A practical framework for ranking universities by their competitive advantages: a mixed methods study on foundation universities in Turkey

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Abstract

Purpose – The purpose of this research is to determine the competitive advantages of higher education institutions (HEIs) and create a new methodology to rank universities according to the competitive advantages.
Design/methodology/approach – The research determines the competitive advantages of HEIs by analysing expert opinions through a semi-structured interview form, matches codes and themes to performance indicators using Saldana's two-cycle coding methods, evaluates content validity through Lawshe and reveals the item weights of the ranking with analytical hierarchy process (AHP). Simple additive weighting (SAW) and Technique for Order of Preference by Similarity (TOPSIS) methods were used for ranking universities.
Findings – Seven dimensions stand out in regard to what should be considered while ranking HEIs: research and publication, education, management, infrastructure, financial resources, human resources and social and economic contribution. Under the 7 dimensions, 69 indicators were determined.
Practical implications – The research provides a scientific reference point where HEIs can compare themselves with other HEIs regarding where they are in the sector, especially in terms of competitive advantages.
Originality/value – Although there are many different ranking methods that rank universities in the national and international literature, almost all these methods are largely based on the outputs of the university such as the number of publications, the number of patents, the number of projects, etc. A framework which ranks universities by considering different aspects of the institution, such as management, human resources and financial resources, has not been developed yet. In this respect, this research aims to fill this gap in the literature.

Keywords Competitive advantage, Strategic planning, Higher education, University rankings, Quality management
Paper type Research paper

Introduction

Perhaps the most important benefit of technological developments is that accessing, processing and sharing information have become so fast and independent of space, higher education institutions (HEIs) are deeply affected by this change (Musselin, 2018). HEIs are the main institutions that train the qualified workforce required by the globalizing world. Therefore, it has undeniable importance both on national and international level. Universities, which were initially established only for "educational purposes", have evolved simultaneously to meet the developments in society and the requirements made compulsory by these developments and have added the mission of "research" among their

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main objectives (Wang, 2020). Today, in addition to these two missions, HEIs, as structures that produce and transmit information, have also undertaken the mission of "making a direct contribution to society socially and economically" (Abed and Ackers, 2021).

The development of networks that increase the sharing of knowledge at the international level, the increasing number of universities, the acceptance of English as a common language, the importance of economic integration, the international mobility of teachers and students and the rising need for globalization have emerged as the factors that make it essential for HEIs to compete both in the national and international arena (Strielkowski *et al.*, 2021). As a natural consequence of these factors, it has become difficult for a university to become competitive in all three of the above-mentioned missions. In this case, it is seen that universities choose one of their education, research and entrepreneurship missions as their focus in order to provide competitive advantage (Distanont and Khongmalai, 2020). As a matter of fact, it is seen that the Council of Higher Education, which is the supreme institution responsible for the management and supervision of higher education in Turkey, also asks universities to choose one of these three missions as a focus area and create a strategy in this direction (YÖK, 2021).

Although competition between HEIs is encouraged by national and international HEIs, the evaluations mostly focus on the "outputs" produced by the universities, and it is not revealed what competitive advantage is for HEIs in their own sectors and to what extent universities have these competitive advantages (Johnes, 2018). For this reason, it is seen that universities have largely integrated the outputs measured in the report card into their strategic plans. However, it is essential that the factors that educational institutions should consider while competing should be based on the competitive advantages revealed by scientific methods. The reason behind this depends on the works of many researchers claiming that performance measurement should be less functionally focused and more focused on value creation processes that can eventually turn into competitive advantage (Kaplan and Norton, 1992; Bititci *et al.*, 1997; Childe *et al.*, 1994; Bititci *et al.*, 2002). HEIs are no exception as they are seen as one of the primary sources of innovation and mediators of transferring knowledge and creating value (Buckley *et al.*, 2019). Therefore, their performance measurement should be less functionally focused and more focused on value creation by making use of specific performance indicators that are aligned to the competitive advantages in the sector; consequently, this will shed light onto how much value creation can they actually put forward.

In addition, none of the systems currently used to evaluate HEIs have an approach that focuses on competitive advantages. It is seen that almost all of the national and international rating agencies evaluate HEIs on the basis of general performance indicators (Çakır *et al.*, 2015). In this study, rather than the general performance of HEIs, the qualifications that can be described as competitive advantage are highlighted. Recently, the need to encourage competition in Turkish higher education has led to the need for a more competition-oriented assessment (YÖK, 2021). In this respect, the ranking prepared in this study, especially according to competitive advantages, is a unique aspect that distinguishes it from all other rating systems.

Moreover, in current evaluation systems, there is no explanation as to which scientific method the selection of performance indicators and item weighting are made. However, in this study, what can be qualified as a competitive advantage for HEIs has been discovered with the themes and codes obtained from the opinions of academic experts who have been working in HEIs for years. For example, the scientific method by which performance indicators and item weights in rating indices, such as Times Higher Education (THE), Quacquarelli Symonds (QS)-World and Academic Ranking of World Universities (ARWU) are selected is not mentioned in the methodology sections. Although these indices were probably developed by experts, it is not known how the performance indicators of the indices were created using a methodology.

Similarly, the issue of how the item weights of performance indicators in other indices are determined is also problematic. In most indices, it is seen that these weights are formed by dividing the total weight ratio by the number of items, and the weights of the items in all dimensions are the same. Determining item weights in this way weakens the ability of the items to actually measure the phenomenon to be measured. In this study, the item weights of the performance indicators in this model were found by the analytical hierarchy process (AHP) method (Saaty, 2014). This method, which is one of the multi-criteria decision-making methods, is based on the principle of determining the superior items in terms of importance by comparing all items in pairs with each other and assigning their weights according to their importance.

The research, on the other hand, is unique in terms of both determining the competitive advantages with a scientific method and revealing the item weights with the AHP method. While developing the ranking in this research, each stage is based on a scientific method, and these stages are explained in detail in the method section. As a result of this study, a new method of ranking has been developed in which each HEI can compare itself with other HEIs. In this way, it will be possible to obtain a scientific result regarding the position of the institution in terms of current competitive advantages, especially during the strategic planning studies, before proceeding to the "differentiation strategy" section. This opportunity will not only support the "situation analysis" section but will also shed light on the future strategies to be developed by the institution.

Consequently, the research question is determined to be "What are the competitive advantages of HEIs and how should foundation universities be arranged in order according to a competitive advantage ranking?". The sub-questions of the research question are as follows:

RQ1. What are the competitive advantages of HEIs?

RQ2. With which performance indicators can the competitive advantages of HEIs be measured?

RQ3. What should be the weights of the performance indicators in the ranking to be created?

RQ4. What will be the ordinal arrangement of universities according to the ranking to be created?

Literature review

The definition of competitive advantage in the literature was made by Ansoff for the first time. According to his definition, competitive advantage is the sum of the products or services that give the company a strong and competitive position in the sector in which it operates (Ansoff, 1965). Researchers after Ansoff have expanded the definition of the concept in the business literature added "through the appropriate use of the resources and capabilities of the institution" to this definition (Uyterhoeven *et al.*, 1973). Further on, it was Porter's book "*Competitive Strategy: Techniques for Analyzing Industries and Competitors*" published in 1980 that brought the concept of competitive advantage to its real popularity. In this book, Porter talked about five forces that explain the theory that competition in the industry is affected by five main factors (Porter, 1980). The five forces mentioned here are the potential of competitors to enter the market, the threat of substitute products, the bargaining power of customers and the bargaining power of suppliers. Together, these forces determine the ultimate benefit potential an organization can achieve (de Haan, 2015).

While talking about competitive advantage, rather than defining the concept, Porter emphasizes that it is related to the concept of "value" (de Haan, 2015). According to him,

creating value for customers is an important way to gain competitive advantages. Therefore, the more value an organization can generate compared to its competitors, the more competitive advantage it has (Porter, 1980; de Haan, 2015). In addition, this competitive advantage causes the institution to gain more economic value than its competitors. It is possible to explain the concept of "competitive advantage" as "all the things that add value to an organization" (Ertosun and Adıgüzel, 2018). Thus, the survival of the institution becomes more possible (Adner and Zemsky, 2006; de Haan, 2015).

HEIs must compete with their peers in the sector in order to obtain research funds and receive more funding from the state. This competition requires HEIs to have a certain standard of education and research quality. To be able to do this is to be a centre of attraction for qualified personnel and students (Knight, 2004; Marginson and van der Wende, 2007; de Haan, 2015). With the increasing competition among institutions, it is predicted that the importance of rankings for students and academics will continue to increase, especially on the international platform. According to Hazelkorn (2011), rankings are a manifestation of what is known worldwide as the "war for excellence" and are used to assess the quality of an institution's teaching system and measure its global competitiveness. As internationalization has become a priority for the higher education sector, higher education's capacity to acquire talent and generate knowledge has become a vital sign of how much a country can contribute to science and the global economy (Horseman, 2018). In the process, rankings are transforming universities and reshaping higher education (Hazelkorn, 2015).

