

Survey and Ranking Techniques of Evaluation and Supplier Selection via AHP Method

¹Farhad Nejadirani, ²Yaghub Alavi Matin, ³Hossein Seyf Farshad

^{1,3}Department of Management, Bonab Branch, Islamic Azad University, Bonab, Iran.

²Department of Management, Tabriz Branch, Islamic Azad University, Tabriz, Iran.

Abstract: In today competitive world, decision making and supplier selection become more significant and complicated in synchronous to various purchase methods. The more the organizations are depended on suppliers, the more harmful the erroneous direct and indirect decision making will be. The modern organizational structures caused the participation of more individuals in supplier selection and this has lead to significant place of decision making. The complication and significance of decision making in supplier selection clarifies the necessity of affective, organized, clear and highly confidant method. In this study, strengths and weaknesses of evaluation and supplier selection various methods are compared and finally an affective and assured method in different organizational circumstances is introduced. In this study, 13 common techniques and models of evaluation and supplier selection are investigated. One of these models is introduced as the basic model through questionnaire, AHP method, expert interview and Expert Choice software on the bases of celerity, accuracy, software utilization, model cost and the comprehensiveness of evaluated model factors. And the other models are investigated and classified through basic model in order to reach organization strategic aims on the bases of necessary approach.

Key words: Supplier Selection, SCM, AHP, Supplier Selection Method.

INTRODUCTION

Various methods are considered in order to supplier selection and evaluation which can be utilized by organizations but, the advantages and disadvantages of these methods are not compared and as a result an affective and highly assured method in different organizational circumstances is not introduced. On the whole, the basic model clarification in order to studied models evaluation and ranking, ranking various models and techniques and answering the question of 'Which model is of high assurance and ability on the bases of organizational necessary approach over supplier selection' are not performed. The first study over supplier selection was performed by Dickson in 1966. In this study, a questionnaire of 23 criteria was sent to 273 American and Canadian purchase managers and assistants and they were asked to rate the criteria from 0 (not important) to 4 (highly important) (Dickson, 1966, 517).

Weber *et al.* (1991) investigated 74 papers in a comprehensive review in some of which there was only 1 criterion (cost) and in some there were 2 criteria (cost and quality) and in some cases there were a group of criteria. They classified the number of papers on the bases of Dickson criteria. (Weber, 1991, 2-18). Hang Hong *et al.* represented a mathematical programming model including changes in supplier offer and customers' demand in a period of time. The presented model is used for supplier selection of Korea agricultural industry. (Hang Hong, 2005, 1). Chen *et al.* introduced a Fuzzy decision making method in order to supplier selection in supply chain system. They stated that suitable supplier clarification in supply chain became a significant strategic matter. (Chen, 2005, 17). Zaim *et al.* proposed a Fuzzy hierarchical analyses method in order to solve the problem of multi-criteria decision making for suppliers. Their case study is about television suppliers of Turkey. In this study, AHP method was compared to non-Fuzzy method. The results showed that this method is better for supplier selection and evaluation. (Zaim, 2005, 7). Sharma divides the supply chain process into 4 chains: 1. Customer order chain 2. Refilling chain 3. Structure chain 4. Preparation chain (Sharma, 2010, 3). Suaford *et al.* defined the supply chain celerity as the supply chain ability in instant answering to market changeable environment.

Corresponding Author: Farhad Nejadirani, Department of Management, Bonab Branch, Islamic Azad University, Bonab, Iran.
E-mail: Irani@bonabiau.ac.ir, farhad.nejadirani@gmail.com.

The proposed frame by Suaford *et al.* has process focused approach toward organization supply chain which is composed of 3 key processes of: resourcing/ preparation, structure and offer/ composed logistic. (Suaford *et al.*, 2006, 173).

2. Supplier Selection and Evaluation Techniques Ranking:

2.1. The Aims:

The whole applied and scientific aims of current study:

1. Ranking and introducing scientific affective technique with high accuracy and application in supplier selection and logistics management.
2. Proposing new approaches for decision makers in order to select affective methods in supplier selection decision.
3. Applicability in all industries and organizations related to supplier selection and evaluation and aiding master managers of organizations in order to suitable supplier selection over organization strategic aims.
4. Ranking each one of applied techniques according to celerity, accuracy, cost, applicability and comprehensibility of model.

2.2. Affective Factors:

Several factors are considered significant via investigating multi-factor decision making methods and operational research.

