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COMPARISON OF RANKING RESULTS OBTAINED BY TOPSIS AND VIKOR METHODS, USING THE SAME CRITERIA AS TIMES HIGHER EDUCATION WORLD UNIVERSITY RANKING

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ABSTRACT

Nowadays, the increase of competition among universities on a local and global basis reveals for the individuals and institutions the need of ranking universities, considering many different comparable criteria with regard to universities. There are many different world universities rankings, prepared by different institutions for this purpose, and results of which are shared with public every year. In this study, firstly the history of university rankings in the world has been discussed and the rankings of the world universities according to the world university ranking criteria have been described. In the second part of the study, TOPSIS and VIKOR methods, the multicriteria decision making methods used in practice, have theoretically been explained. In the next section, the universities have been re-ranked according to the TOPSIS and VIKOR methods, using the same world university ranking criteria. At the consequence part of the study, the world university ranking has been evaluated comparing the world universities rankings each other, obtained according to TOPSIS and VIKOR methods. The purpose of this study is the application of the TOPSIS and VIKOR methods to reveal the university rankings, any relevant example of which haven't been available in the literature, and to compare the findings of these rankings with those of the rankings obtained by THEWUR. Another aim of the study is to reveal whether ranking numbers vary in those performed by different methods. Based on the fact that university rankings do not differ according to methods using the same criteria and weights, Spearman's rank correlation coefficient was calculated and the results were evaluated.

Key Words: THE World University Ranking • TOPSIS • VIKOR • Ranking • World Universities

Introduction:

Universities are in a competition environment in all over the world. This competition environment is further increased by the ranking of universities by specific institutions and announcement of these rankings. Universities not only provide education but also play an important role in the socio-economic development of the regions in which they were located. The university, which is in a good status in the rankings, will make the region's name it has been involved, and will contribute to the development of that region. In this context, all world universities are making great efforts to take part especially in top fifty in rankings.

The ranking of America's best universities, published firstly in 1983 by US News in 1983 and published regularly on the annual basis since 1987, is an example of the use of statistical methods as of its methodology (Morse, 2008). Especially after 2003, different institutions interested in education have continued to rank and publish universities by, using different criteria. The most followed world universities rankings among these are Academic Ranking of World Universities (ARWU), which has been issued since 2003; Ranking Web of Universities (Webometrics) ,which has been issued since 2004; Quacquarelli Symonds (QS) World University Rankings and Times Higher Education (THEWUR).

These rankings carried out by different institutions have relative differences regarding the criteria used and the weights given according to the importance levels of these criteria. ARWU is calculated using six different criteria including number of alumni and staff winning Nobel prizes and Fields Medals, number of higly cited researchers selected by Thomson Reuters, number of articles published in journals of Nature and Science, number of articles indexed in SSCI and SCI, and per capita performance of a university (Academic Ranking of World Universities, 2016).

Docampo, Egret and Cram (2015) investigated the effects of the union of universities in France on ARWU, and Docampo and Cram (2015) investigated the changes in ARWU which was caused by the sizes of the examined institutions, by using statistical methods.

Webometrics, another ranking that has continuously been made a current issue by public, has used the following variables as criteria: the number of pages recovered from four engines (size), the total number of unique external links received by a site (visibility), after evaluation of their relevance to academic and publication activities and considering the volume of the different file formats (rich files) and the combination of items published included in Google Scholar and the global output (scholar) (Ranking Web Of Universities, 2016).

Thelwall, Klitkou, Verbeek, Stuart and Vincent (2010) investigated the discussions of variables called "webometric indicators" by themselves in four separate cases, and stated that these rankings generally yielded effective results for new and small areas. QS World University Ranking, one of the rankings that has been used in ranking of universities in the world and attracted attention by the public, has used the criteria of academic reputation, employer reputation, student to faculty ratio, citations per faculty, international faculty ratio and international student ratio (QS World University Rankings, 2016). In his study, Huang (2012) criticized the QS ranking for criterion selection and weighting issues, and stated that the rankings determined by this way were unfair, because of some problems, such as the return rate of the questionnaires, the position of universities such as being in domestic or international lists, indicators which are not common for all universities. . Radojicic, Milenkovic and Jeremic (2017) criticized the QS rankings and asserted that it was an unsatisfactory ranking due to its criterion selection and the reputation of the universities rather than their actual performances are ranked because people likely rank only well-known international universities.