Having been on the spotlight for over a decade, higher education rankings have been the subject of many research papers, and there are studies in literature that propose alternative models of rankings, similar to the one that is proposed in this research. As international rankings, namely THE, QS and ARWU are criticized heavily on their methodology, implications on universities and the determinants that they use, many scholars have come forward suggesting alternative ways of measuring overall performance of universities on a global scale. In a 2018 study, Brankovic, Ringel and Werron suggest a new approach to rankings to which they refer as "ranking as a type of social operation", prioritizing globalization, scarcification of reputation and regular publication of findings. As one of the harshest criticisms on the methodology of global rankings (and rightfully so), Daraio and Bonaccorsi (2017) suggest a reformist change on the design and production of performance indicators in such systems. On a different note, Torabian (2019) suggests alteration of performance indicators in order to facilitate the implementation of sustainable development goals. Apart from these theoretical models proposing changes in performance indicators, there are studies suggesting new methodologies of ranking HEIs based on the revealed preferences of applicants (Csató and Tóth, 2020), metrics obtained from activities on web, specifically social media (McCoy *et al.*, 2018) and using specific software to collect and analyse data to approximate rankings (Siniksaran and Satman, 2019). There are also studies that suggest alternative rankings based on different groupings of HEIs by proposing a five-cluster solution (Poole *et al.*, 2017) and ranking institutions by reference groups (Kosztyán *et al.*, 2019). It is possible to infer from all these studies that in literature, there is an effort to create a better alternative to the global university ranking systems, which is in fact one of the underlying reasons behind this study as well.

Methodology

In the study, exploratory sequential mixed design (Creswell *et al.*, 2003) was used, and Saldana's two-cycle coding analytics (Saldana, 2021) was used to analyse expert opinions at the qualitative stage and to match the codes and themes obtained from the analysis with performance indicators. At the quantitative stage, the Lawshe method (Lawshe, 1975) was used to determine the content validity, and the AHP method (Saaty, 2014) was used to

determine the item weights. As a result of the determined item weights, the competitive advantage ranking of foundation HEIs in Turkey was created, and the rankings of the universities were determined by collecting the data. The codes and themes obtained in the qualitative stage were used to determine the performance indicators, and with this feature, the qualitative stage directly supported and fed the quantitative stage with its data. In the light of the data obtained, simple additive weighting (SAW) (Fishburn, 1967) and TOPSIS (Hwang *et al.*, 1993) methods were applied in ordering the universities. Then, Spearman's rank difference correlation coefficient (Spearman, 1904) was determined, and the results were interpreted in order to compare the correlation of the two rankings.

In qualitative phase, the aim was to discover what can provide a competitive advantage to a university in the higher education sector from people who have worked in strategic planning processes in HEIs or have knowledge about these processes. At this stage of the research, the "phenomenology" design, one of the qualitative research designs, was applied. Phenomenology primarily tries to describe the world experienced by individuals and to explain the essence of the experiences in order to discover the common meanings underlying the phenomenon. The study group of the qualitative phase consisted of 30 people selected by the maximum diversity sampling method, one of the purposive sampling methods, from the people who worked in the strategy development boards and strategic planning teams at the universities, which prepared strategic plans according to the "Strategic Planning Guide for Universities", which was last updated by the Council of Higher Education in 2018. Purposive sampling was chosen because it makes it possible to explore the situations that are predicted to have rich information in terms of data collection in depth (Patton, 2002). In the qualitative phase of the research, data were collected through a semi-structured interview form.

While analysing the data in the research, first, thematic analysis was made, followed by descriptive analysis and content analysis, respectively. In order to ensure reliability and validity in the qualitative phase, three coders coded the data in a three-month period and categorized them thematically. Before the coding was done, the coders agreed on the concepts by exchanging views. Then, each encoder independently coded the data two times in different time slots. Care was taken to ensure that the intervals between coding were at least 15 days. The coders compared the codes they obtained at two different times with each other and transformed them into a final coding. Later, the coders came together and compared these codings, discussed which codes were seen more statistically, and to what extent these codes answered the research questions, and together they decided what the best coding should be.

The themes and codes obtained from the data collected at the qualitative stage of the research are of a nature that feeds the beginning of the quantitative stage. Performance indicators matched with the codes reached formed the items of the developed model. This methodological relationship between these two stages of the research is also proof that the research is mixed methods research. The use of both qualitative and quantitative data collection methods in a study is not sufficient to classify a study as a "mixed method". It is the integration or linking of two data sets that defines mixed methods research and highlights its value. This integration can occur at multiple levels of a work (design level, method level or interpretation level) and can take different forms such as linking, creating, combining or embedding (Cresswell and Plano Clark, 2011).

The content validity of the item pool created for the ranking was determined by the Lawshe method. As a sample for this stage of the research, 20 academicians from academic staff working in HEIs who participated in strategic planning studies were selected by criterion sampling method from purposive sampling methods. The reason for this is that it is possible to reach experts with the determined characteristics on the subject. The criterion taken while determining the sample is that the experts have worked in strategic planning studies or have knowledge about the processes. In the next step of the quantitative phase, after the item pool was created, the AHP method was used to determine the item weights.

The definition of the sample determined at this stage was the same as in the content validity, and the opinions of 11 experts were consulted.

In the second step of the quantitative phase, the foundation HEIs within the borders of Turkey constitute the universe. At this stage of the research, since all foundation HEIs were accessible, sample was not selected; all of the foundation universities were included in the research. As of 2022, there are 73 active foundation universities in Turkey, which corresponds to approximately 37% of the total number of 207 universities in the country (YÖK, 2022). All universities in Turkey, specifically state universities, could not be included in research because Higher Education Council of Turkey (YÖK) does not publicly announce performance data of state universities as detailed as it does for foundation universities.

The first step in the application of the SAW method is the normalization of the data matrix. This process is calculated separately for all data with the help of the following formulas:

$$r_{ij} = \frac{r_{ij}}{Max\,(x_{ij})} \tag{1}$$

$$r_{ij} = \frac{Min(x_{ij})}{x_{ij}} \tag{2}$$

In the first formula, each of the criteria that is more significant (in terms of benefit) than the data is normalized by dividing by the highest value of the criterion, while in the second formula, the lowest value of the criterion is normalized by dividing each value of the criteria that are less significant (in terms of cost).

In the next step, the total score for each alternative was calculated using the criterion weights. The formula used in this calculation is shown in formula (3) below:

$$V_i = \sum_{j-1}^{n} w_j r_{ij} \tag{3}$$

The alternatives are ranked by multiplying the normalized values in each criterion by the weight of the criterion to which they belong and by summing all the values. According to this method, the best alternative is the one with the most points.

In the TOPSIS method, the first step is to create the normalized decision matrix. To facilitate comparisons, this step aims to make the data unit independent. The process at this stage is shown in formula (4) below:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^{m} x_{ij}^2}} \tag{4}$$

In order to obtain the normalized decision matrix according to the formula, the square root of the sum of the squares of the column values should be taken, and the relevant element of the column should be divided by this value.

In the second step, the weighted normalized decision matrix is created. At this stage, the weighted decision matrix of the values is calculated by using the criterion weights. The formula for this process is shown below:

$$v_{ij} = w_j \times r_{ij} \tag{5}$$

In the third step, positive and negative ideal alternatives are determined. Here, the evaluation criteria are the largest of the positive ideal alternative column values in terms of benefit, and

the smallest of the column values in terms of cost. On the other hand, the negative ideal alternative is the smallest column values when the criteria are in terms of benefits and the largest when they are in terms of cost. These calculations are made with the help of the following formulas (El Alaoui, 2021):

$$A^* = \left\{v_1^*, \ \ldots, \ v_n^*\right\} = \{(max_i v_{ij} | j \in \Omega_b), \ (min_i v_{ij} | j \in \Omega_c)\} \tag{6}$$

$$A^- = \left\{v_1^-, \ \ldots, \ v_n^-\right\} = \{(min_i v_{ij} | j \in \Omega_b), \ (max_i v_{ij} | j \in \Omega_c)\} \tag{7}$$

Formula (6) shows how to calculate positive ideal alternatives, and formula (7) shows how to calculate negative ideal alternatives; the value "b" is used for values in terms of benefits, and the value "c" is used for values in terms of costs.

In the fourth step, the distance of each alternative to the ideal values is calculated. Accordingly, the distance to the positive ideal value is calculated with formula (8):

$$D_i^* = \sqrt{\sum_{j=1}^{m} \left(v_{ij} - v_j^*\right)^2} \, i = 1, \ \ldots, \ m \tag{8}$$

The distance to the negative ideal value is calculated with formula (9):

$$D_i^- = \sqrt{\sum_{j=1}^{m} \left(v_{ij} - v_j^-\right)^2} \, i = 1, \ \ldots, \ m \tag{9}$$

In the fifth step, the relative distance to the ideal alternatives is calculated with the help of Formula (10). As a result of this calculation, the CCi values closest to 1 are placed in the first row, and the alternatives are listed accordingly below.

$$CC_i = \frac{D_i^-}{D_i^- + D_i^*}, \ i = 1, \ \ldots, \ m \tag{10}$$

Findings

The researchers used *in vivo* coding in the first cycle and elaborative coding in the second cycle (Saldana, 2021) while matching the codes with performance indicators. The main purpose of *in vivo* coding is to consider what is said together with the content, to discover common expressions in the sentences used by the participants and to convert them into short phrases or sentences (MacQueen *et al.*, 2008). Elaborative coding, on the one hand, examines the similarities with the performance indicators of the current ranking indices, and, on the other hand, it also includes the performance indicators created by the researcher according to the codes. Other studies investigated in terms of similarity are as follows:

(1) THE; Times Higher Education Higher Education Rankings (Times Higher Education, 2022),

(2) QS World University Rankings (QS Quacquarelli Symonds Limited, 2022),

(3) ARWU; Academic Ranking of World Universities (ShanghaiRanking Consultancy, 2022),

(4) U-Multirank; World University Rankings (U-MULTIRANK, 2022),

(5) URAP; University Rankings by Academic Performance (ODTÜ - Urap Araştırma Laboratuvarı, 2022),

(6) Competency Analysis of TÜBİTAK Universities by Field (TÜBİTAK, 2022),

(7) Council of Higher Education, Turkey – Monitoring and Evaluation Reports (YÖK, 2022),

(8) Council of Higher Education, Turkey; Accreditation Council – Institution Quality Reports (YÖKAK, 2022) and

(9) TÜMA/Turkey University Satisfaction Survey (Karadağ and Yücel, 2022).