The most important factors in supplier selection and evaluation: accuracy, celerity, cost, applicability and comprehensibility of model. (Ghazanfari, 2001, 24)

2.3. Investigated Techniques:

Methods and techniques investigated in this study:

Taksonomi, Topsis, AHP, Linear Weightning, Timmerman, Mathematical Programming, PCA, ANP, DEA, Fuzzy Programming, VAHP, CBR, Thompson

2.4. Data Gathering and Statistical Analyses Method:

Necessary data of this study was gathered through questionnaire and library resources (papers, thesis, books). The first table or question compile of questionnaire includes: accuracy, celerity, cost, comprehensibility and applicability of model and software. The next questions are planned from index points in separated matrices. One matrix is related to accuracy which questions investigated techniques scores of this study in comparison to each other and the other is over celerity. The score of each index and technique gathered through questionnaire and professors and experts ideas over supplier selection and evaluation. Then, one or several models as the most suitable model in organization special circumstances were identified and rated through data gathering and Expert Choice software on the bases of celerity, accuracy, applicability, cost and comprehensibility factors and index.

3. Statistical Analyses:

3.1. Index Scoring and Investigation:

We are going to rate 5 index of accuracy, celerity, cost, comprehensibility and applicability of model and software via EC software. As it is shown in the figure 1, accuracy is of the most in desirability supplier selection and evaluation. Then, celerity, comprehensibility of model and technique cost and software applicability are in the next rations.

Table 1: Index Scoring and Investigation.

Priority	Index	Value	Normal Value
1	Accuracy	0.465	1
2	Celerity	0.304	0.655
3	Model Comprehensibility	0.119	0.257
4	Model cost	0.070	0.150
5	Software Applicability	0.042	0.090

3.2. Graphic Investigation and Scoring of Models from The Accuracy Aspect:

We rate 13 investigated techniques from the accuracy aspect via Expert Choice software. As it is shown in the figure 2, AHP is the mostly accepted from the accuracy aspect in supply selection and evaluation. And then, Mathematical Programming, Topsis , Taksonomi are respectively in the next places.

Table 2. Graphic Investigation and Scoring of Models from the Accuracy aspect.

Priority	Model after Accuracy	Value	Normal Value
1	AHP	0.164	1
2	Mathematical Programming	0.154	0.940
3	Topsis	0.148	0.903
4	Taksonomi	0.147	0.896
5	DEA	0.097	0.590
6	CBR	0.054	0.327
7	Fuzzy Programming	0.054	0.327
8	PCA	0.054	0.327
9	Linear Programming	0.034	0.210
10	VAHP	0.034	0.210
11	ANP	0.030	0.182
12	Thompson	0.018	0.108
13	Timmerman	0.014	0.085

3.3. Graphic Investigation and Scoring of Models from The Celerity Aspect:

We rate 13 investigated techniques from the celerity aspect via Expert Choice software. As it is shown in the figure 3, Taksonomi is the mostly accepted from the accuracy aspect in supply selection and evaluation. And then, Topsis, AHP, Linear programming are respectively in the next places.

Table 3: Graphic Investigation and Scoring of Models from the Celerity aspect.

Priority	Model after Accuracy	Value	Normal Value
1	Taksonomi	0.213	1
2	Topsis	0.209	0.983
3	AHP	0.149	0.702
4	Linear Programming	0.083	0.391
5	Timmerman	0.071	0.332
6	Mathematical Programming	0.054	0.255
7	PCA	0.052	0.243
8	ANP	0.047	0.219
9	DEA	0.045	0.210
10	Fuzzy Programming	0.029	0.134
11	VAHP	0.018	0.084
12	CBR	0.018	0.083
13	Thompson	0.014	0.064

3.4. Graphic Investigation and Scoring of Models from The Model Comprehensibility Aspect:

We rate 13 investigated techniques from the Model Comprehensibility aspect via Expert Choice software. As it is shown in the figure 4, AHP is the mostly accepted from the accuracy aspect in supply selection and evaluation. And then, Linear Programming, Taksonomi, Topsis are respectively in the next places.

Table 4: Graphic Investigation and Scoring of Models from the Model Comprehensibility aspect.

Priority	Model after Accuracy	Value	Normal Value
1	AHP	0.172	1
2	Linear Programming	0.168	0.975
3	Taksonomi	0.153	0.891
4	Topsis	0.132	0.767
5	ANP	0.076	0.442
6	Mathematical Programming	0.054	0.313
7	Fuzzy Programming	0.052	0.305
8	Timmerman	0.052	0.304
9	VAHP	0.047	0.275
10	Thompson	0.029	0.169
11	DEA	0.025	0.145
12	PCA	0.022	0.130
13	CBR	0.018	0.104

3.5. Graphic Investigation and Scoring of Models from the Cost of Making Use of Model Aspect:

We rate 13 investigated techniques from the cost of making use of model aspect via Expert Choice software. As it is shown in the figure 5, Linear Programming is the mostly accepted from the accuracy aspect in supply selection and evaluation. And then, Timmerman, AHP, Taksonomi are respectively in the next places.

Table 5: Graphic Investigation and Scoring of Models from the cost of making use of model aspect.