THEWUR constituting the subject of this study as well ranks world universities through teaching, research, citations, international outlook, industry income criteria and shares the ranking results with public (THE World University Rankings, 2016a). The information regarding the criteria has been explained in detail in the methodology section. As well as all other ranking methods, THEWUR has also been criticised. Lukman, Krajnc and Glavic (2010) compared three dimensional university ranking values that they developed considering the logic that different criteria could be used in the comparison of universities, with ARWU and THEWUR. Likewise, Saisana, d'Hombres and Saltelli (2011) found that statistical results obtained with THEWUR and ARWU at university and country level are unsatisfactory but those obtained on macro regions are more robust. However, as an alternative to these ranking methods, they proposed a ranking method that is environmentally more dependent.

. In their study, Saka and Yaman (2011) investigated the university ranking systems, criterias and criticisms for the systems. The authors investigated the ranking systems in detail taking their advantages and disadvantages into consideration, and accordingly offered that universities, the number of which have increased rapidly in Turkey, should make themselves compatible with the world according to the criteria convenient for their nature. Ağıralioğlu (2012) suggested an approach for the ranking of universities in Turkey in his study, after studying the university ranking systems in the world. In his study, Soh (2015) compared the world university rankings by ARWU, THEWUR and QS, and criticised to rank on the basis of weighted sums in these systems due to the fact that the scores calculated in the rankings could not express significant differences since the scores calculated in the indicators would have different nature from each other, and proposed the method of factor analysis.

As stated in the relevant examples in the literature, the ranking methods, accepted throughout the world , have often been compared with each other. These expressed methods rank with the help of these scores created by giving weights to certain criteria. Whereas, different statistical methods, used for rankings and not been used extensively in scientific studies concerning university rankings yet, have been available. TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) and VIKOR (Vise Kriterijumska Optimizacija I KompromisnoResenje), which are among the multi-criteria decision making methods and have different algorithms, are some of these methods. In this study carried out, considering the fact that each different method applied may offer different rankings, it was aimed to find out whether the differentiation of these statistical methods has any effect on the rankings when the weights kept the same.

Method

In this study which compares the university rankings described with THEWUR, with the rankings calculated by TOPSIS and VIKOR methods; the data were created by university rankings shared by public on September 21, 2016 and declared as the 2016-2017 year's world university ranking (THE World University Rankings, 2016b). The ranking involves the comparison of 980 universities in the world with one another according to the specified criteria. Only the top 50 universities were selected to compare in this study. It was considered that if the results obtained for the top 50 selected universities are statistically significant, it can be generalized, and if there are not important changes in the first 50 rankings, this result will be similar for the rest of the rankings.

The criteria used in the calculation of THEWUR and in the study are as shown in Table 1.

Table 1. ***Performance Criteria and Criteria Weights***

Main Topics	Weight	Performance Criteria	Weight
Teaching (the learning environment)	%30	Reputation survey	%15
		Staff-to-student ratio	%4.5
		Doctorate-to-bachelor's ratio	%2.25
		Doctorates-awarded- to-academic-staff ratio	%6
		Institutional income	%2.25
Research (volume, income and reputation)	%30	Reputation survey	%18
		Research income	%6
		Research productivity	%6
Citations (research influence)	%30	Citations (research influence)	%30
International outlook (staff, students and research)	%7.5	International-to-domestic-student ratio	%2.5
		International-to-domestic-staff ratio	%2.5
		International collaboration	%2.5
Industry income (knowledge transfer)	%2.5	Industry income (knowledge transfer)	%2.5

Source: (Times Higher Education, 2016)

Teaching (The Learning Environment): This category consists of five subtitles. Reputation survey includes the results from a questionnaire designed to measure the perceived prestige of institutions. The information about the general status of the institution and about the infrastructure and opportunities for the students and staff were aimed to acquire with the subtitles of the ratio of the number of students to the number of staff, the ratio of the number of doctorate students to the number of bachelor students, the ratio of the number of doctoral awards to the number of academic staff, and instutional income (THE World University Rankings, 2016a).

