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Identifying Criteria and Proposing a Model for Industrial Cooperatives Evaluation Using MADM Methods

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ABSTRACT

Lack of proper criteria has always been a significant constraint in industrial cooperatives evaluation. In this study first criteria are extracted via literature review and then proper criteria are selected for final evaluation by CVR. In the second step relation network among criteria is achieved using DEMATEL technique based on the idea of experts. Criteria weights are found using ANP. And finally TOPSIS method is used for performance evaluation of sample cooperatives as an illustrative example and final ranking. The proposed model in this study can be used for performance evaluation of industrial cooperatives and similar organizations.

KEY WORDS: Performance Evaluation - CVR – DEMATEL – ANP – TOPSIS.

INTRODUCTION

Since the start of cooperatives in the 19th century there has been a lot of changes on both the concept and function of this economical sector. They can reduce the cost of products distribution, omit the mediators and extend economical and social justice. In Iran's constitution cooperative enterprises are recognized as an independent part of economy which can help capable people with asset constraints and support them by governmental funding and facilities both for prospering the economy and helping low income citizens [1].

Appraisal system was officially used in 1800 by Robert Owen. With the advent of post industrial management by Deming in 1950s a substantial development was made in the quality, innovation and management based on performance appraisal [2]. Using nonfinancial evaluation criteria has a long history but in 1992 Kaplan and Norton presented the concept of BSC by combining financial and nonfinancial criteria. This model considers 1-customer, 2-internal business processes, 3-learning and growth as well as the company's financial status in evaluation [3]. In the international studies about performance evaluation different techniques like BSC, TQM, EFQM are used but these techniques do not consider cooperatives as an independent sector of economy with unique characteristics and goals away from the private sector and the evaluation criteria are not specifically defined for this sector. In the domestic studies some of the differences between the evaluation of private and cooperative enterprises are mentioned [4, 5].

The selection of successful cooperative enterprises can extend the culture of economical cooperation, exhibit potential capabilities of this branch of economy and encourage groups and individuals to take part in this branch. Identification of productive cooperatives and proposing appropriate criteria for evaluating them can help to the prosperity of other cooperatives and strengthen this sector as an independent part of economy. The appraisal of cooperatives are not based on up to date and purposeful evaluation and ranking techniques and these old appraisal methods are not precise in evaluation and decision making [5].

Regarding the recent studies, focusing on proper evaluation criteria and their importance and weights are still two basic needs in this field.

This study tries to find answer for the following questions:

1-What are proper criteria for industrial cooperatives evaluation and what are the expectations of evaluating experts from successful industrial cooperatives?
2-How criteria affect each other and what is the network relationship among criteria?
3-What are the weights and importance of each criterion?
4- What is the ranking of selected industrial cooperatives in this study?

First important criteria for industrial firms are defined by studying different resources in this field, consulting with experts and questioner. Interdependencies among criteria are clarified using DEMATEL technique, the weights of criteria are achieved by pair comparison tables and ANP method and finally TOPSIS method is used for ranking 18 selected cooperatives in the Central Province as the sample of this study. Experts in this study are evaluating consultants in cooperation ministry and some activists in the field of cooperative production.

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MATERIALS AND METHODS

1-Content Validity Ratio

Lawshe(1975) proposed a model for selecting important evaluation criteria from a number of criteria. In this method if more than half of the experts vote on the importance of a criterion that criterion will be selected for final evaluation.

$$\text{CVR} = \frac{(ne - \frac{N}{2})}{\frac{N}{2}} \tag{1}$$

In this equation CVR is content validity ratio, ne is the number of experts who vote on the importance of a criterion, and N is the number of experts. Minimum CVR for selecting a criterion is 0.49[6].

2- The DEMATEL method

DEMATEL technique was designed in Geneva Battle memorial institute between 1972 and 1976 for studying very complex problems. This technique is based on directed graphs (also called diagraphs) that can divide criteria into cause-and-effect group and enables us to plot a network relationship map. The methodology can confirm interdependences among variables/criteria and restrict relations that reflect characteristics within an essential systematic and developmental trend [7, 8, 9].

