THE PERFORMANCE EVALUATION OF MUNICIPALITIES WITH VIKOR: AN APPLICATION AMONG MUNICIPALITIES IN ISTANBUL

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—Abstract —

Performance evaluation systems play an important role for the development of institutions. It has widely been used in the special sector for a long time but can be regarded as new for the public institutions as a result of the legal compulsories. Performance of each individual municipality is important. However, the performance of the other similar municipalities is a good indicator for obtaining a relative evaluation based on benchmarking. With this study, it is aimed to assess the performance of the municipalities with VIKOR multi-criteria decision making method where nearness to ideal solution is regarded. For this aim, an application is performed among the municipalities in İstanbul. For the proper performance indicators already in literature, the required steps of VIKOR method are executed for ranking the municipalities. Moreover, a comparison is performed with the studies using different decision making methods.

Key Words: *Performance evaluation, local government, VIKOR, multi-criteria decision making*

JEL Classification: H11, D81

1. INTRODUCTION

Performance assessment systems play an important role for the success of institutions. It can be defined as a system providing that the goals of a corporation are performed by an effective gathering and using process of resources (Adler, 2011). As a result of a survey among the best employers in the United Kingdom, it is regarded as one of the two most important human resources management activities (Aguinis et al., 2011). It has extensively been used in the special sector for a long time. But it is not that old in state-owned institutions especially in Turkey.

With the regulation of Financial Management and Control Law (numbered 5018) in 2005, every municipality in Turkey having a population greater than 50 000 has the obligation of preparing a strategic plan and a performance program related with it. With this legal application, every municipality has started to measure its performance and studies about performance assessment systems have increasingly had popularity in literature.

When the studies are reviewed about performance assessment, it is concluded that there are a lot of studies including the performance evaluation systems, but the scope is limited and the ones especially related with the performance of public sectors are regarded.

A study analyzing the performance assessment systems both in public and private sectors were performed by Black et al. (2001) by stating the similarities and differences between two sectors. The probable negative results of performance assessment systems and strategies for overcoming these are stated by Bruijn (2002). For investigating the use of performance measurement applications in Canada, Pollanen (2005) made a study including 334 senior administrators. Similarly, Greiling (2005) in Germany, Sotirakou and Zeppou (2006) in Greece and Rantanen et al. (2007) in Finland analyzed the performance assessment applications and recommended improvement activities. Alioğlu (2006) used multi-criteria decision making techniques for ranking the municipalities in İstanbul. The properties of public sector influencing the performance measurement in developing countries were analyzed by Mimba et al. (2007). Kilic (2011) proposed a fuzzy AHP based model for the performance evaluation in Turkish municipalities.

As can be concluded from the reviewed studies, most of the studies are about the individual performance of the municipalities. There are few studies comparing the performance of the municipalities and ranking them. At this point, it is certain that not only the individual performance of the municipalities is important but also the comparative performance or the ranking of the municipalities among other municipalities is important. Because, by the help of ranking, there will be the opportunity of benchmarking which will enable the improvement of municipalities.

The rest of the paper is organized as follows: The multi-criteria decision making technique VIKOR is provided in Section 2. Section 3 includes the application among the municipalities of Istanbul and finally, conclusions are provided in section 4 with the reference following.

2. VIKOR

VIKOR (Vise Kriterijumska Optimizacija I Kompromisno Resenje) meaning multi-criteria optimization and compromise solution is one of the many multi-criteria decision making techniques. It was firstly introduced by Opricovic (1998). But then it was used in the multi-criteria decision making problems in 2004 (Opricovic and Tzeng, 2004). VIKOR is based on compromise solution obtained by regarding the nearness to the ideal solution. Then by comparing the distances to the ideal solution, ranking is performed (Opricovic and Tzeng, 2007).

There are a lot of applications of VIKOR in literature such as in renewable energy planning (Kaya and Kahraman, 2010), in water resources planning (Opricovic, 2011), in the improvement of domestic airlines service quality (Liou, 2011), in robot selection (Devi, 2011), in financial performance evaluation of manufacturing industries (Yalcin, 2012) and etc.

The steps of VIKOR method are as follows (Opricovic and Tzeng, 2004):

Step 1: For each of the criteria, the best fi* and the worst fi- values are determined. If the criterion "i" can be regarded as benefit for the model then:

Let "i" represent the criterion and "j" represents the alternative.