Research (Volume, Income and Reputation): The status of universities with regard to the researches has been described in this category consisting of subtitles of reputation surveys, research income, and research productivity. The reputation of the university in comparison to other universities was measured by the reputation survey. The quality of publication can be tested with the research income variable, which can be criticized publicly because it is thought to be influenced by national policies and economic conditions, and which is scaled according to the number of academic staff. Research grants are often thought to be given to the high quality of research or publications. The number of articles published in Elsevier's Scopus database have been taken into account through research productivity and included in the study, with the necessary normalization procedures (The World University Rankings, 2016a).

*Citations (reference influence):*The citation numbers of academicians in relevant universities have been taken into account in order to reveal the role of universities with regard to disseminate new knowledge and ideas (The World University Rankings, 2016a).

*International Outlook (staff, students,research):*The calculations of international to domestic student ratio and international to domestic staff ratio calculations have been made under this category, considering that the number of international students at a university may be an indicator of to which extent it is globalized and how much it is internationally preferred. With international collaboration as a third subtitle under this category, the ratio of the total number of articles of at least one international coauthor of a university to the reward higher volumes value was calculated (THE World University Rankings, 2016a).

Industry Income (knowledge transfer): Through this category, the ability of an university to assist the industry with its innovations, inventions and consultancies, which is one of the basic missions of the contemporary global academy, was intended to be measured. The earned research revenues from the industry scaled by the number of academic staff employed were used in this category (THE World University Rankings, 2016a).

In the study,since the rankings described with THEWUR will be compared with the rankings calculated by using the Sanna and MS Excel computer programs for the TOPSIS and VIKOR methods, among the most commonly used in multi-criteria decision making methods, these two relevant methods have been explained in this section.

TOPSIS Method

TOPSIS method was first created by Hwang and Yoon (1981) , considering that alternatives are present in the shortest distance to positive-ideal solution and uttermost distance to negative-ideal solution. It was later applied by Zeleny (1982) as well, developed by Yoon (1987) and Lai, Liu and Hwang, (1994) (as cited in Kaya & Kahraman, 2006).

The ranking is made by using the TOPSIS method, by evaluating the distances of alternatives to the ideal solution (according to the maximum and minimum values of the criteria) in accordance with certain criteria (Eleren and & Karagül, 2008). In the TOPSIS method, while the proximity required for the ideal (best) solution is found, thus, both the positive-ideal solution distance and the negative-ideal solution distance are considered. The best solution, which is expressed as an ideal or positive ideal solution, is a solution that maximizes the benefit criterion and minimizes the cost criterion. On the other hand, the negative or anti-ideal solution is a solution that maximizes the cost criterion and minimizes the benefit criterion (Wang & Elhag, 2006). In the method, all alternatives can be ranked by comparing the relative distances, since it is assumed that the nearest alternative to the positive-ideal solution is the farthest alternative to the negative ideal solution as well (Cheng, Chan & Huang, 2002; Janko & Bernroider, 2005; Tong, Wang, Chen & Chen 2004).

After defining the problem and determining the alternatives, criteria and criterial weights (wj) in the TOPSIS method, the decision matrix is created (Trantaphyllou, 2000). Each of the x_{ij} values in the decision matrix represents the performance value for the jth criterion of the i th alternative.

$$X = \begin{vmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ . & . & \dots & . \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{vmatrix} \quad (1)$$

In order to be able to compare the values of the criteria included in the decision matrix independently of the measurement unit; making the decision matrix values normalized; when the alternative number is denoted by m and the number of criteria is denoted by n, then the normalized decision matrix R is obtained as follows (the normalized value for the jth criterion of the i th alternative is rij).