The codes obtained as a result of the study were grouped by paying attention to the themes and semantic similarities. The codes available in each group were matched with the performance indicators required for the measurement of these codes. As a result of the matching, 89 performance indicators were matched with 53 codes. While making detailed coding in the matches, attention was also paid to the value of the indicators and their applicability to the ranking. It is stated in the literature that the evaluation of the value and applicability of each indicator can be structured by considering five basic criteria. These criteria are (1) availability of data; (2) geographic scope; (3) frequency of updating data; (4) applicability and (5) its interpretability (Coombes and Wong, 1994).

As a result of the Lawshe application, the evaluations made on the basis of performance indicators, the performance criteria that were below the scope validity rate were removed from the list, and 69 performance indicators remained. The full list of performance indicators can be found in Table A1.

In the next stage, the application of the AHP method was started. After the matrix was normalized, the sum of each row was divided by the size of the matrix and averaged. The resulting values are the weights of importance calculated for each criterion. While these weights form the priority vector, percentage importance distributions showing the importance values of the criteria relative to each other are obtained and shown in Table 1 below:

The AHP method used at this stage also decides for the weights of individual items (performance indicators) that are used in the ranking. These item weights have been used in both SAW and TOPSIS rankings as in literature similar variations of AHP-SAW and AHP-TOPSIS hybrid methods are used to strengthen decision-making processes. The reason behind this can be explained as follows (Hadikurniawati *et al.*, 2018):

> The essence of multi-criteria decision-making methods (MCDM) is to determine the weighting value for each parameter, followed by the rank which will select the given alternatives. The difference in the ranking order of this method is due to the effects of alternative values, weighting criteria, and calculation methods. AHP is a MCDM method that has consistency in giving weighting to its parameters while TOPSIS, SAW and WP methods have no consistency.

Table 1. Weights of dimensions in universities' competitive advantage ranking

Dimensions	Total weight of performance indicators in the dimension
A1. Education	0.24952
A2. Infrastructure	0.09811
A3. Financial resources	0.08816
A4. Human resources	0.03948
A5. Management	0.13654
A6. Research and publication	0.36153
A7. Social and economic contribution	0.02666
Total	*1.0*

In the next step of the research, the competitive advantage ranking of foundation HEIs was created in the light of the data obtained. In the ranking created, the data of each performance indicator was entered on the basis of the university, the data obtained as a ratio was taken as it is and the data obtained in terms of quantity was written as a percentage based on the share of the university over the total. As mentioned in the data analysis section of the research, after list-based deletion and multiple imputation processes, the ranking, whose data set was completed, was prepared for SAW, and the resulting rankings are in Table A2, accordingly.

By using the same data set, HEIs were ranked again by obtaining results with the TOPSIS method since it is a method that takes into account the closeness of the data to the ideal positive alternative and the distance to the ideal negative alternative. The purpose of this ranking is to compare the two rankings to determine whether there is a significant relationship between them. Accordingly, the resulting rankings are in Table A3.

After the rankings were made, the correlation between the SAW ranking and the TOPSIS ranking was examined with the Spearman's rank difference correlation coefficient. This value was found as $r_s = 0.357$, and the significance of the correlation was found as $p = 0.005$, which expresses that it is not significant. Although SAW and TOPSIS are both used for rankings, their methodology and approach are fundamentally different. First of all, when SAW ranks items according to their cumulative score, in other words, by adding the maximum number of points obtained per item altogether, TOPSIS calculates closeness to the positive ideal solution as well as distance from the negative ideal solution. This makes the rankings statistically different. To clarify which ranking method produces better results, both of these methods, along with AHP, are accepted as reliable multi-criteria decision-making methods. However, there have been studies in literature that both TOPSIS and SAW have the most accurate results among other multi-criteria ranking methodologies (Widianta *et al.*, 2018; Sunarti *et al.*, 2018; Wardana *et al.*, 2020). As for the ideal methodology of the ranking in this study, both of these methods are presented to provide an alternative perspective to the reader to examine differences in rankings when only the cumulative score of the items are taken into account and when closeness to the ideal positive solution, as well as distance to the negative solution, are taken into account. To exemplify the calculation of both methods, one of the universities' step by step process is given in Table A4.

Discussion

Item weights and cumulative weights of the dimensions from the AHP show that the research and publication dimension (sub-theme) of the ranking is the most important dimension (36.2%), followed by education (24.9%) and management (13.6%) dimensions, respectively. The contribution of these three dimensions that make up the ranking to the total evaluation stood out as more than 70%. Considering the basic roles that universities take in the society they are in, the fact that the research dimension is more important than other dimensions is in line with the studies in the literature. Indeed, the research function of the university distinguishes it as an institution from all other teaching institutions in society (Mintrom, 2008). The most important reason why HEIs still fulfil this function is that the university still needs the research role (savoir d'etre) in society. In this context, it is stated that the society's search for knowledge will continue unabated, and universities will continue to be institutions that gather bright-minded individuals who can fulfil this function (Moscardini *et al.*, 2022).

Considering the educational role of HEIs, it is very important that the education dimension stands out as the second most important dimension of the ranking model. When looking at other ranking systems, it is stated that rankings that programmatically exclude other outputs of universities (other than research) are biased. In addition, it has been argued that completely ignoring educational outcomes in rankings severely distorts reality (Daraio *et al.*, 2014). Some

researchers have questioned the relationship between the rankings and the quality of education, citing that what is included in the rankings in general is what is measurable, not valid (Cremonini *et al.*, 2008). In this context, it has been stated that rankings that include only research indicators or are overly dependent on research indicators may lead to biased decisions (Bastedo and Bowman, 2010). In conclusion, it is stated that global rankings are largely based on research outputs and ignore the importance of education (Moed *et al.*, 1985).

The third most important dimension of the ranking is the management dimension. It shows that the role of management is very important in achieving the strategic goals determined by HEIs. The concept that best reflects the way HEIs differ from other institutions is management, affecting the structures and processes in which institutional participants interact with each other and communicate with the wider environment (Birnbaum, 1988). In strategic management, in the analysis of the resources available in the internal environment, the economic, physical and human resources of the different units of the institution as well as the abilities of the people are taken into account. These resources are considered the forces that support strategic decisions (Fauzi *et al.*, 2021). In many studies in the literature, it has been stated that management can be considered a competitive advantage for HEIs as the most important part of human resources. In a higher education institution, human resources are a strategic advantage of the institution. It is factors like these that distinguish one university from another. Having a good management, distinguished faculty members and employees provides a competitive advantage to that institution (Kongolo, 2019). In this respect, the findings related to the importance of the management dimension in the study support the findings in both business and educational management literature.

Looking at the literature, it is claimed that the current rankings include a series of indicators with a narrow scope and questionable meaning in terms of educational activities of universities (Daraio *et al.*, 2014). For example, Nobel and field awards received by alumni at ARWU, student/staff ratios (20%), international students (5%), international staff (5%) and income per lecturer (2.25%) in the QS World University Rankings, the number of undergraduates per academic staff (4.5%), the ratio of international students to the total number of students (2.5%) and the ratio of international employees to the total number of employees (2.5%) at THE (Times Higher Education Rankings). It is known that these indicators are seen as lacking in consistency except for the institutions at the top of the rankings; therefore, they are considered unreliable and highly volatile by most analysts (Salmi and Saroyan, 2007; Saisana *et al.*, 2011). In this study, the education dimension is the second most important dimension with a weight of 24.9%, as well as the second dimension with the most performance indicators in the ranking with 12 performance indicators.

Four of these indicators consist of the Turkish University Satisfaction Research (TÜMA) (Karadağ and Yücel, 2022) rankings in which student and personnel satisfaction is measured. In this respect, this study differs from similar studies in the literature. Studies in the literature show that there is no significant relationship between the level of satisfaction with the education received by the students, the position of the educational institution in the rankings and the number of publications (Stenstrom *et al.*, 2015). In this context, it can be argued that the achievements of the educational institution and its position in the rankings contribute little to the quality of the students' experience. For example, although the number of publications gives an idea that students can conduct scientific research, they are not explanatory in terms of students' satisfaction with the education they receive, the stress they experience and their autonomy skills. What is more interesting is that there are very few significant relationships between ranking systems and these factors. It seems that the place of educational institutions in the rankings is affected little or not at all by the experiences of the students (Stenstrom *et al.*, 2015). In this study, students' satisfaction with their learning experience, their views on academic support and interest, and their satisfaction with the richness of learning opportunities and resources are among the most important indicators of the education dimension. The weight

of these three indicators (as determined by the AHP) in the education dimension is 19.7, 12.3 and 15.2%, respectively. Considering the general weight of these performance indicators in the ranking, it is seen that the satisfaction of students with their learning experience is the third highest indicator in the ranking with 4.9% item weight. Similarly, academic support and interest stand out as the fourth most important indicator of the ranking with the item weight of 3.8% in the ranking. Satisfaction with the richness of learning opportunities and resources is the ninth most important indicator of the ranking with 3%.