The DEMATEL method can be summarized in the following steps:

Step 1: find the average matrix. Suppose there are H experts in this study and n criteria to consider. Each expert is asked to indicate the degree which represents he or she believes a criterion i affects criterion j. these comparisons among any two criteria are denoted by aij and are given an integer score ranging from 0, 1, 2, 3, 4, representing 'No influence (0)','Low influence (1)', 'Medium influence (2)', 'High influence (3)', and 'Very high influence (4),' respectively. The scores by each expert will give us a n × n non-negative answer matrix X^k=[xij]n × n with $1 \le k \le H$. Thus $X^1, X^2, ...X^H$ are the answer matrices for each of the H experts. We can then compute the n × n average matrix **A** for all the expert opinions by averaging the H expert's scores as follows:

$$A = [aij]_{n\times n} = \frac{1}{H}\sum_{k=1}^{H}[x_{ij}]^k{}_{n\times n} \tag{2}$$

The average matrix **A** is also named the initial direct relation matrix. **A** show the initial direct affects that a criterion exerts on and gets from other criteria. We can map out the casual effects between each pair of criteria in a system by drawing an influence map. Fig. 1 below is an example of such a network influence map. Each letter shows a criterion in the system. An arrow from d to b shows the effect that d has on b and the strength of this effect is 2.

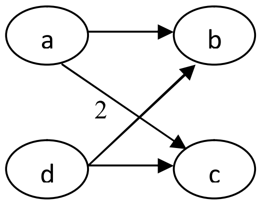

Figure 1: Example of an influence map

The sum of each row i of matrix **A** represents the total direct effects that criterion i gives to the other criteria and the sum of each column j of matrix **A** represents the total direct effects received to other criteria by criterion i.

Step 2: calculate the normalized initial direct-relation matrix. The normalized initial direct relation matrix **D** is obtained by normalizing the average matrix **A** in the following way:

$$S = \max(\max_{1\le i\le n}\sum_{j=1}^{n} aij, \max_{1\le j\le n}\sum_{i=1}^{n} aij) \tag{3}$$

$$D = \frac{A}{S} \tag{4}$$

Each element dij of matrix **D** is between zero and less than 1.

Step 3: compute the total relation matrix. A continuous decrease of the indirect effects of problems along the powers of matrix **D** e.g. $D^2, D^3, ..., D^\infty$ **,** guarantees convergent solutions to the matrix inverse. The total relation matrix T is an $n \times n$ matrix and is defined as follow:

$$T=[tij] ,\ \ i,j= 1,2,\ldots n \quad (5)$$

$$T = D + D^2 + ...D^m = D(I + D + D^2 + ...D^{m-1}) = D(I - D)^{-1} \quad (6)$$

We also define r and c as $n \times 1$ vectors

$$r = [ri]_{n\times1} = (\sum_{j=1}^{n} tij)_{n\times1} \quad (7)$$

$$c = [cj]_{1\times n} = (\sum_{i=1}^{n} tij)_{1\times n} \quad (8)$$

ri is the sum of ith row in matrix T and shows the total direct and indirect effects given by criterion i to the other criteria j=1,2,…,n. cj is the sum jth column in matrix T and shows the total effects both direct and indirect received by criterion j from the other criteria i=1,2,…,n. When j=i the sum (ri + ci) gives us an index representing the total effects both given and received by criterion i. the difference (ri-ci) shows the net effect that criterion i contributes to the system. When (ri – ci) is positive criterion i is a net causer and when (ri – cj) is negative criterion i is a net receiver [10].