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{k=1}^{m} x_{kj}^2}} = \frac{x_{ij}}{\sqrt{b_j}} \quad (2)$$

When the number of criteria is n, the criterial weights corresponding to each criterion determined by the decision makers can be shown as vj (= w_1, w_2, ..., w_n). The weights assigned to the criteria can vary from person to person (Opricovic & Tzeng, 2003). Here, the sum of the criteria weights must equal to 1. The weighted normalized decision matrix values (V) are calculated by the formula,(v_{ij}), $v_{ij} = r_{ij}.w_j$ through multiplying each value in the normalized decision matrix by weights (w_1, w_2, w_3, …, w_n) belonging to the criteria.

When the positive ideal solution is indicated by A * and negative-ideal solution is indicated by A- in the TOPSIS method, the alternatives for the positive and negative ideal solutions are defined as follows:

$$A^* = \left\{ \left(\max_i v_{ij} \,\middle|\, j \in J \right), \left(\min_i v_{ij} \,\middle|\, j \in J^I \right), i = 1, 2, ..., m \right\} = \{ v_{1^*}, v_{2^*}, ..., v_{n^*} \} \quad (3)$$

$$A^- = \left\{ \left(\min_i v_{ij} \,\middle|\, j \in J \right), \left(\max_i v_{ij} \,\middle|\, j \in J^I \right), i = 1, 2, ..., m \right\} = \{ v_{1^-}, v_{2^-}, ..., v_{n^-} \} \quad (4)$$

J = {j = 1, 2, 3, ..., n and j express the criterion that provide the benefit.}

J^I = {j=1, 2, 3,…, n and j^I express the criterion that causes the cost / loss.}

If a criterion is a benefit criterion, it is taken to the maximum vj set, if it is a criterion causing the negativeness, it is taken to the minimum vj pozitive-ideal set. Subsequent to this step, with n-dimensional Euclid distance method, the distinction distance of each alternative from the ideal solution and from the negative-ideal solution are calculated. When the distance of each alternative from the ideal solution is indicated by Si * according to the Euclid conception, the formula given below is used for calculating these distances.

$$S_{i^*} = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_{j^*})^2}, \quad i = 1, 2, 3, ..., m \quad (5)$$

Similarly, when the distance of each alternative from the negative-ideal solution is indicated by Si - according to the Euclid conception, the formula given below is used for calculating these distances.

$$S_{i-} = \sqrt{\sum_{j=1}^{n} (v_{ij} - v_{j-})^2}, \; i = 1, 2, 3, ..., m \tag{6}$$

In the TOPSIS method, the relative proximity of the i th alternative (A_i) to the ideal solution (A_*) is indicated by C_i * and calculated by the formula given below.

$$C_{i*} = \frac{S_{i-}}{S_{i*} + S_{i-}}, \quad (i = 1, ..., m) \tag{7}$$

On the other hand, the ideal solution proximity (C_{i*}) of alternative i takes a value between $0 \leq C_{i*} \leq 1$. Besides, if $A_i = A^*$,then $C_{i*} = 1$, if $A_i = A-$ then $C_{i-} = 0$. Finally, the alternatives are ranked according to the their ideal solution proximity values (C_{i*}) calculated within the existing criteria. The best alternative is the closest alternative to the ideal solution.

VIKOR Method

VIKOR method has been proposed by Opricovic and Tzeng (2004) for the first time to solve multi-criteria decision making problems, which can not be measured by the same unit but consist of conflicting criteria (Opricovic & Tzeng, 2004).

On the assumption that each alternative is evaluated for each criterion, with the weights determined in the VIKOR method, the compromised ranking is obtained by comparing their ideal proximity values for ideal alternative (Opricovic & Tzeng, 2007). The compromised solution was proposed by Yu (1973) for the first time. The compromised solution is the proximate appropriate solution to the ideal solution, and compromise expresses the common acceptance on the basis of criteria (Opricovic & Tzeng, 2004).

