.40	−4.16	−1.27
TC	−4.99	−3.77	2.20	1.71	−0.41	−2.44
ME	−0.03	−1.31	−1.71	−2.34	3.74	−2.91
LP	−4.68	−1.68	−0.77	0.97	0.63	2.28

4 Conclusion

In this paper, we present a workable method to describe and prioritize organization activities. This method can be used to identify priorities and calculate the impact of each activity on other activities. This method is applicable to all real organizations. First, the activities and sub-activities of the organization were represented by the Fuzzy Activity Model (OV-5). In this format, real communication between activities is visible. Some of these communications may not be very effective on others. If not more than the threshold, it is not considered. Then the weight of each activity is calculated using the fuzzy AHP method based on the expert opinion of the organization. Also, by fuzzy DEMATEL method with little change, interdependency between activities was determined. In addition to the weight of the activity, the number of activities that are affected by this activity is also important. Therefore, in phase IV, we calculated the number of activities that are affected by each activity (W_2). Finally, in phase V, the priority of each activity is calculated by multiplying the internal dependence matrix (W_2) in its weight (calculated with F-AHP). The proposed method is implemented in a real organization. The comparison matrix (Table 2) has been calculated based on the opinions of 153 business experts and managers of science and technology parks from different parts of Iran. Implementation of the proposed method on science and technology parks in Iran has shown some facts in knowledge-based businesses in Iran. Training and Consulting in Iran's science and technology parks is the top priority. The reason for this is the lack of enough business education required for college courses. Knowledge-based business managers are generally engineering graduates. These courses do not teach business management skills. Perhaps these trainings are not compatible with market realities. Therefore, they need business skills, and training and consulting on business skills have the most impact on the success of their businesses. Therefore, business education in universities should be given more attention. Also, according to the results of this study, Marketing and Sales activities have become the second priority in Iranian science and technology parks. The reason is clear. Iran's economy is an almost state-run economy. Science and Technology Parks in Iran are a government agency. A government agency like the Science and Technology Park can better sell knowledge-based companies' products and services to large state-owned corporations.

On the other hand, the new method proposed in this paper has some advantages. Prioritizing activities and identifying their impact, under Normal Conditions and during the development of the organization, will help the organization's decision-makers make the best decision. The decision-makers of the organization employ more qualified and specialized people in the most important activities of the organization. This will ultimately help the organization succeed. Also, the use of fuzzy concepts at all stages leads to a realistic and accurate analysis of the actual conditions of the organization.

Although this method has many benefits, it is based on the opinions of the organization's experts. So people's opinions are influential in the result. Therefore, selecting suitable participants needs careful consideration. Although this method has some advantages and disadvantages, it can be better and more complete by other researchers. Prioritization of activities is a kind of Multiple Criteria Decision Making (MCDM) problem. Another possible and interesting direction is further research to develop new models for actual group decision-making problems under a social network [10, 25, 43, 47] And large-scale group decision-making problems [14, 15] with fuzzy AHP [5] and fuzzy DEMATEL [11].

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