Step 4: set a threshold value and obtain the network relationship map (NRM). In order to explain the structural relation among the criteria and keep the complexity of the system to a controllable level at the same time it is necessary to set a threshold value P to filter out some minor effects in matrix T. only some criteria whose effect in matrix T is greater than the threshold value, should be chosen and shown in a network relationship map (NRM) for influence [11]. In this paper the threshold value has been decided by experts through discussions. After the threshold value is decided the final influence result of criteria can be shown in a NRM.

3-The ANP method

The ANP was introduced by Saaty (1996). It is an extension of AHP and it is the basic form of analytic hierarchy process (AHP). The ANP control interdependence within criterion. AHP models a decision making framework using a unidirectional hierarchical relationship among criteria, but ANP allows more complex interrelations among criteria. A considerable difference between the two techniques is the existence of a feedback relationship among criteria within this framework [12, 13]. The method of ANP can be described as follows:

The first step of the ANP is comparison of the criteria in whole system to achieve the super matrix, this is done through pair wise comparisons by asking "how much influence does a criterion have compared to another criterion with respect to our interest or preferences?" the relative importance value can be determined using a scale of 1-9 to represent equal importance to extreme importance. The general form of the super matrix can be described as the matrix below:

$$W = \begin{array}{ll} & \begin{array}{l} e11 \\ C1\ e12 \\ e1m_1 \\ e11 \\ C2\ e12 \\ e1m_1 \\ en1 \\ Cn\ en2 \\ enm_n \end{array} \begin{array}{llll} W_{11} & W_{12} & \cdots & W_{1n} \\ & & & \\ & & & \\ W_{21} & W_{22} & \cdots & W_{2n} \\ & & \ddots & \\ \vdots & & & \\ & & & \\ W_{n1} & W_{n2} & \cdots & W_{nn} \\ & & & \end{array} \end{array}$$

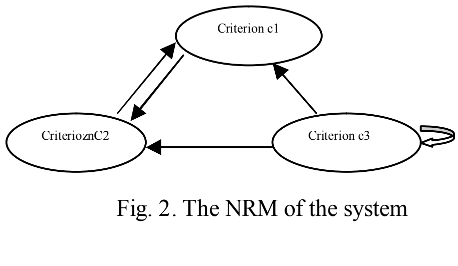

Fig. 2. The NRM of the system

In W matrix C_n denotes the nth cluster, e_{nm} denotes the mth element in nth cluster, and W_{ij} is the major eigenvector of the influence of the elements compared in the jth cluster to the ith cluster. In addition, if the jth cluster has no influence to the ith cluster then $W_{ij} = [0]$. Fig. 2. Shows how criteria can affect each other in ANP method.

After the super matrix calculation it should be normalized such as Eq. (9) and finally we raise super matrix to limiting powers, such as Eq. (10) until the super matrix converged to get the global priority vectors or weights [11].

$$\frac{1}{N}\sum_{i=1}^{N} Wij \tag{9}$$

$$\lim_{K\to\infty}(W)^K \tag{10}$$

4- The TOPSIS method

TOPSIS method was established by Hwang and Yoon in 1981. TOPSIS is an MADM problem with m alternatives as a geometric system with n points in the m dimensional space of criteria which is the Decision Making Matrix. The method is based on the concept that the selected alternative should have the shortest distance from the positive-ideal solution and the longest distance from the negative ideal solution. TOPSIS defines a ratio called similarity to the positive-ideal solution and the distance from the negative-ideal solution. Then the method chooses an alternative with the maximum similarity to the positive-ideal solution [14, 15]. The TOPSIS method consists of the following steps:

Step 1-Calculate the normalized decision matrix. The normalized value r_{ij} is calculated as

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{n} x_{ij}^2}} \tag{11}$$

Step 2-Calculate the weighted normalized decision matrix. The weighted normalized value v_{ij} is calculated as

$$v_{ij} = w_j r_{ij} \tag{12}$$

where w_j is the weight of jth criterion and $\sum_{j=1}^{m} w_j = 1$.