When A_i indicates ith alternative (i = 1, 2, …, n), C_j indicates jth alternative (j = 1, 2, …, n), xij indicates the performance value of the ith alternative according to the jth criterion, and mco indicates the best compromised alternative selection process operator from multi-criteria decision making method ; VIKOR can be expressed as follows.

$$\underset{i}{mco} = \{x_{ij}(A_i), \; j = 1, 2, \; ..., n, \; i = 1, 2, 3, ..., m\} \tag{8}$$

Assuming that each alternative is evaluated according to all criteria, the ranking can be done by comparing it with the ideal solution F * (best values of criteria). The compromise values in the VIKOR method are found by making use of the L_p measure used in the compromise based programming (compromise programming) method (Zeleny, 1982). $L_{p,i}$ measure given in Equation (9) indicates the proximity of alternative i $(A_i)$to the ideal solution. (distance spacing).

$$L_{p,i} = \left\{ \sum_{j=1}^{n} \left[w_j \frac{(f_j^* - f_{ij})}{(f_j^* - f_j^-)} \right]^p \right\}^{1/p}, \; 1 \le p \le \infty; i = 1, 2, ..., m \qquad (9)$$

After defining the problem and determining alternatives, criteria and criteria weights in the VIKOR method, the decision matrix is created as in TOPSIS method.

Opricovic & Tzeng, 2007)

If Jth criterion is the one that provides benefit, since the alternative that offers the greatest benefit will be preferred, In this case the best *(fj *)* and worst *(fj-)* criterion values are determined using the relationship given below.

$$f_j^* = \underset{i}{maks}\, x_{ij}, \; f_j^- = \min_i x_{ij}$$

However, if j is the cost criterion, since the value of this criterion is desired to be small, the best and worst criterion values are determined using the relationship given below

$$f_j^* = \min_i x_{ij}, \; f_j^- = \underset{i}{maks}\, x_{ij}$$

Unlike the TOPSIS method, linear normalization is used in the VIKOR method (Opricovic & Tzeng, 2004). When the number of alternatives is indicated by m and the number of criteria is indicated by n, then, the normalized decision matrix is indicated by R, and the normalized value of i th alternative for the j th criterion is indicated by r_{ij} (see equation11).The decision matrix normalized with the previously determined weights regarding these criteria is weighted. Being w_j as the weigths of the criteria that define the relative preference of the decision makers; S_i and R_i values indicate the mean and the worst group scores for the i th alternative. S_i and R_i values are calculated by the formulas given below:

$$S_i = \sum_{j=1}^{n} w_j \frac{(f_j^* - x_{ij})}{(f_j^* - f_j^-)} = \sum_{j=1}^{n} w_j . r_{ij} = \sum_{j=1}^{n} v_{ij} \qquad (11)$$

$$R_i = \underset{j}{maks} \left[w_j \frac{(f_j^* - x_{ij})}{(f_j^* - f_j^-)} \right] = \underset{j}{maks} \left[w_j . r_{ij} \right] = \underset{j}{maks} \left[v_{ij} \right] \qquad (12)$$

Considering the expressions of $S^* = \min_i S_i$, $S^- = maks_i S_i$, $R^* = \min_i R_i$, ve $R^- = maks_j R_j$ then Q_i values are calculated by $Q_i = v(S_i - S^*)/(S^- - S^*) + (1-v)(R_i - R^*)/(R^- - R^*)$ formula. In this formula, v indicates the weight for the strategy that provides the maximum group benefit, (1-v) indicates the weight of the minimum regret of the people with opposing views (Opricovic & Tzeng, 2007). In a decision-making process, compromise can be achieved with "majority vote" (v> 0.5), "consensus" (v = 0.5) or "veto" (v <0.5). After calculating the values of S_i, R_i and Q_i, the results are ranked from small to large. In consequence, three ranked lists are obtained. If $A^{(1)}$ alternative with (minimum Q value) which is included in the first order in the ranking from small to large in accordance with *Q* measure meets the requirements of "acceptable advantage" and "acceptable stability in decision", then it is recommended as the compromised best solution (Özden, 2009). In this case, the rankings made according to Q values are considered as the compromised common rankings.

Findings

In the study, the top 50 universities were included in the ranking performed by TIMES. The universities were ranked according to the 13 criteria in Table 1 and using SANNA and MS excel computer programs for TOPSIS and VIKOR which are among multi-criteria decision making methods. In Table 2, the scores of each university have been given according to TIMES, TOPSIS and VIKOR methods.