$fi^* = \max_j f_{ij}$, $fi^- = \min_j f_{ij}$ otherwise if the criterion is a cost criterion then:

$fi^* = \min_j f_{ij}$, $fi^- = \max_j f_{ij}$

Step 2: For each of the alternatives, S_j and R_j values are calculated.

Let "w_i" represent the importance weight of the criterion then:

$$S_j = \sum_{i=1}^{n} w_i (f_i^* - f_{ij}) / (f_i^* - f_i^-) \quad (1)$$

$$R_j = \max\left[w_i (f_i^* - f_{ij}) / (f_i^* - f_i^-) \right] \quad (2)$$

Step 3: For each of the alternatives, Qj values are computed.

Let $S^* = \min_j S_j$; $S^- = \max_j S_j$; $R^* = \min_j R_j$; $R^- = \max_j R_j$ Then

$$Q_j = v(S_j - S^*) / (S^- - S^*) + (1 - v)(R_j - R^*) / (R^- - R^*) \quad (3)$$

And "v" represents importance weight of the strategy for the maximum group utility (Opricovic and Tzeng, 2004). It is usually taken as 0.5 (Lixin et al., 2008).

Step 4: The obtained values of Q_j, S_j and R_j are ranked from lowest to highest one. The alternative having the lowest value of Q_j is regarded as the best alternative among the alternatives.

Step 5: For the obtained results to be valid, two conditions must be satisfied. These are:

Condition 1: Acceptable advantage: There must be considerable difference between the best alternative and the second alternative when ranked according to the values of Q.

Let P1 represent the first and P2 represent the second best alternative when ranked according to Q values. Then the below equation (4) must be satisfied.

$$Q(P2) - Q(P1) \geq D(Q) \quad (4)$$

D(Q) equals 1/(j-1) where j represents the number of alternatives. If the number of alternatives is less than 4 then D(Q) is regarded as 0.25 (Chen and Wang, 2009).

Condition 2: Acceptable stability in decision making: For proving the stability of the compromise solution, this condition must be satisfied: The P1 alternative which has the best Q value, must be in the first rank at least in one of the rankings with respect to S and R.

Unless one of the two conditions is satisfied, the compromise solution set is proposed as follows:

(i) If the second condition is not satisfied, the alternatives P1 and P2 are regarded.

(ii) If the first condition is not satisfied, the alternatives P1, P2,…,Pm are regarded where Pm is determined by the relation

$$Q(Pm) - Q(P1) < D(Q) \quad (5)$$

3. APPLICATION AMONG THE MUNICIPALITIES OF ISTANBUL

For the application of VIKOR method, the related data from a real application made by Alioğlu (2006) is used. Alioğlu (2006) applied Fuzzy TOPSIS in his study and obtained a ranking of six municipalities in Istanbul. After applying the VIKOR method to the same data, a comparison is also made with his results.

The criteria and the municipalities used in the application are as follows:

Criteria

Cr1: The factor of solid waste collection

Cr2: The ratio of expenses for education, culture and public relations in total cost (%)

Cr3: The capacity of producing income (%)

Cr4: The number of staff in fire department per 1000 citizens

Cr5: The ratio of management cost in total cost (%)

Cr6: The number of administrative personnel

Cr7: The indicator for environment protection

Cr8: The administrative efficiency

Out of 8 criteria, only two of them (Criterion 5 and 6) are cost criteria, the other ones are benefit criteria.

Municipalities

- Bakırköy
- Bayrampaşa
- Kadıköy
- Şişli
- Ümraniye
- Üsküdar

Table 1: Performance scores of the municipalities for the related criteria (Cr.) (Alioğlu, 2006)

Cr.	Weight	Bakırköy	Bayrampaşa	Kadıköy	Şişli	Ümraniye	Üsküdar
Cr1	0.16	79	49	68	80	70	50.36
Cr2	0.08	0.03	2.88	1.67	2.29	5.56	2.4
Cr3	0.13	73.14	40.48	49.47	69.47	33.12	55.39
Cr4	0.22	0.06	0.09	0.24	0.1	0.2	0.19
Cr5	0.07	18.15	27.43	16.41	32.55	16.92	21.17
Cr6	0.06	0.57	1.03	1.14	2.2	1.18	0.99
Cr7	0.18	43.92	38.92	42.08	44.08	42.42	39.14
Cr8	0.11	29.92	29.67	38.58	30.6	61.51	31.33

The performance scores of the municipalities for the related criteria with the importance weights are shown in Table 1.