Step 3- determine positive and negative-ideal solution.

$$A^+ = \{v_1^+, ... v_m^+\} = \{(\max_i v_{ij} \forall j \in C_b), (\min_i v_{ij} \forall j \in C_c)\} \tag{13}$$

$$A^- = \{v_1^-, ... v_m^-\} = \{(\min_i v_{ij} \forall j \in C_b), (\max_i v_{ij} \forall j \in C_c)\} \tag{14}$$

Where C_b is associated with benefit criteria and C_c is associated with cost criteria.

Step 4-Calculate the separation measures using the m-dimensional Euclidean distance. The distance of each alternative from the ideal solution is given as

$$S_i^+ = \sqrt{\sum_{j=1}^{m} (v_{ij} - v_j^+) \forall i} \tag{15}$$

$$S_i^- = \sqrt{\sum_{j=1}^{m} (v_{ij} - v_j^-) \forall i} \tag{16}$$

Step 5-Calculate the relative closeness to the ideal solution. The relative closeness of the alternative A_i with respect to A^+ is defined as

$$RC_i^+ = \frac{S_i^-}{S_i^+ + S_i^-}, \forall i \tag{17}$$

Step 6-Rank the preference order. The index values of RC_i^+ lie between 0 and 1. The larger index value means the closer to ideal solution for alternatives [16].

RESULTS AND DISCUSSIONS

1- Criteria Selection

After literature review 39 evaluation criteria are obtained in 5 sections as following:

16 criteria are selected for final evaluation based on the result from questioners answered by the vote of experts and using content validity ratio Eq. (1). Results are shown in table (1).

Table 1: Criteria and sub- criteria

criteria	Sub-criteria
Financial Status(A)	➢ **Amount of primary investment(a1)** ➢ **Export(a2)** ➢ **Number of jobs(a3)** ➢ **Relatively low price with competitive quality(a4)**
Customer(B)	➢ **Customer satisfaction(b1)** ➢ **Number of customers(b2)** ➢ **Keeping customers(b3)**
Internal business Processes(C)	➢ **Production to capacity ratio(c1)** ➢ **New technology implementation(c2)** ➢ **Having national or international standard(c3)**
Learning and growth (D)	➢ **Having social security for personnel(d1)** ➢ **Innovation ability(d2)**
Strategy(E)	➢ **increasing control over material suppliers(e1)** ➢ **increasing control over retailers(e2)** ➢ **increasing market share by more marketing activities(e3)** ➢ **increasing sale by high quality production(e4)**

2- Determining the network relationships among criteria

The objective of this part is to determine the network relationships among criteria. Therefore a questionnaire was used to detect the influential relations from each expert for ranking each criterion with a four point scale ranging discussed earlier. Meanwhile the participants were also asked to respond to a questionnaire through comparisons with saaty's nine –point scale. Each question consisted of a pair wise comparison of two criteria. For each pair wise comparison the experts have to determine the extent of the relative importance between two criteria. At first the average initial direct matrix A is obtained based on Eq. (2) as table 2. By using Eqs. (3) and (4), The normalized initial direct matrix D is calculated. Subsequently the total relation matrix T is also calculated utilizing Eq. (5) and (6) shown in table 3. Total sum of effects given and received by each criterion are presented in table 4 using Eqs. (7) and (8). To acquire an appropriate network relation map a threshold value of 1.5 was chosen by experts. Thus the NRM of DEMATEL method result was obtained and shown in fig. 3.

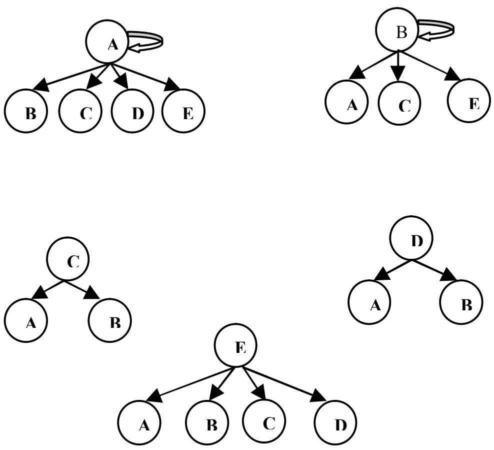

Fig.3. Network relation map of impacts

The Fig. 3. Shows financial criteria have the most impact on other criteria and then customer criteria, strategy, learning and growth and internal processes have the most impact respectively.