Another important indicator within the education dimension is the fields determined according to the current field-based competency analysis of the institution. The opinions taken from the experts in the qualitative part of the study indicated that HEIs should develop strategies according to their areas of competence. There are studies in the literature suggesting that HEIs should develop strategies in line with their competencies. Core competencies as a managerial concept are central to strategy development. Therefore, it forms the basis of an organization's competitive position in the industry (Holmes and Hooper, 2000). In this study, in addition to the total number of programs determined on the basis of volume quality according to the field-based competence analysis of HEIs, the ratio of the number of programs that exceed the median value of these programs to the total number of programs is among the indicators of the education dimension. In this sense, it can be said that strategy development based on competencies has a direct and quality-enhancing effect on educational processes, which is one of the basic functions of HEIs. This finding also coincides with Hamel and Prahalad's theory of competitive advantage based on resources and capabilities (1990). Similarly, Barney stated that an institution's resources, capabilities and corporate identity are factors that differentiate it from others in the industry and provide competitive advantage (1991).

Although academic reputation emerged as one of the elements considered a competitive advantage by experts in the interviews held at the qualitative stage of the study, it was deemed more appropriate to be excluded from the ranking in the content validity study 40% of the experts stated that the said performance indicator should be changed. Among the reasons given by the experts regarding this decision, (1) the reputation measurements are limited to the limited information of the participants, (2) the reputation has a stronger nature over the years and therefore it will create a disadvantage for the newly established HEIs in the rankings, (3) the scientific methodology of the reputation measurements should be elaborated in detail and (4) failure to publicly and comprehensively announce the results of national reputation measures. Looking at the literature, it is stated that academic reputation can be counted as one of the competitive advantages of HEIs (Miotto *et al.*, 2020). As a matter of fact, one of the results that emerged in the qualitative phase of this study is that academic reputation is one of the competitive advantages of HEIs. In addition, it is seen that reputation is among the evaluation criteria in international rankings. For example, both QS and THE use reputation surveys to measure how an institution is rated by academics and key stakeholders. However, methodologies that use reputation as a criterion for rankings are widely criticized for being overly subjective, self-referential and self-perpetuating where the participant's knowledge is limited to what they know and reputation is equated with quality or institutional age (Hazelkorn, 2019).

In addition, it is argued that HEIs ignore academic freedom in order to gain academic reputation through international rankings and that academics are kept under pressure by university administrations on issues such as the number of publications and the quality of publications (Kinzelbach *et al.*, 2021). Although previous research has found that academic reputation is an important variable in the university selection process, the components of reputation have not been definitively determined. Higher education administrators need to better understand this important variable in order to develop more effective marketing strategies (Conard and Conard, 2000). In sectors such as higher education, reputation and trust play an important role in pre-admission assessments

because students often lack the knowledge and experience needed to make accurate judgements about service quality (Su *et al.*, 2016). Findings from the literature actually support the reasons put forward by the experts for changing the reputation-related indicator at the content validity stage of this study. In this respect, not including academic reputation in the ranking is supported by both expert opinions and the reasons put forward by the studies in the literature.

Considering the research and publication criteria of the study, it is seen that criteria such as the number of national and international publications and citation points come to the fore. As a matter of fact, it is seen that the indicator of the number of publications by academic staff published in Science Citation Index (SCI), Science Citation Index Expanded (SCI-Expanded), Social Sciences Citation Index (SSCI), Arts and Humanities Citation Index (AHCI) and Emerging Sources Citation Index (ESCI) indexed journals is the second most important indicator in the dimension and the fifth most important indicator in the ranking with 10.1%, which is similar to other ranking systems in the literature. For example, ARWU gives 20% weight to the number of publications indexed in SCI-Expanded and SCI, while the number of citations per academician in five sciences in the QS ranking: arts and humanities, engineering and technology, life sciences and medicine, natural sciences and social sciences, and management are given 20% each. THE ranking uses the field-weighted citation score for the publication criterion and gives 30% weight to this criterion. In U-Multirank, on the other hand, there are indicators such as the citation rate and the most cited publications, but no information is given about the weights of the indicator groups. In the URAP rankings, on the other hand, the national rankings are mainly based on the publication scores, while the international rankings are only ranked according to the publication performance. As mentioned before, although it is widely discussed that these systems are mostly research-oriented, it is not an indicator of how successful universities are in activities such as education and third mission (Hazelkorn, 2019).

The infrastructure dimension, which is the fourth most important dimension of the ranking with 9.8%, is seen as the most important factor determining the quality of the activities carried out in HEIs. In the literature, it is stated that the improvements made in the infrastructure make the learning environment more suitable for the needs of student-centred teaching, facilitate the research processes and the presentation of printed and electronic resources in the library to the use of students directly affects the competitiveness of the institution (Supe *et al.*, 2018). The findings of this study also support this view. As a matter of fact, when we look at the performance indicators under the infrastructure dimension, in addition to the number of printed and electronic publications per student in the university library, the number of indoor and outdoor spaces in the library and campus per student is also counted as a competitive advantage.

In the literature, the location of the HEI is mentioned as one of the competitive advantages. Elements that shape the internal environment of HEIs include workshops, equipment, geographic location, access to materials, distribution networks and physical resources from technology. The more the organization can optimize the use of these resources, the higher the three resource types (human, institutional and physical resources) provide it with a sustainable competitive advantage (Fauzi *et al.*, 2021). The findings of this study also revealed that location can be counted as a competitive advantage for HEIs, but this competitive advantage is not directly referred to as "location" in the ranking. The reasons for this are (1) the fact that scientific research has not specified which locations can be counted as a competitive advantage of universities and (2) the fact that this competitive advantage in HEIs is not only taken as a location but also as a campus and satisfaction of life does not mean that universities are not only a study area, but also a living space. In other words, the scope of the indicator has been expanded by including the physical location of university campuses as well as satisfaction with life on campus.

When we look at the university rankings in general, it is seen that the top five HEIs in the rankings obtained by SAW and TOPSIS are the same. One of the main points where these HEIs differ from other HEIs is the high level of student and staff satisfaction. In this context, it has been concluded that getting high scores from the ranking's satisfaction indicators positively affects the position in the rankings. When the literature is examined, it is emphasized that the concept of satisfaction in the higher education sector is generally handled superficially and that those who develop strategies in management should definitely consider this concept alongside concepts such as satisfaction and happiness and think about it while developing a strategy (Elwick and Cannizzaro, 2017). In addition, it is seen that there is a positive relationship between students' satisfaction levels and their success (Moussa and Ali, 2022). From this point of view, it can be argued that the results obtained in this study are in line with the studies in the literature. It is seen that satisfaction with the policies implemented by the university, resource allocation and management are supportive of success.

Conclusion

This study aims to develop a new form of ranking which focuses on competitive advantages of HEIs and develops multi-dimensional criteria for a balanced evaluation of different aspects of their role in the society. Consequently, it targets to eliminate two fundamental problems with the current ranking systems: the widely criticized problem of relying too much on research performance and lack of scientific basis for the ordering of universities, especially item weights of performance indicators. By consulting experts in HEIs, this study has established that there are six additional dimensions other than research performance that should be taken into account in regard to the overall performance. Hence, revealing the item weights of the performance indicators by using a scientific method and ordering universities by using SAW and TOPSIS addresses the second problem mentioned above. As rankings continue to gain popularity on the national and international platform, it is important to address these problems by developing alternative forms of ranking and therefore present solutions so that the results are scientifically justified and embraced by all participants.

Considering the universities that are included in the top 500 in reputable ranking systems today, it is obvious that developing countries like Turkey need to urge HEIs to be more competitive and while doing so, target superior performance in research as well as education, management and financial resources. In this regard, foundation universities feel the pressure more intimately as they have extra resources that are not bounded by state limitations and continue to compete for qualified faculty, higher-achieving students and partnerships that can yield to better performance on the institutional level. Therefore, aligning to a ranking system which can provide the institution with a multi-dimensional evaluation by putting competitive advantages at its heart will contribute to internationalization, governance and productivity of the institution as a whole.

This study provides an insight into what kind of indicators should be generated and prioritized if the ultimate goal is to rank HEIs according to their performance, and in this regard, its rationale is meant to be compared to how current systems have ranked universities for many years. Any ranking by itself suggests a certain form of competition on its own, or at least a decision to be taken regarding the order of items and more importantly, that decision is shaped by the factors which are thought to measure performance accurately at that time. Considering the dynamic nature of competition at any given sector, those factors are very likely to change over time, and as a result, the measure needs to be changed as well. So, if such systems have used performance indicators for over a decade without changing, it only underlines the importance of revisiting how the concept of competition shaped over the years and updating the measurement accordingly.

Limitations of the present study and suggestions for future research

This research is limited to foundation universities in Turkey. As the study can be used to provide scientific basis during quality management processes, qualitative interviews to be conducted in the research are limited to the people who take part in the strategic planning boards and strategic planning teams of the universities that comply with the above item. Based on the principle of data accessibility, the research is limited to 61 foundation universities among 73 foundation HEIs with a missing data rate of less than 5%.

In this research, competitive advantage ranking was developed by examining the competitive advantages of foundation HEIs. In future studies, it would be even better if this research is expanded to include all HEIs in Turkey or in the world. Likewise, in-depth examination of one or more selected dimensions of the research by submitting it to the expert opinion might benefit the revision of the ranking. Another suggestion is doing a detailed comparison of the research with other ranking systems in terms of process and outcome, which would highlight the differences and similarities between those systems and the one in this study. In terms of possible implications in the institutions, collecting, analysing and concluding the opinions of education administrators on the results would be noteworthy. Lastly, examining which of these performance indicators universities have directly or indirectly included in their strategies by examining their strategic plans would provide a clearer understanding of how it can be implemented and resulted in institutional performance.