The VIKOR method is applied step by step as follows:

Step 1: Determining f_{max} and f_{min}

All the criteria except Cr5 and Cr6 can be regarded as utility criteria. Then f_{max} and f_{min} values are obtained as in Table 2:

Table 2: The best and the worst values for the criteria

f values	Cr1	Cr2	Cr3	Cr4	Cr5	Cr6	Cr7	Cr8
fmax	80	5.56	73.14	0.24	16.41	0.57	44.08	61.51
fmin	49	0.03	33.12	0.06	32.55	2.2	38.92	29.67

Step 2: Determining S_j and R_j

When the related operations are performed as stated in the equations (1) and (2), the values in Table 3 are obtained.

Table 3: S_j and R_j values of the alternatives

	Bakırköy	Bayrampaşa	Kadıköy	Şişli	Ümraniye	Üsküdar
S_j	0.427	0.843	0.365	0.467	0.313	0.630
R_j	0.220	0.183	0.079	0.171	0.130	0.172

Step 3: Determining Q_j for all alternatives

Q_j's are obtained by benefiting from the equation (3) and shown as in Table 4.

Table 4: Q_j values for the alternatives

	Bakırköy	Bayrampaşa	Kadıköy	Şişli	Ümraniye	Üsküdar
Q_j	0.608	0.870	0.049	0.472	0.180	0.630

Step 4: Ranking Q_j, S_j and R_j.

Table 5: Ranking of municipalities with respect to Q_j, S_j and R_j.

	S		R		Q	
Municipalities	**Distance**	**Ranking**	**Distance**	**Ranking**	**Distance**	**Ranking**
Bakırköy	0.427	3	0.220	6	0.608	3
Bayrampaşa	0.843	6	0.183	5	0.870	6
Kadıköy	0.365	2	0.079	1	0.049	1
Şişli	0.467	4	0.171	3	0.472	5
Ümraniye	0.313	1	0.130	2	0.180	2
Üsküdar	0.630	5	0.172	4	0.630	4

After obtaining the values of Q_j, S_j and R_j, the alternatives are ranked with respect to these values as in Table 5.

Step 5: Checking the conditions

After obtaining Q_j, S_j and R_j's, the conditions are checked.

For the first condition, D(Q) is obtained as 1/(6-1) = 0.2 and the condition 1 is not provided since Q(p2) – Q(p1)= 0.131 and not greater than 0.2 (D(Q)).

For the second condition, S_j and R_j rankings are checked and concluded that Kadıköy which has the smallest Q_j has also the smallest value with respect to R_j. So condition 2 is satisfied and the compromise solution set satisfying the equation (5) is obtained. The members of the compromise set are Kadiköy and Ümraniye and since Kadıköy has the smallest Q value it can be regarded as the best alternative.

Since both of the conditions are not satisfied we can only say that the best municipality is Kadıköy and the second one is Ümraniye. On the other hand, in the ranking of Alioğlu (2006), the best municipality is Ümraniye and the second one is Kadıköy. The difference in the ranking depends on the different structure of these methodologies. But, although the rankings are different, the first two are the same.

5. CONCLUSION

Performance assessment system plays an important role for managing a system effectively. Although it has widely been used in the private sector for a long time, the importance of performance assessment systems in public sector especially in municipalities has increased with the legal compulsories. There are various studies for determining the performance of municipalities individually. But in addition to the importance of individual performance of the municipalities, the comparative performance of the municipalities with each other is important as well.

With this study, after presenting the literature about performance assessment studies in public sector, a multi-criteria decision making method VIKOR is used for ranking the six big municipalities of Istanbul with respect to performance. While determining the criteria and the performance scores, it was benefited from an existing study in the literature. The results obtained from the VIKOR method are commented and compared with the results of the existing study. For further studies, various decision making methods such as PROMETHEE, ELECTRE,

ANP can be applied for the same data set and results can be compared by stating the similarities and differences.

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