Table 2: Initial direct matrix **A.**

Criteria	Financial	Customer	Internal business processes	Learning and growth	Strategy
Financial	0	2.333	2.4	2	1.78
Customer	2.5	0	1.82	1.5	1.916
Internal business processes	2.166	2.083	0	1.583	1.34
Learning and growth	1.674	1.8	1.4	0	1.72
Strategy	2.03	2.34	1.833	1.74	0

Table 3: Total influential relation matrix **T.**

Criteria	Financial	Customer	Internal business processes	Learning and growth	Strategy
Financial	1.73	1.96	1.8	1.64	1.62
Customer	1.83	1.62	1.64	1.5	1.53
Internal business processes	1.7	1.71	1.37	1.42	1.39
Learning and growth	1.1.57	1.59	1.42	1.18	1.34
Strategy	1.83	1.87	1.65	1.54	1.37

Table 4: Sum of influences given and received on each criterion.

Criteria	$r_i + c_i$	$r_i - c_i$
Financial	17.42	0.996
Customer	16.89	0.0919
Internal business processes	15.53	-0.178
Learning and growth	15.48	-0.302
Strategy	14.37	-0.608

3- Calculating the weights of criteria by ANP

From table 3 we know the degrees of influence of criteria are different with each other. Result of combined pairwise comparisons is expressed in table 5. After normalizing table 5 the converged supermatrix is presented in table 6.

The weights of criteria can be achieved from each column of table 7.

Table 5: Super matrix

	a1	a2	a3	a4	b1	b2	b3	c1	c2	c3	d1	d2	e1	e2	e3	e4
a1	0.274	0.46	0.54	0.245	0.57	0.12	0.1289	0.4203	0.56	0.303	0.103	0.245	0.368	0.1047	0.112	0.231
a2	0.487	0.221	0.209	0.6102	0.257	0.05	0.043	0.365	0.243	0.187	0.068	0.607	0.263	0.1065	0.398	0.212
a3	0.106	0.059	0.089	0.101	0.108	0.25	0.2692	0.136	0.1041	0.057	0.23	0.101	0.2	0.0718	0.054	0.207
a4	0.133	0.26	0.159	0.048	0.065	0.57	0.56	0.0797	0.0927	0.453	0.599	0.048	0.169	0.717	0.437	0.35
b1	0.586	0.44	0.497	0.65	0.279	0.634	0.588	0.334	0.47	0.374	0.588	0.333	0.383	0.361	0.332	0.712
b2	0.226	0.45	0.343	0.266	0.649	0.258	0.322	0.59	0.435	0.38	0.323	0.569	0.328	0.189	0.384	0.145
b3	0.188	0.11	0.159	0.0818	0.072	0.105	0.0889	0.075	0.095	0.246	0.089	0.097	0.289	0.45	0.284	0.143
c1	0.73	0.1	0.73	0.65	0.063	0.46	0.63	0	0	0	0	0	0.297	0.288	0.539	0.352
c2	0.08	0.674	0.08	0.07	0.265	0.387	0.12	0	0	0	0	0	0.243	0.383	0.369	0.304
c3	0.19	0.226	0.188	0.278	0.67	0.169	0.25	0	0	0	0	0	0.46	0.329	0.0921	0.344
d1	0.457	0.249	0.619	0.651	0	0	0	0	0	0	0	0	0.466	0.538	0.288	0.286
d2	0.543	0.751	0.381	0.349	0	0	0	0	0	0	0	0	0.534	0.462	0.712	0.714
d1	0.119	0.131	0.204	0.237	0.249	0.119	0.204	0	0	0	0	0	0	0	0	0
d2	0.061	0.043	0.1065	0.584	0.221	0.057	0.107	0	0	0	0	0	0	0	0	0
d3	0.25	0.266	0.0785	0.112	0.055	0.25	0.07	0	0	0	0	0	0	0	0	0
d4	0.57	0.56	0.617	0.067	0.477	0.571	0.619	0	0	0	0	0	0	0	0	0
sum	5	5	5	5	4	4	4	2	1.998	2	2	2	4	4	4.0011	4