References

Abed, S. and Ackers, B. (2021), "Social transformation interventions at South African public universities", *International Journal of Sustainability in Higher Education*, Vol. 22 No. 4, pp. 870-890.

Adner, R. and Zemsky, P. (2006), "A demand-based perspective on sustainable competitive advantage", *Strategic Management Journal*, Vol. 27 No. 3, pp. 215-239.

Ansoff, I. (1965), *Corporate Strategy: an Analytic Approach to Business Policy for Growth and Expansion*, 1st ed., McGraw-Hill, New York.

Barney, J. (1991), "Firm resources and sustained competitive advantage", *Journal of Management*, Vol. 17, pp. 99-120.

Bastedo, M.N. and Bowman, N.A. (2010), "The U.S. News and World Report college rankings: modeling institutional effects on organizational reputation", *American Journal of Education*, Vol. 116, pp. 163-184.

Birnbaum, R. (1988), *How Colleges Work: the Cybernetics of Academic Organization and Leadership*, 1st ed., Jossey-Bass, San Francisco.

Bititci, U., Carrie, A. and McDevitt, L. (1997), "Integrated performance measurement systems: a development guide", *International Journal of Operations and Production Management*, Vol. 17 No. 5, pp. 522-534, doi: 10.1108/01443579710167230.

Bititci, U., McCallum, N., Bourne, M., MacBryde, J. and Turner, T. (2002), "Performance indicators for sustainable competitive advantage: the next Frontier", *Proceedings of the 2nd International Workshop on Performance Measurement*.

Brankovic, J., Ringel, L. and Werron, T. (2018), "How rankings produce competition: the case of global university rankings", *Zeitschrift für Soziologie*, Vol. 47 No. 4, pp. 270-288.

Buckley, A., Maguire, P. and Gardiner, D. (2019), "An exploratory study of the role and contribution of university knowledge transfer offices (KTOs) in knowledge transfer and value creation", *14th European Conference on Innovation & Entrepreneurship*, Kalamata, Greece, 19-20 September, Academic Conferences International, Reading, pp 1-12.

Çakır, M.P., Acartürk, C., Alaşehir, O. and Çilingir, C. (2015), "A comparative analysis of global and national university ranking systems", *Scientometrics*, Vol. 103 No. 3, pp. 813-848.

Childe, S.J., Maull, R.S. and Bennett, J. (1994), "Frameworks for understanding business process re-engineering", *International Journal of Operation and Production Management*, Vol. 14 No. 12, pp. 23-34.

Conard, M.J. and Conard, M.A. (2000), "An analysis of academic reputation as perceived by consumers of higher education", *Journal of Marketing for Higher Education*, Vol. 9 No. 4, pp. 69-80.

Coombes, M. and Wong, C. (1994), "Methodological steps in the development of multivariate indexes for urban and regional policy analysis", *Environment and Planning*, Vol. 26 No. 8, pp. 1297-1316.

Cremonini, L., Westerheijden, D. and Enders, J. (2008), "Disseminating the right information to the right audience: cultural determinants in the use (and misuse) of rankings", *Higher Education*, Vol. 55, pp. 373-385.

Cresswell, J. and Plano Clark, V. (2011), *Designing and Conducting Mixed Method Research*, 2nd ed., Sage, Thousand Oaks, CA.

Creswell, J., Plano Clark, V., Gutmann, M. and Hanson, W. (2003), "Advanced mixed methods research designs", in Tashakkori, A. and Teddlie, C. (Eds), *Handbook of Mixed Methods in Social & Behavioral Research*, Sage, Thousand Oaks, pp. 209-240.

Csató, L. and Tóth, C. (2020), "University rankings from the revealed preferences of the applicants", *European Journal of Operational Research*, Vol. 286 No. 1, pp. 309-320.

Daraio, C. and Bonaccorsi, A. (2017), "Beyond university rankings? Generating new indicators on universities by linking data in open platforms", *Journal of the Association for Information Science and Technology*, Vol. 68, pp. 508-529.

Daraio, C., Bonaccorsi, A. and Simar, L. (2014), *Rankings and University Performance: A Conditional Multidimensional Approach*, Sapienza Universita di Roma, Rome.

de Haan, H. (2015), "Competitive advantage, what does it really mean in the context of public higher education institutions?", *International Journal of Educational Management*, Vol. 29 No. 1, pp. 44-61.

Distanont, A. and Khongmalai, O. (2020), "The role of innovation in creating a competitive advantage", *Kasetsart Journal of Social Sciences*, Vol. 41 No. 1, pp. 15-21.

El Alaoui, M. (2021), *Fuzzy TOPSIS: Logic, Approaches and Case Studies*, 1st ed., Taylor & Francis, NW.

Elwick, A. and Cannizzaro, S. (2017), "Happiness in higher education", *Higher Education Quarterly*, Vol. 71 No. 2, pp. 204-219.

Ertosun, Ö.G. and Adıgüzel, Z. (2018), "Leadership, personal values and organizational culture", in Dincer, H., Hacioglu, Ü. and Yüksel, S. (Eds), *Strategic Design and Innovative Thinking In Business Operations. İstanbul*, Springer, Cham, pp. 51-74.

Fauzi, T., Santosa, P., Purwanti, Y. and Nurhayati, N. (2021), "The effect of internal elements of strategic management of organizational structure, management role and employee behavior on corporate mission", *Management Science Letters*, Vol. 11 No. 4, p. 1189.

Fishburn, P. (1967), *Additive Utilities with Incomplete Product Set: Applications to Priorities and Assignments*, 1st ed., ORSA Publication, Baltimore.

Hadikurniawati, W., Winarno, E., Cahyono, T. and Abdullah, D. (2018), *Comparison of AHP-TOPSIS Hybrid Methods,WP and SAW for Multi-Attribute Decision-Making to Select the Best Electrical Expert*, IOP Publishing, Nusa Dua Bali.

Hamel, G. and Prahalad, C. (1990), "The core competence of the corporation", *Harvard Business Review*, Vol. 67 No. 3, pp. 79-91.

Hazelkorn, E. (2011), *Rankings and the Reshaping of Higher Education*, 1st ed., Pelgrave Macmillan, London.

Hazelkorn, E. (2015), "Globalization and the reputation race", *Rankings and the Reshaping of Higher Education*, 1st ed., Palgrave Macmillan, London.

Hazelkorn, E. (2019), "The dubious practice of university rankings", available at: https://elephantinthelab.org/the-accuracy-of-university-rankings-in-a-international-perspective/ (accessed 12 April 2022).

Holmes, G. and Hooper, N. (2000), "Core competence and education", *Higher Education*, Vol. 40 No. 3, pp. 247-258.

Horseman, N. (2018), "Benchmarking and rankings", in Strike, T. (Ed.), *Higher Education Strategy and Planning*, Routledge, New York, pp. 228-246.

Hwang, C., Lai, Y. and Liu, T. (1993), "A new approach for multiple objective decision making", *Computers and Operational Research*, Vol. 20, pp. 889-899.

Johnes, J. (2018), "University rankings: what do they really show?", *Scientometrics*, Vol. 115 No. 1, pp. 585-606.

Kaplan, R.S. and Norton, D.P. (1992), "The balanced scorecard: measures that drive performance", *Harvard Business Review*, Vol. 83 No. 7, p. 172.

Karadağ, E. and Yücel, C. (2022), "TÜMA/Türkiye Üniversite memnuniyet Araştırması", available at: https://www.uniar.net/_files/ugd/779fe1_9715270bbb264da3b51ec6c34c622322.pdf (accessed 4 March 2022).

Kinzelbach, K., Saliba, I. and Spannagel, J. (2021), "Global data on the freedom indispensable for scientific research: towards a reconciliation of academic reputation and academic freedom", *The International Journal of Human Rights*, pp. 1-18.

Knight, J. (2004), "Internationalization remodeled: definition, approaches, and rationales", *Journal of Studies in International Education*, Vol. 8 No. 1, pp. 5-31.

Kongolo, M. (2019), "Management of higher education institutions in uncertain times: the perspectives of university college", *Journal of Social Science Studies*, Vol. 6 No. 2, pp. 97-107.

Kosztyán, Z., Banász, Z., Csányi, V. and Telcs, A. (2019), "Rankings or leagues or rankings on leagues? - ranking in fair reference groups", *Tertiary Education and Management*, Vol. 25, pp. 289-310.

Lawshe, C.H. (1975), "A quantitative approach to content validity", *Personnel Psychology*, Vol. 28, pp. 563-575.

MacQueen, K., McLellan-Lemal, E., Bartholow, K. and Milstein, B. (2008), *Teambased Codebook Development: Structure, Process, and Agreement*, 1st ed., AltaMira Press, MD.

Marginson, S. and van der Wende, M. (2007), "To rank or to be ranked: the impact of global rankings in higher education", *Journal of Studies in International Education*, Vol. 11 No. 3, pp. 306-329.

McCoy, C., Nelson, M. and Weigle, M. (2018), "Mining the web to approximate university rankings", *Information Discovery and Delivery*, Vol. 46 No. 3, pp. 173-183.

Mintrom, M. (2008), "Managing the research function of the university: pressures and dilemmas", *Journal of Higher Education Policy and Management*, Vol. 30 No. 3, pp. 231-244.