Table 2

Scores According to TOPSIS, VIKOR and THEWUR Criteria

TOP 50 UNIVERSITIES	THEWUR OVERALL	(R.U.V) (TOPSIS	Qj (VIKOR)
University of Oxford	95	0.895716284	0.026628245
California Instutide of Tech.	94.3	0.863625362	0.028256984
Stanford University	93.8	0.881410515	0.016845161
University of Cambridge	93.6	0.884529877	0.043021096
Massachusetts Instutide of Tech.	93.4	0.866187369	0.092018048
Harvard University	92.7	0.840977705	0.087452373
Princeton University	90.2	0.798917126	0.20648833
Imperial College London	90	0.775695744	0.253426821
ETH Zurich – Swiss Federal Institute of Technology Zurich	89.3	0.755829785	0.254378377
University of California, Berkeley	88.9	0.748686456	0.215750232
University Of Chicago	88.9	0.774624163	0.21235976
Yale University	88.2	0.761602402	0.248246102
University of Pennsyvania	87.1	0.728069593	0.245127728
University of California, Los Angeles	86.6	0.715460258	0.263166708
University College London	86.5	0.687249384	0.355758521
Columbia University	86.1	0.690287826	0.436824839
Johns Hopkins University	85.9	0.654555481	0.368358537
Duke University	84.7	0.640532367	0.445575688
Cornell University	84.6	0.668196177	0.347093395
Northwestern University	83.7	0.620674764	0.420584523
University of Michigan	83.6	0.649910799	0.369187626
University of Toronto	83	0.614117247	0.459324685
Carnegie Mellon University	81.8	0.568592779	0.522914847
National University of Singapore	81.7	0.590352223	0.535271172
London School of Economics and Political Science	80.2	0.528249315	0.62631098
University of Washington	80.2	0.540290702	0.555831756
University of Edinburgh	79.2	0.500074514	0.646922116
Karolinska University	77.6	0.454226553	0.730414071
Peking University	77.2	0.533109659	0.7369189
École Polytechnique Fédérale de Lausanne	76.8	0.436866957	0.841048847

LMU Munich	76.8	0.457064302	0.718864732
New York University	76.7	0.492804	0.771070652
Georgia Institute of Technology	76.3	0.432752093	0.770890129
University of Melbourne	76.3	0.435994179	0.729908283
Tsinghua University	76.2	0.510401922	0.805533914
King's College London	75.9	0.426720105	0.783365978
University of British Columbia	75.9	0.426854124	0.784686628
University of Illinois at Urbana-Champaign	75.9	0.454138406	0.702074886
University of Tokyo	74.1	0.507493706	0.911338644
KU Leuven	73.8	0.372772805	0.876613938
University of California, San Diego	73.2	0.398259369	0.879847757
McGill University	73.1	0.384175756	0.847098858
Heidelberg University	73	0.391965864	0.917063557
University of Hong Kong	73	0.38973539	0.81077673
University of Wisconsin-Madison	72.6	0.398419842	0.810524497
Technical University of Munich	71.6	0.326736488	0.879668354
Australian National University	71.3	0.332842521	0.977217402
University of California, Santa Barbara	71.2	0.361262141	0.988179118
Hong Kong University of Science and Technology	71.1	0.342180913	0.985353093
University of Texas at Austin	70.8	0.368508397	0.926225052

In the TOPSIS method, the highest score indicates the farthest alternative for the negative ideal solution and proximate alternative for the positive ideal solution. For this reason, the scores are sorted from small to large to rank universities in the TOPSIS method. In this way the ranking from the best alternative to the worst alternative is obtained. In the VIKOR method, since the lowest value expresses the best compromised common solution, the values are sorted from the smallest to the largest, and thus the best compromised rank numbers are obtained. In Table 3, the rank numbers of the universities are indicated according to the both methods and THEWUR.