Table 6: converged super matrix

	a1	a2	a3	a4	b1	b2	b3	c1	c2	c3	d1	d2	e1	e2	e3	e4
a1	0.0977	0.0977	0.0977	0.0977	0.0977	0.0977	0.0977	0.0977	0.0977	0.0977	0.0977	0.0977	0.0977	0.0977	0.0977	0.0977
a2	0.084	0.084	0.084	0.084	0.084	0.084	0.084	0.084	0.084	0.084	0.0839	0.0839	0.0839	0.0839	0.0839	0.0839
a3	0.0407	0.0407	0.0407	0.0407	0.0407	0.0407	0.0407	0.0407	0.0407	0.0407	0.0407	0.0407	0.0407	0.0407	0.0407	0.0407
a4	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782	0.0782
b1	0.1394	0.1394	0.1394	0.1394	0.1394	0.1394	0.1394	0.1394	0.1394	0.1394	0.1393	0.1393	0.1393	0.1393	0.1393	0.1393
b2	0.1224	0.1224	0.1224	0.1224	0.1224	0.1224	0.1224	0.1224	0.1224	0.1224	0.1224	0.1224	0.1223	0.1223	0.1223	0.1223
b3	0.0388	0.0388	0.0388	0.0388	0.0388	0.0388	0.0389	0.0389	0.0389	0.0389	0.0389	0.0389	0.0388	0.0388	0.0388	0.0388
c1	0.0667	0.0667	0.0667	0.0667	0.0667	0.0667	0.0667	0.0667	0.0667	0.0667	0.0667	0.0667	0.0667	0.0667	0.0667	0.0667
c2	0.0476	0.0476	0.0476	0.0476	0.0476	0.0476	0.0476	0.0476	0.0476	0.0476	0.0476	0.0476	0.0476	0.0476	0.0476	0.0476
c3	0.0552	0.0552	0.0552	0.0552	0.0552	0.0552	0.0552	0.0552	0.0552	0.0552	0.0552	0.0552	0.0552	0.0552	0.0552	0.0552
d1	0.0405	0.0405	0.0405	0.0405	0.0405	0.0405	0.0405	0.0405	0.0405	0.0405	0.0405	0.0405	0.0405	0.0405	0.0405	0.0405
d2	0.0534	0.0534	0.0534	0.0534	0.0534	0.0534	0.0535	0.0535	0.0535	0.0535	0.0535	0.0535	0.0535	0.0535	0.0535	0.0535
e1	0.0242	0.0242	0.0242	0.0242	0.0242	0.0242	0.0242	0.0242	0.0242	0.0242	0.0242	0.0242	0.0242	0.0242	0.0242	0.0242
e2	0.0224	0.0224	0.0224	0.0224	0.0224	0.0224	0.0224	0.0224	0.0224	0.0224	0.0224	0.0224	0.0224	0.0224	0.0224	0.0224
e3	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	0.022	**0.022**	0.022	0.022	0.022	0.022	0.022	0.022
e4	0.0668	0.0668	0.0668	0.0668	0.0667	0.0667	0.0666	0.0666	0.0666	0.0666	0.0666	0.0666	0.0668	0.0668	0.0668	0.0668
SUM	1	1	1	1	0.9999	0.9999	1	1	1	1	0.9998	0.9998	0.9998	0.9998	0.9998	0.9998

Table 7: The weights of 16 evaluation criteria.

criteria	a1	a2	a3	a4	b1	b2	b3	c1	c2	c3	d1	d2	e1	e2	e3	e4
weight	0.097	0.084	0.04	0.078	0.139	0.122	0.038	0.066	0.047	0.055	0.04	0.053	0.024	0.0224	0.022	**0.0668**

According to Table 7 b1 and b2 are the most important criteria for industrial cooperatives to succeed. The weights of different criteria can be ranked from the most important to the least important based on this table.