Miotto, G., Del-Castillo-Feito, C. and Blanco-González, A. (2020), "Reputation and legitimacy: key factors for Higher Education Institutions' sustained competitive advantage", *Journal of Business Research*, Vol. 112, pp. 342-353.

Moed, H.F., Burger, W.J., Frankfort, J.G. and van Raan, A.F.J. (1985), "The use of bibliometric data for the measurement of university research performance", *Research Policy*, Vol. 14, pp. 131-149.

Moscardini, A.O., Strachan, R. and Vlasova, T. (2022), "The role of universities in modern society", *Studies in Higher Education*, Vol. 47 No. 4, pp. 812-830.

Moussa, N.M. and Ali, W.F. (2022), "Exploring the relationship between students' academic success and happiness levels in the higher education settings during the lockdown period of COVID-19", *Psychological Reports*, Vol. 125 No. 2, pp. 986-1010.

Musselin, C. (2018), "New forms of competition in higher education", *Socio-Economic Review*, Vol. 16 No. 3, pp. 657-683.

ODTÜ - Urap Araştırma Laboratuvarı (2022), "Methodologies", available at: https://urapcenter.org/Methodology (accessed 2 May 2022).

Patton, M. (2002), *Qualitative Research and Evaluation Methods*, 1st ed., CA, Thousand Oaks.

Poole, S., Levin, M. and Elam, K. (2017), "Getting out of the rankings game: a better way to evaluate higher education institutions for best fit", *Journal of Marketing for Higher Education*, Vol. 28 No. 1, pp. 1-20.

Porter, M. (1980), *Competitive Strategy: Techniques for Analyzing Industries and Competitors*, 1st ed., Free Press, New York.

QS Quacquarelli Symonds Limited (2022), "QS world university rankings – methodology", available at: https://www.topuniversities.com/qs-world-university-rankings/methodology (accessed 13 April 2022).

Saaty, T.L. (2005), *Theory and Applications of the Analytic Network Process: Decision Making with Benefits, Opportunities, Costs, and Risks*, 1st ed., RWS Publications, Pittsburgh.

Saaty, T. (2014), *Mathematical Principles of Decision Making*, 3rd ed., RWS Publications, Pittsburgh, PA.

Saisana, M., d'Hombres, B. and Saltelli, A. (2011), "Rickety numbers: volatility of university rankings and policy implications", *Research Policy*, Vol. 40, pp. 165-177.

Saldana, J. (2021), *The Coding Manual for Qualitative Researchers*, 4th ed., SAGE, London.

Salmi, J. and Saroyan, A. (2007), "League tables as policy instruments: uses and misuses", *Higher Education Management and Policy*, Vol. 19 No. 2, pp. 1-38.

ShanghaiRanking Consultancy (2022), "ShanghaiRanking's academic ranking of world universities methodology 2021", available at: https://www.shanghairanking.com/methodology/arwu/2021 (accessed 17 January 2022).

Siniksaran, E. and Satman, M. (2019), "WURS: a simulation software for university rankings—software review", *Scientometrics*, Vol. 122, pp. 701-717.

Spearman, C. (1904), "'General intelligence' objectively determined and measured", *American Journal of Psychology*, Vol. 15, pp. 72-101.

Stenstrom, D., Curtis, M. and Iyer, R. (2015), "The relationship between school/department rankings, student achievements, and student experiences: the case of psychology", *International Journal of Doctoral Studies*, Vol. 10, pp. 19-37.

Strielkowski, W., Grebennikova, V., Razinkina, E. and Rudenko, E. (2021), *Relationship Between Globalization and Internationalization of Higher Education*, EDP Sciences, Les Ulis.

Su, L., Swanson, S. and Chen, X. (2016), "The effects of perceived service quality on repurchase intentions and subjective well-being of Chinese tourists: the mediating role of relationship quality", *Tourism Management*, Vol. 52, pp. 82-95.

Sunarti, S., Sundari, J., Anggraeni, S., Siahaan, F. and Jimmi (2018), *Comparison Topsis and Saw Method in the Selection of Tourism Destination in Indonesia*, IEEE, Palembang.

Supe, L., Zeps, A., Jurgelane, I. and Ribickis, L. (2018), "Factors affecting the competitiveness of a higher education institution: systematic literature overview", *Research for Rural Development*, Vol. 2, pp. 245-252.

Times Higher Education (2022), "World university rankings 2022: methodology", available at: https://www.timeshighereducation.com/world-university-rankings/world-university-rankings-2022-methodology (accessed 21 February 2022).

Torabian, J.E. (2019), "Revisiting global university rankings and their indicators in the age of sustainable development", *Sustainability: The Journal of Record*, Vol. 12 No. 3, pp. 167-172.

TÜBİTAK (2022), "Üniversitelerin alan Bazında Yetkinlik Analizi", available at: https://www.tubitak.gov.tr/sites/default/files/Guncel_Universitelerin_Alan_Bazli_Yetkinlik_Analizi.pdf (accessed 11 February 2022).

U-MULTIRANK (2022), "U-Multirank's rank group calculation", available at: https://www.umultirank.org/export/sites/default/press-media/documents/Rank-Group-Calculation-2018.pdf (accessed 11 February 2022).

Uyterhoeven, H., Ackerman, R. and Rosenblum, J. (1973), *Strategy and Organisation*, 1st ed., Irwin, Homewood.

Wang, J. (2020), "A brief review on the evolution and transformation of universities in UK", *Education Research Frontier*, Vol. 10 No. 3, pp. 203-206.

Wardana, B., Habibi, R. and Saputra, M. (2020), *Comparation of SAW Method and Topsis in Assessing the Best Area Using HSE Standards*, EEPIS, Surabaya.

Widianta, M., Rizaldi, T., Setyohadi, D. and Riskiawan, H. (2018), *Comparison of Multi-Criteria Decision Support Methods (AHP, TOPSIS, SAW & PROMENTHEE) for Employee Placement*, IOP Publishing, Nusa Dua Bali.

YÖK (2021), "Bölgesel Kalkınma odaklı misyon Farklılaşması ve İhtisaslaşma programı", available at: https://bolgeselkalkinma.yok.gov.tr/ (accessed 19 May 2022).

YÖK (2022), "Üniversite İzleme ve değerlendirme raporları", available at: https://www.yok.gov.tr/Sayfalar/Universiteler/izleme-ve-degerlendirme-kriterleri.aspx (accessed 22 March 2022).

YÖKAK (2022), "Kurum Gösterge raporları", available at: https://yokak.gov.tr/raporlar/kurum-gosterge-raporlari (accessed 13 March 2022).

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Appendix

Table A1. Distribution of dimensions and items by Lawshe (1975) results

	Dimensions	Items
INPUTS	A1. Education	PG1. The number of students per faculty member
		PG2. Average course load of lecturers
		PG3. The university's score in the "universities' ranking of learning experience satisfaction" survey
		PG4. The university's score in the "ranking of universities in academic support and interest" survey
		PG5. The number of associate degrees + undergraduate + master's + doctorate programs with complete program information package, which can be viewed on the website of the institution, to the total number of programs (%)
		PG6. The score of the university in the "distance education infrastructure ranking of universities"
		PG7. The ratio of the number of programs determined on the basis of volume quality to the total number of programs according to the current competency analysis of universities (%)
		PG8. The ratio of the number of programs that exceed the median value on the basis of volume quality to the total number of programs according to the current field-based competency analysis of universities (%)
		PG9. The number of undergraduate programs stated to be accredited in the YKS higher education programs and quotas guide
		PG10. The number of self-evaluated programs
		PG11. The ratio of the number of interdisciplinary programs (undergraduate/graduate) to the total number of programs (%)
		PG12. The score of the university in the "Ranking of Satisfaction with the Richness of Learning Opportunities and Resources of Universities" survey
	A2. Infrastructure	PG13. The number of printed books per student in the university library
		PG14. The number of electronic publications per student in the university library
		PG15. Open area per student (m2)
		PG16. Indoor area per student (m2)
		PG17. Library area per student (m2)
		PG18. The university's score in the "Universities Ranking by Campus and Satisfaction of Life" survey

(*continued*)

Table A1.

Dimensions	Items
A3. Financial resources	PG19. The ratio of total central non-budgetary revenues to total budget
	PG20. Current amount transferred within the scope of TÜBİTAK-ARDEB support per project
	PG21. The ratio of library expenditure to total expenditure (%)
	PG22. R&D expenditure amount to total expenditure (%)
	PG23. Library and internal sourced R&D expenditure amount
	PG24. Current expense amount per student
	PG25. The budget allocated to promotional activities to the total budget (%)
	PG26. The ratio of wages paid to instructors to total expenses (%)
	PG27. The ratio of the number of students given educational scholarships by the university to the total number of students (%)
	PG28. Scholarships given to students to education and training income (%)
	PG29. The total budget of projects carried out jointly with the industry
A4. Human resources	PG30. The number of instructors who received training within the scope of the training of trainers program in the institution
	PG31. The university's ranking of "Universities' Personal Development and Career Support" survey
	PG32. The number of employed foreign national lecturers and researchers with doctorate (%)
	PG33. Foreign student rate (%)
	PG34. The rate of teaching staff coming within the scope of international exchange programs (%)
	PG35. The rate of foreign academic staff at the university (%)
	PG36. The rate of students coming within the scope of international exchange programs (%)
	PG37. The proportion of students going through international exchange programs (%)
A5. Management	PG38. The percentage of realizing the objectives regarding the education and training activities included in the strategic plan of the institution (%)
	PG39. The percentage of realizing the research activities in the strategic plan of the institution (%)
	PG40. The percentage of realizing the objectives related to administrative and social service activities included in the strategic plan of the institution (%)
	PG41. The score of the university in the "Ranking of Universities for Satisfaction with the Administration and Operation of the Institution" survey

(*continued*)

Table A1.