Table 3

Ranking by TOPSIS, VIKOR and THEWUR Criteria

TOP 50 UNIVERSITIES	THEWUR	TOPSIS RANKING	VIKOR RANKING
University of Oxford	1	1	2
California Instutide of Tech.	2	5	3
Stanford University	3	3	1
University of Cambridge	4	2	4
Massachusetts Instutide of Tech.	5	4	6
Harvard University	6	6	5
Princeton University	7	7	7
Imperial College London	8	8	12
ETH Zurich – Swiss Federal Institute of Technology Zurich	9	11	13
University of California, Berkeley	10	12	9
University Of Chicago	10	9	8
Yale University	12	10	11
University of Pennsyvania	13	13	10
University of California, Los Angeles	14	14	14
University College London	15	16	16
Columbia University	16	15	20
Johns Hopkins University	17	18	17
Duke University	18	20	21
Cornell University	19	17	15
Northwestern University	20	21	19
University of Michigan	21	19	18
University of Toronto	22	22	22
Carnegie Mellon University	23	24	23
National University of Singapore	24	23	24
London School of Economics and Political Science	25	27	26
University of Washington	25	25	25
University of Edinburgh	27	30	27
Karolinska University	28	33	31
Peking University	29	26	32
École Polytechnique Fédérale de Lausanne	30	35	40
LMU Munich	30	32	29
New York University	32	31	34
Georgia Institute of Technology	33	37	33
University of Melbourne	33	36	30
Tsinghua University	35	28	37

King's College London	36	39	35
University of British Columbia	36	38	36
University of Illinois at Urbana-Champaign	36	34	28
University of Tokyo	39	29	45
KU Leuven	40	45	42
University of California, San Diego	41	41	44
McGill University	42	44	41
Heidelberg University	43	42	46
University of Hong Kong	43	43	39
University of Wisconsin-Madison	45	40	38
Technical University of Munich	46	50	43
Australian National University	47	49	48
University of California, Santa Barbara	48	47	50
Hong Kong University of Science and Technology	49	48	49
University of Texas at Austin	50	46	47

Since the ranking in Table 3 will take a lot of space for interpretation of all universities and since all comments will be similar, information will only be given about the rank numbers of the top 5 and last 5 universities. According to THEWUR, the universities included in top five are University of Oxford, California Instutide of Tech, Stanford University University of Cambridge and Massachusetts Instutide of Tech. University of Oxford ranked as 1 st according to the TOPSIS method, and ranked as 2 nd in the VIKOR method. California Instutide of Tech, which ranked as 2 nd in the THEWUR ranking, ranked as 5th rank in the TOPSIS method and ranked as 3th in the VIKOR method. While Stanford University ranked as 3th rank in the THEWUR and TOPSIS rankings, it ranked as 1 st in the ranking done according to the VIKOR method. While University of Cambridge ranked as 4th rank in the THEWUR and VIKOR rankings, it ranked as 2 nd in the ranking done according to the TOPSIS method. On the basis of methods; the universities that are included in the top 5 ranks according to the THEWUR and TOPSIS methods are the same, but Harward University is included in the top 5 ranks instead of Massachusetts Instutide of Tech. according to the VIKOR method. Massachusetts Instutide of Tech. ranked as 5 th in the THEWUR ranking, ranked as 4 th in the TOPSIS ranking, ranked as 6 th in the VIKOR ranking. Harward University which was ranked as 6 th in other two methods, ranked as 5 th in the VIKOR method.

On the other hand, when and rank numbers of the 50 universities, examined according to the THEWUR, TOPSIS and VIKOR methods, were taken into account, even if the rank numbers of the last 5 universities differs according to all methods, the same universities were included in the top 5 universities. Accordingly, the universities included in the top 5 are Technical University of Munich, Australian National University, University of California Santa Barbara, Hong Kong University of Science and Technology and University of Texas at Austin. Technical University of Munich, which ranked as 46 th according to the THEWUR method, ranked as 50 th in the TOPSIS ranking, ranked as 43 th in the VIKOR ranking. While Australian National University ranked as 47 th according to the THEWUR method, it ranked as 49 th in the TOPSIS ranking, and ranked as 48 th in the VIKOR ranking. While the university of California Santa Barbara ranked as 48th according to the THEWUR method, it ranked as 47 th in the TOPSIS ranking, and ranked as the last (50 th) in the VIKOR ranking. Hong Kong University of Science and Technology, ranked as 49 th according to the THEWUR and VIKOR methods, ranked as 48th in the TOPSIS ranking. On the other hand,

the University of Texas at Austin which ranked as the last (50 th) according to the THEWUR method, also ranked as 46 th in the TOPSIS ranking and ranked as 47 th according to the VIKOR method.