4-Using TOPSIS method for ranking sample industrial cooperatives

After calculating the weights of different criteria the ranking process begins using TOPSIS. A 1 to 9 evaluation scale is used for nonfinancial criteria where 1 means very weak and 9 means perfect. And for financial criteria (a1, a2, a3, c1) information is extracted from Cooperation Ministry Data Base. The result of ranking is given in table 11.

Table8: linguistic scale for rating each cooperative

Linguistic variable	Corresponding number
Very weak	1
Weak	3
Fair	5
Good	7
Very good	9

Table 9: Decision Matrix

	A1	A2	A3	A4	E1	E2	E3	E4	C1	C2	C3	B1	B2	B3	D1	D2
1	40	0	35	3.75	3.083	3.667	2.499	4.333	0.4286	5.667	6.333	5.667	4.333	4.333	4.333	3.083
2	10	0	20	6.333	1.835	3	3.083	4.333	0.1667	3.667	2.416	5.667	4.333	5	4.333	3
3	40	303100	96	4.333	3.667	3.667	6.333	6.333	0.375	5	8.166	5.667	4.333	5	5.667	6.333
4	10.1	0	40	7	2.125	1.25	4	3	0.2667	4	5	5	3	7	3	3
5	10	0	50	7	6	5	2.125	4	0.555	5	5	5	6	6	5	8.75
6	150	0	42	5.667	5	4.333	5.667	3	0.03125	4.333	5.667	6.916	5	5.667	6.333	3.667
7	10	0	10	7.583	2.416	2.499	5	3.083	1	4.333	2.416	3.667	5	5	3.667	3.667
8	140	0	183	5.667	5.667	3.667	4.333	5.667	0.586	7.583	8.166	6.333	6.333	6.249	7.583	5.667
9	20	300	30	5	5	4	5	6	0.682	7	8.75	6	6	5	6	4
10	5	0	10	3.125	2.125	4	4	3	1	3	5	6	2.125	3	7	4
11	1.77	0	92	4	1.25	2.125	3	4	0.785	3.125	6	4	3	4	5	2.125
12	80	78	80	4	6	2.125	2.125	4	1	2.875	2.125	5	3	4	6	3
13	6.5	3895	35	4	6	4	2.125	6	0.423	6	2.125	5	3	4	7	4
14	18	0	40	4	2.125	1.25	3	3	0.8602	3	2.125	5	3	5	5	3
15	50	0	29	6.937	5.5	3.5	5.5	7.437	0.2489	7.875	7.437	5.5	6	6	7.437	6.937
16	25	0	140	4	4	4	5	5	1	6	7	6	6	6	3	6
17	20	0	30	5.667	3.667	3.083	5.667	4.333	1	3.667	6.333	5.667	3	4.333	4.333	3
18	15	693	16	5.667	5.667	5	6.9167	5.667	1	5.667	7	7.58	6.333	5.667	6.333	3.999

Table 10: Relative closeness to the ideal solution

Alternatives	RC_i^+
Saveh Boton	0.210553435
Yaragh Sazan	0.194449683
Navid Karan	0.758113429
Abrisham Pooya	0.177976008
Koshtargah Delijan	0.301173902
Hezareh Sadaf	0.254780906
Armaghan	0.257940741
Pars Ampool	0.359943903
Sadaf Bam	0.307386572
Pooshineh Teb	0.226037944
Taksa	0.199149888
Berfereh	0.224877858
Keshmesh Sabz	0.188574963
Mashin Sanat	0.187897935
Ard Visaran	0.315603979
Dorsa Morgh	0.336422024
Hallal Pooyan	0.242424208
Kimiya Razin	0.345563673