	Dimensions	Items
OUTPUTS	A6. Research and publication	PG42. The number of publications published in national peer-reviewed journals by academic staff
		PG43. The number of publications per academic staff member published in SCI, SCI-Expanded, SSCI, AHCI and ESCI indexed journals
		PG44. Citation score
		PG45. The number of cited publications in the top 10%
		PG46. Scientific document score
		PG47. The number of doctorate degrees per lecturer
		PG48. The proportion of graduate students (%)
		PG49. The proportion of students with doctorate (%)
		PG50. Research assistant rate (%)
		PG51. The ratio of master's and doctorate programs (%)
		PG52. The university's place in the QS World rankings
		PG53. The university's place in the QS Europe and Central Asia Rankings
		PG54. The university's place in THE world rankings
		PG55. The university's place in THE regional rankings
		PG56. The university's place in THE national rankings
		PG57. The university's place in the URAP world ranking
		PG58. The university's place in URAP Turkey ranking
		PG59. The number of active faculty technology companies
		PG60. The number of patents, utility models or designs concluded
		PG61. The rate of publications made with international cooperation (%)
		PG62. The ratio of the number of publications made in cooperation with the university industry to the total number of publications (%)
	A7. Social and economic contribution	PG63. The number of projects carried out jointly with the industry
		PG64. The number of projects carried out with other public institutions
		PG65. The number of employed graduates
		PG66. The satisfaction rate of the business world regarding the qualifications of the graduates (%)
		PG67. The proportion of graduates in the alumni tracking system (%)
		PG68. The average score of graduates in KPSS exam
		PG69. The proportion of students who scored 70 and above in the ALES exam

Rank	University	Point
1	Koç University	65.441
2	Sabanci UniveRSITY	63.912
3	Ihsan Doğramaci Bilkent University	58.378
4	Çankaya University	46.907
5	Özyeğin University	46.794
6	Bezm-I Âlem Vakif University	45.246
7	Acibadem Mehmet ali Aydinlar University	41.428
8	Yeditepe University	39.643
9	Kadir Has University	38.971
10	Atilim University	38.723
11	Bahçeşehir University	38.710
12	İstanbul Medipol University	38.585
13	Yaşar University	38.080
14	Tobb Ekonomi Ve Teknoloji University	37.810
15	Başkent University	36.950
16	Mef University	36.599
17	Sanko University	36.576
18	Piri Reis University	35.983
19	İzmir Ekonomi University	35.532
20	İstanbul Ticaret University	35.026
21	İstanbul 29 Mayis University	34.778
22	Hasan Kalyoncu University	34.732
23	İbn Haldun University	34.683
24	Demiroğlu Bilim University	34.490
25	Maltepe University	34.326
26	Üsküdar University	33.969
27	Ted University	33.635
28	Nişantaşi University	33.136
29	Kto Karatay University	33.055
30	Yüksek İhtisas University	32.402
31	İstanbul Bilgi University	31.773
32	İstanbul Kültür University	31.718
33	Altinbaş University	31.089
34	Fatih Sultan Mehmet Vakif University	31.064
35	Nuh Naci Yazgan University	30.877
36	Doğuş University	30.674
37	İstanbul Okan University	30.656
38	Beykoz University	30.629
39	Işik University	30.541
40	Biruni University	30.280
41	Lokman Hekim University	29.783
42	Ufuk University	29.699
43	Beykent University	29.660
44	Konya Gida Ve Tarim University	29.642
45	Kapadokya University	29.452
46	Antalya Bilim University	29.396
47	İstanbul Aydin University	29.107
48	Çağ University	28.973
49	İstanbul Sabahattin Zaim University	28.147
50	Alanya Hamdullah Emin Paşa University	27.673
51	İstinye University	27.420
52	İstanbul Gelişim University	27.283

Table A2. Universities' competitive advantage ranking – SAW

(*continued*)

Rank	University	Point
53	Toros University	27.125
54	İstanbul Arel University	24.398
55	Türk Hava Kurumu University	24.275
56	Haliç University	24.105
57	İstanbul Yeni Yüzyil University	24.034
58	İstanbul Rumeli University	23.999
59	Avrasya University	23.125
60	İstanbul Esenyurt University	22.354
61	İstanbul Gedik University	20.357

Source(s): Fishburn (1967)

Table A2.

Rank	University	Point
1	İhsan Doğramaci Bilkent University	0.602
2	Koç University	0.599
3	Sabanci University	0.592
4	Özyeğin University	0.472
5	Çankaya University	0.472
6	Kto Karatay University	0.470
7	Bezm-İ Âlem Vakif University	0.469
8	Sanko University	0.465
9	Maltepe University	0.461
10	İstanbul Gelişim University	0.459
11	Piri Reis University	0.458
12	Konya Gida Ve Tarim University	0.455
13	İstanbul 29 Mayis University	0.454
14	Demiroğlu Bilim University	0.453
15	Hasan Kalyoncu University	0.453
16	Yüksek İhtisas University	0.451
17	Mef University	0.450
18	İbn Haldun University	0.450
19	Doğuş University	0.450
20	İstanbul Medipol University	0.450
21	Yaşar University	0.449
22	Üsküdar University	0.447
23	Ted University	0.447
24	Lokman Hekim University	0.446
25	İstinye University	0.445
26	Nuh Naci Yazgan University	0.445
27	Nişantaşi University	0.442
28	Antalya Bilim University	0.442
29	Kadir Has University	0.440
30	Ufuk University	0.440
31	Beykoz University	0.439
32	Alanya Hamdullah Emin Paşa University	0.439
33	Beykent University	0.439
34	Çağ University	0.438
35	İstanbul Okan University	0.437
36	Kapadokya University	0.436
37	Biruni University	0.435

(*continued*)

Table A3. Universities' competitive advantage ranking – TOPSIS

Rank	University	Point
38	Türk Hava Kurumu University	0.435
39	Fatih Sultan Mehmet Vakif University	0.435
40	İstanbul Rumeli University	0.433
41	Toros University	0.433
42	İstanbul Sabahattin Zaim University	0.432
43	İstanbul Yeni Yüzyil University	0.432
44	Yeditepe University	0.430
45	Altinbaş University	0.429
46	Haliç University	0.428
47	İstanbul Esenyurt University	0.426
48	Avrasya University	0.423
49	İzmir Ekonomi University	0.423
50	İstanbul Ticaret University	0.423
51	İstanbul Arel University	0.421
52	İstanbul Bilgi University	0.419
53	İstanbul Aydin University	0.419
54	Acibadem Mehmet ali Aydinlar University	0.415
55	İstanbul Gedik University	0.413
56	Atilim University	0.406
57	Işik University	0.406
58	İstanbul Kültür University	0.405
59	Tobb Ekonomi Ve Teknoloji University	0.395
60	Bahçeşehir University	0.391
61	Başkent University	0.385

Table A3.

Source(s): Hwang *et al.* (1993)

University's data set					
PG1	15.854	PG24	47864.70	PG47	1.21
PG2	8.200	PG25	0.10	PG48	6.83
PG3	86	PG26	31	PG49	3.68
PG4	85	PG27	45.2000	PG50	0.95
PG5	100.00	PG28	0.99	PG51	30.39
PG6	87	PG29	134654510.00	PG52	551
PG7	37.63	PG30	168	PG53	18
PG8	18.28	PG31	91	PG54	601
PG9	6	PG32	1.50	PG55	100.000
PG10	24	PG33	0.062	PG56	3
PG11	0.98	PG34	0.40	PG57	960
PG12	95	PG35	11.57	PG58	9
PG13	43	PG36	1.20	PG59	12
PG14	97.50	PG37	2.17	PG60	21
PG15	264	PG38	74.19	PG61	49.1
PG16	16.11	PG39	56.67	PG62	6.5
PG17	1.2	PG40	80.835	PG63	84
PG18	88	PG41	87	PG64	22
PG19	25.0600	PG42	0.061	PG65	10290
PG20	626105.08	PG43	0.762	PG66	81.80
PG21	1.97	PG44	8.00	PG67	94.90
PG22	14.70	PG45	310	PG68	68.86
PG23	33059138.00	PG46	174.90	PG69	65

Table A4.
Sample calculation steps for İhsan Doğramacı Bilkent University

(*continued*)

SAW normalization					
PG1	0.32	PG24	0.491	PG47	0.007
PG2	0.122	PG25	0.036	PG48	0.163
PG3	0.989	PG26	0.373	PG49	0.36
PG4	0.955	PG27	0.452	PG50	0.018
PG5	1	PG28	0.08	PG51	0.477
PG6	0.989	PG29	1	PG52	0.819
PG7	0.382	PG30	0.068	PG53	0.611
PG8	0.282	PG31	0.989	PG54	0.667
PG9	0.136	PG32	0.278	PG55	0.48
PG10	0.174	PG33	0.1	PG56	0.333
PG11	0.074	PG34	0.136	PG57	1
PG12	1	PG35	1	PG58	0.556
PG13	0.896	PG36	0.435	PG59	0.545
PG14	0.092	PG37	0.759	PG60	0.568
PG15	0.849	PG38	0.742	PG61	0.626
PG16	0.175	PG39	0.423	PG62	0.164
PG17	0.203	PG40	0.608	PG63	0.808
PG18	0.957	PG41	0.978	PG64	0.393
PG19	0.44	PG42	0.115	PG65	0.372
PG20	0.372	PG43	0.438	PG66	0.86
PG21	0.556	PG44	0.39	PG67	0.949
PG22	0.398	PG45	0.668	PG68	0.965
PG23	1	PG46	0.987	PG69	0.65