Priority	Model after Accuracy	Value	Normal Value
1	Linear Programming	0.164	1
2	Timmerman	0.154	0.940
3	AHP	0.148	0.903
4	Taksonomi	0.147	0.896
5	Topsis	0.097	0.590
6	ANP	0.054	0.327
7	PCA	0.054	0.327
8	DEA	0.054	0.327
9	VAHP	0.034	0.210
10	Mathematical Programming	0.034	0.210
11	Fuzzy Programming	0.030	0.182
12	CBR	0.018	0.108
13	Thompson	0.014	0.085

3.6. Graphic Investigation and Scoring of Models from the Software Applicability Aspect:

We rate 13 investigated techniques from the accuracy aspect via Expert Choice software. As it is shown in the figure 6, AHP is the mostly accepted from the accuracy aspect in supply selection and evaluation. And then, Timmerman, Linear Programming, Taksonomi are respectively in the next places.

Table 6: Graphic Investigation and Scoring of Models from the Accuracy aspect.

Priority	Model after Accuracy	Value	Normal Value
1	AHP	0.236	1
2	Timmerman	0.189	0.798
3	Linear Programming	0.169	0.714
4	Taksonomi	0.088	0.372
5	Topsis	0.081	0.341
6	VAHP	0.049	0.209
7	Mathematical Programming	0.031	0.130
8	Fuzzy Programming	0.028	0.121
9	PCA	0.028	0.120
10	Thompson	0.028	0.117
11	DEA	0.025	0.107
12	ANP	0.025	0.102
13	CBR	0.024	0.102

4. Whole Ranking of Techniques:

On the whole by considering models and index scores and on the bases of AHP, Topsis is in the highest rate (0.160) and Thompson is in the lowest rate (0.019).

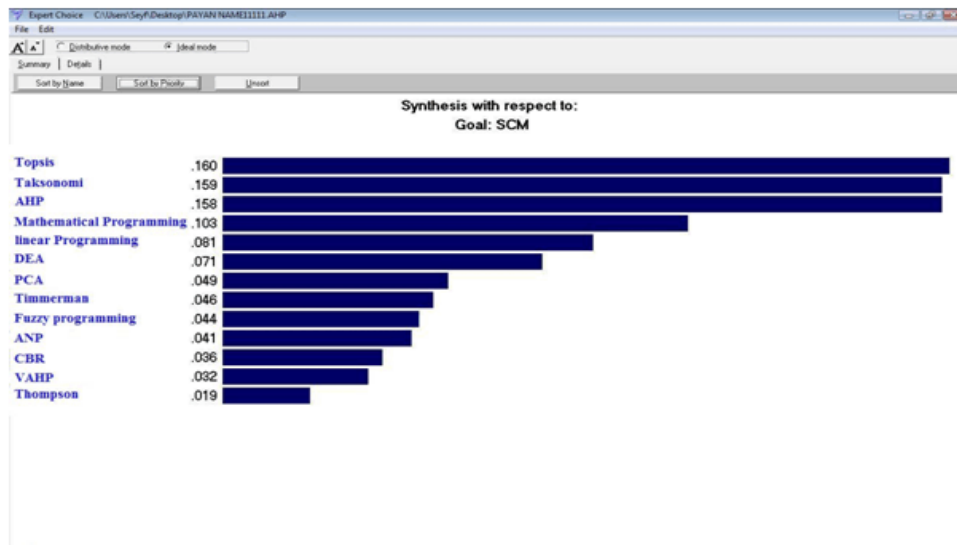


Fig. 1: Ranking of Techniques Ranking of Techniques.

Conclusion:

On the whole by considering models and index scores and on the bases of AHP, Topsis is in the highest rate (0.160) and Thompson is in the lowest rate (0.019). So, Topsis, Toksonomi and AHP are of the most acceptability in supplier selection and evaluation. In the case that the accuracy is supposed the only technique in supplier selection and evaluation, the techniques can be utilized as following:

1. AHP
2. Mathematical Programming
3. Topsis

In the case that the celerity is supposed the only technique in supplier selection and evaluation, the techniques can be utilized as following:

1. Taksonomi
2. Topsis
3. AHP

In the case that the cost is supposed the only technique in supplier selection and evaluation, the techniques can be utilized as following:

1. Linear Weightning
2. Timmerman
3. AHP

In the case that the software applicability is supposed the only technique in supplier selection and evaluation, the techniques can be utilized as following:

1. AHP
2. Timmerman
3. Linear Weightning

In the case that the technique comprehensibility is supposed the only technique in supplier selection and evaluation, the techniques can be utilized as following:

1. AHP
2. Linear Weightning
3. Taksonomi

It is supposed that organizations utilize the most prioritized techniques and methods in above conditions according to their necessary circumstances in supplier selection and evaluation and index focus (accuracy, celerity, model cost, software applicability and model comprehensibility).

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