The findings show that there is no significant difference between the university rankings calculated using the same criteria and the same weights for different methods. In order to prove this istatistically, the relationships between the university rankings obtained by different methods were examined with the Spearman's rank correlation coefficient. The Spearman's rank correlation coefficient is used to measure the linear relationship between two ordinally defined variables, not normally distributed (Karagöz, 2010).

Table 4

Relations Between Rankings

			TOPSIS	VIKOR	TIMES
Spearman's rho	TOPSIS	Correlation Coefficient	1,000	0,964**	0,981**
		Sig. (2-tailed)	.	0,000	0,000
		N	50	50	50
	VIKOR	Correlation Coefficient	0,964**	1,000	0,977**
		Sig. (2-tailed)	,000	.	,000
		N	50	50	50
	THEWUR	Correlation Coefficient	0,981**	0,977**	1,000
		Sig. (2-tailed)	0,000	0,000	.
		N	50	50	50

When Table 4 is examined, it is seen that there is a positive and very strong (the correlation power ranges between 0,964 and 0,981) statistically significant relationship between every three rankings. This can be regarded as an indication of that the methods do not affect the rankings.

Discussion and Conclusion

With the acceleration of globalization, the education sector continues to develop in a competitive environment. Now, universities are compared with not only with the domestic universities, but also with the universities in other countries and thus they both continue to develop in scientific sense and attract more national / international students thus contributing economically to the regions in which they are located.

Nowadays, the increase of competition among universities on a local and global basis reveals for the individuals and institutions the need of ranking universities, considering many different comparable criteria with regard to universities. There are many different world universities rankings, prepared by different institutions for this purpose, and results of which are shared with public every year. The most known ones among them are Times Higher Education World University Ranking (THE), Academic Ranking of World Universities (ARWU), Ranking Web of Universities (Webometrics) ve Quacquarelli Symonds World University Rankings (QS).

In this study, the university rankings shared with the public on September 21, 2016 and declared as THE World University Ranking in 2016-2017 have been taken into consideration. The rankings of the top 50 universities arranged with THE scores were compared with the rankings obtained with TOPSIS and VIKOR which are among the most criterion decision making methods and which were calculated using the same criteria. The rankings and critera used wasn't changed so that the rankings obtained could be comparable. At the end of the study, 3 different scores and ranking values regarding 50 universities were obtained.

When VIKOR and THE World university rankings were examined, it was seen that the top 4 universities yielded the same results, only their rankings differed. The University of Oxford which ranked as the first in THE world university ranking, ranked as 2nd in the ranking calculated by VIKOR method. However, Stanford University which ranked as third in the THE World university ranking, ranked as the first in the rankings calculated by VIKOR method. In the study, the rankings obtained by the TOPSIS method were also compared and it was determined that any different result weren't obtained apart from THE World university ranking values and the rankings calculated by VIKOR method. When all methods were compared, it was found that as well as any big difference wasn't observed in general , the universities either are included in the same ranking or in the proximate ranking by a few number.

It was determined that there was a high correlation between the rankings obtained with THE World Ranking of University and those obtained with the TOPSIS and VIKOR methods, and accordingly the rankings of the universities did not change so much even if the method was changed. As a result, this shows that universities that are determined to be "good" have really high values for the relevant criteria of the universities and they are different from other world universities included in the ranking. In addition to these, it can be said that the ranking will change according to the criteria used in ranking the universities of the world, the weights used in accordance with the importance given to these criteria and the methodology applied; accordingly remarks will be different.

The findings of the study suggests that the rankings did not change even though different methods were used. But, it should not be forgotten that this study was performed with only current THEWUR findings in 2016. The reason why THEWUR findings were taken as a reference is being regarded as the most reputable ranking in the literature. In the subsequent studies, instead of the THEWUR results, another study's results can be compared with those of this study. Besides, it is thought that instead of changing the methods; performing new studies by changing weights and criteria and comparing their results will make contribution to the literature.

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