Table 11: Final ranking of cooperatives

1	**Navid Karan**
2	Pars Ampool
3	Kimiya Razin
4	Dorsa Morgh
5	Ard Visaran
6	Sadaf Bam
7	Koshtargah Delijan
8	Armaghan
9	Hezareh Sadaf
10	Hallal Pooyan
11	Pooshineh Teb
12	Berfereh
13	Saveh Boton
14	Taksa
15	Yaragh Sazan
16	Keshmesh Sabz
17	Mashin Sanat
18	Abrisham Pooya

CONCLUSIONS

The selected proper criteria in this study show the success factors for industrial cooperatives, the way they affect each other, their importance and weights. This can help individuals and groups who are willing to join this productive sector of economy by providing information and also give appraisal experts at the Cooperation Ministry a scientific evaluation model which is specifically designed for this new branch of economy. In the end an illustrative example for ranking is shown and 18 industrial cooperatives in The Central Province of Iran are ranked. The results of this part broaden our knowledge about prosperous fields of production in this province and Top cooperatives are selected. As a direction for future research one might work on a comparative study between cooperative and private companies with the proposed model in this paper.

REFRENCES

1. Kazemi, S., 2006. The performance of cooperative enterprises in Iran: Journal of Cooperation ministry, 175:37-53.

2. Sadeghi, M., 2009. A comparative study between performance criteria among cooperative and private industrial companies: Journal of cooperation ministry, 207:21-33.

3. Roghanian, E., 2002. Studying different appraisal methods and introducing Balanced Score Card as a comprehensive method. International Management Conference, Tehran.

4. Karimi, T., 2006. New models for company performance evaluation: Journal of management, 171:236-249.

5. Aryafar, K., 2010. Cooperative evaluation by environment- content and structure model, M.S. thesis, Islamic Azad University Naragh Branch.

6. Lawshe CH., 1975. A quantitative approach to content validity Personnel Psychology, pp: 563–575.

7. Chiu, Y.J., Chen, H.C., Tzeng, G.H., Shyu, J.Z., 2006. Marketing strategy based on customer behavior for the LCD-TV, International Journal of Management and Decision Making, 7: 143-165.

8. Hori, S., Shimizu, Y., 1999. Designing methods of human interface for supervisory control systems, Control Engineering Practice, 11: 1413-1419.

9. Tamura, M., Nagata, H., Akazawa, K., 2002. Extraction and systems analysis of factors that prevent safety and security by structural models, fourth SICE annual conference, Japan.

10. Tzeng, G. H., Chiang, C. H., Li, C. W., 2007. Evaluating intertwined effects in e-learning programs a novel hybrid MCDM model based on factor analysis and DEMATEL, Expert Systems with Application, 32: 1028-1044.

11. Jiann, L. Y., Gwo, H. T., 2011. An integrated MCDM technique combined with DEMATEL for a novel cluster-weighted with ANP method, Expert Systems with Application, 38: 1714-1424.

12. Saaty, T. L. 1980. The analytic hierarchy process, McGraw-Hill.

13. Saaty, T. L. 1996. Decision making with dependence and feedback, Analytic network process, RWS Publications.

14. Hwang, C. L., Yoon, K., 1981. Multiple Attributes Decision Making Methods And Application.

15- Opricovic, S., Tzeng, G. H., 2003. Compromise solution by MCDM methods a comparative analysis of VIKOR and TOPSIS, European Journal of Operational Research, 152: 445-455.

16. Cheng, S. W., Chin, T. L., Chuan, L., 2010. Optimal marketing strategy: A decision making with ANP and TOPSIS, Int. J. Production Economics, 127: 190-196.