Multiplying the normalized values in each criterion by the weight of the criterion (weights come from AHP, hybrid method)					
PG1	0.8966658257	PG24	0.5838642430	PG47	0.0070249143
PG2	0.3336585366	PG25	0.0057246377	PG48	0.0568216925
PG3	4.8762988506	PG26	0.1833855422	PG49	0.2660978474
PG4	2.9501685393	PG27	0.1080280000	PG50	0.0060340265
PG5	0.5980000000	PG28	0.0163390244	PG51	0.2646547937
PG6	0.4824545455	PG29	1.1340000000	PG52	2.9524950000
PG7	0.3043855678	PG30	0.0148014616	PG53	1.1566230000
PG8	0.3370118992	PG31	0.5598478261	PG54	3.4077030000
PG9	0.3308181818	PG32	0.3100000000	PG55	1.2192000000
PG10	0.2198260870	PG33	0.0153247173	PG56	0.6083910000
PG11	0.0601027190	PG34	0.0704761905	PG57	2.3090000000
PG12	3.8120000000	PG35	0.8900000000	PG58	0.9162880000
PG13	1.1144166667	PG36	0.0830434783	PG59	0.2994545455
PG14	0.0709087565	PG37	0.2253461538	PG60	1.4665945946
PG15	0.9532861736	PG38	2.4304644000	PG61	0.5504961735
PG16	0.3990406328	PG39	3.3266135821	PG62	0.0988916877
PG17	0.1686101695	PG40	0.5938029699	PG63	0.1502307692
PG18	3.4033043478	PG41	1.5014831461	PG64	0.0553928571
PG19	0.5842936842	PG42	0.1925708885	PG65	0.2236632911
PG20	0.1436687547	PG43	1.6019517241	PG66	0.6179909635
PG21	0.3973389831	PG44	0.5731273454	PG67	0.1243190000
PG22	0.7403795066	PG45	1.2680603448	PG68	0.4833126926
PG23	1.1160000000	PG46	0.9044168454	PG69	0.2515500000
Total sum: 58.3775408, rank: 3					

(*continued*)

Table A4.

TOPSIS normalization					
PG1	0.082	PG24	0.222	PG47	0.005
PG2	0.096	PG25	0.011	PG48	0.074
PG3	0.166	PG26	0.102	PG49	0.152
PG4	0.168	PG27	0.223	PG50	0.006
PG5	0.135	PG28	0.065	PG51	0.169
PG6	0.172	PG29	0.742	PG52	0.625
PG7	0.117	PG30	0.048	PG53	0.019
PG8	0.105	PG31	0.182	PG54	0.197
PG9	0.092	PG32	0.116	PG55	0.105
PG10	0.082	PG33	0.053	PG56	0.097
PG11	0.03	PG34	0.053	PG57	0.092
PG12	0.188	PG35	0.962	PG58	0.01
PG13	0.427	PG36	0.208	PG59	0.221
PG14	0.071	PG37	0.338	PG60	0.277
PG15	0.447	PG38	0.126	PG61	0.176
PG16	0.035	PG39	0.094	PG62	0.136
PG17	0.14	PG40	0.126	PG63	0.351
PG18	0.158	PG41	0.17	PG64	0.199
PG19	0.224	PG42	0.046	PG65	0.179
PG20	0.175	PG43	0.181	PG66	0.125
PG21	0.259	PG44	0.188	PG67	0.168
PG22	0.276	PG45	0.459	PG68	0.142
PG23	0.445	PG46	0.256	PG69	0.199
Weighted normalized decision matrix (weights come from AHP, hybrid method)					
PG1	0.00229	PG24	0.00265	PG47	0.00005
PG2	0.00263	PG25	0.00002	PG48	0.00026
PG3	0.00818	PG26	0.00050	PG49	0.00112
PG4	0.00519	PG27	0.00053	PG50	0.00002
PG5	0.00081	PG28	0.00013	PG51	0.00094
PG6	0.00084	PG29	0.00842	PG52	0.02251
PG7	0.00093	PG30	0.00010	PG53	0.00036
PG8	0.00125	PG31	0.00103	PG54	0.01006
PG9	0.00224	PG32	0.00130	PG55	0.00267
PG10	0.00104	PG33	0.00008	PG56	0.00176
PG11	0.00024	PG34	0.00028	PG57	0.00214
PG12	0.00717	PG35	0.00856	PG58	0.00016
PG13	0.00532	PG36	0.00040	PG59	0.00121
PG14	0.00055	PG37	0.00100	PG60	0.00715
PG15	0.00502	PG38	0.00413	PG61	0.00155
PG16	0.00081	PG39	0.00742	PG62	0.00082
PG17	0.00116	PG40	0.00123	PG63	0.00065
PG18	0.00561	PG41	0.00261	PG64	0.00028
PG19	0.00298	PG42	0.00077	PG65	0.00108
PG20	0.00067	PG43	0.00661	PG66	0.00090
PG21	0.00185	PG44	0.00277	PG67	0.00022
PG22	0.00512	PG45	0.00871	PG68	0.00071
PG23	0.00497	PG46	0.00235	PG69	0.00077

Table A4. (*continued*)

Ideal positive values for each item					
PG1	0.0007323697	PG24	0.0053937578	PG47	0.0077946989
PG2	0.0003212026	PG25	0.0004579452	PG48	0.0015920368
PG3	0.0082722931	PG26	0.0013347585	PG49	0.0031198949
PG4	0.0054324894	PG27	0.0011781912	PG50	0.0011985914
PG5	0.0008096246	PG28	0.0016293319	PG51	0.0019620909
PG6	0.0008505614	PG29	0.0084197006	PG52	0.0184275841
PG7	0.0024424918	PG30	0.0015297379	PG53	0.0002207236
PG8	0.0044296938	PG31	0.0010439842	PG54	0.0067140073
PG9	0.0164396729	PG32	0.0046774613	PG55	0.0012813554
PG10	0.0059901608	PG33	0.0008164421	PG56	0.0005881321
PG11	0.0033095544	PG34	0.0020276272	PG57	0.0021353843
PG12	0.0071706955	PG35	0.0085606392	PG58	0.0000906765
PG13	0.0059330544	PG36	0.0009119541	PG59	0.0022204160
PG14	0.0059335538	PG37	0.0013217483	PG60	0.0126036447
PG15	0.0059187008	PG38	0.0055637531	PG61	0.0024706269
PG16	0.0046393631	PG39	0.0175372604	PG62	0.0050270200
PG17	0.0056927160	PG40	0.0020303894	PG63	0.0008076420
PG18	0.0058621148	PG41	0.0026665133	PG64	0.0007138400
PG19	0.0067766048	PG42	0.0066956784	PG65	0.0028951515
PG20	0.0018111763	PG43	0.0151005645	PG66	0.0010455165
PG21	0.0033287812	PG44	0.0070968907	PG67	0.0002322036
PG22	0.0128499168	PG45	0.0130375424	PG68	0.0007398370
PG23	0.0049699745	PG46	0.0023791968	PG69	0.0011846445
Ideal negative values for each item					
PG1	0.0074416160	PG24	0.0003529502	PG47	0.0000200435
PG2	0.0084283565	PG25	0.0000082961	PG48	0.0000087287
PG3	0.0019967604	PG26	0.0000482443	PG49	0.0000091582
PG4	0.0015870194	PG27	0.0000003181	PG50	0.0000215248
PG5	0.0003643311	PG28	0.0000251685	PG51	0.0001000596
PG6	0.0002513022	PG29	0.0000000000	PG52	0.0019620909
PG7	0.0000979178	PG30	0.0000000000	PG53	0.0225135229
PG8	0.0001547073	PG31	0.0002950390	PG54	0.0070430896
PG9	0.0000000000	PG32	0.0000606338	PG55	0.0167599035
PG10	0.0000000000	PG33	0.0000013190	PG56	0.0107046563
PG11	0.0000000000	PG34	0.0000827603	PG57	0.0070575853
PG12	0.0015851011	PG35	0.0000073990	PG58	0.0066686271
PG13	0.0002472106	PG36	0.0000033042	PG59	0.0001009280
PG14	0.0000024067	PG37	0.0000231075	PG60	0.0003406390
PG15	0.0000190312	PG38	0.0024480514	PG61	0.0001859273
PG16	0.0001729267	PG39	0.0035336271	PG62	0.0000379876
PG17	0.0000964867	PG40	0.0004579826	PG63	0.0000077658
PG18	0.0024213083	PG41	0.0006291773	PG64	0.0000127471
PG19	0.0000008322	PG42	0.0006075474	PG65	0.0000003141
PG20	0.0000300933	PG43	0.0002169621	PG66	0.0006591467
PG21	0.0000094033	PG44	0.0000300906	PG67	0.0000023220
PG22	0.0000278665	PG45	0.0000280982	PG68	0.0000838510
PG23	0.0000114577	PG46	0.0001014053	PG69	0.0001184645
Distance to the positive ideal value: 0.028799364					
Distance to the negative ideal value: 0.043626217					
Relative distance to the ideal alternatives: 0.602359, rank: 1					

Table A4.