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Original Research

ISC World University Ranking: Its correlation with Leiden, Nature Index, Times Higher Education (THE) and Quacquarelli Symonds (QS)

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Abstract

The present study intended to examine ISC World University Ranking (ISC WUR) as an emerging ranking system. It draws on a descriptive-correlational method. First, the internal correlation held between the criteria of the ISC WUR was examined to clarify the representation of the total university score from each of its functional criteria in the ISC WUR system. Afterwards, the study assessed the extent to which the ISC WUR results diverge or converge at the general level and examined the similarities and differences between ISC WUR criteria and indicators results and those of Leiden, Nature Index, THE, and QS as complicated university rankings. The research sample included the universities ranked via the five global ranking systems in 2020. All ISC WUR's indicators revealed significant and positive correlations with the total ranking scores of the universities. There was a significantly positive correlation between the ISC WUR and those of Leiden, Nature Index, THE, and QS. Moreover, the indicators similarly present in ISC WUR and other ranking systems were significantly and positively correlated. In conclusion, the overall performance of each university in ISC WUR reflects all the functional criteria of that university, especially the criteria of research and international activities. Besides, although the ICS WUR and the other systems have differences and similarities in methodology, the results obtained from these systems are similar to a certain extent. Nevertheless, these similarities are not strong enough to claim that the ISC WUR presents the same results as other ranking systems.

Keywords: University Ranking, ISC World University Ranking (ISC WUR), Times Higher Education (THE), QS, Leiden, Nature Index.

Introduction

Ranking systems use different methodologies to assess universities' credibility, using various criteria, indicators, calculation, weighting, and normalization algorithms. However, in some criteria and indicators, they have something in common. Generally, university ranking systems can be methodologically classified into simple and complicated systems (Moshtagh & Sotudeh, 2021). Simple ranking systems such as Leiden and Nature Index focus only on the research criterion and ignore other academic activities such as education, industry relations, and

reputation. Hence, one of the advantages of these systems is that they are entirely based on objective indicators and do not include subjective criteria (Olcay & Bulu, 2017; Moshtagh & Sotudeh, 2021). The reason for these systems' emphasis on pure bibliometrics is that the statistical sources used to extract educational data, research contracts, and industry relations are non-standardized (Waltman et al., 2012) and are based mainly on universities' self-declarations (Baty, 2011) while its verification is not simply possible. However, these two systems are more efficient due to methodological simplicity, lower costs, and higher execution speed (Moshtagh & Sotudeh, 2021).

In contrast, complicated ranking systems such as Times Higher Education (THE) and Quacquarelli Symonds (QS) are based on diverse and comprehensive academic performance criteria, including education, research, industry relations, and the university's global reputation. Since these systems use surveys and statistics taken from universities and official sources to measure the universities' reputation in various criteria, they include subjective criteria in their rankings (Luke & Walsh, 2010; Ismail, 2010; Lukman, Krajnc, Glavic, 2010; Huang, 2012; Moshtagh & Sotudeh, 2021). Therefore, the subjective criteria inclusion among ranking methodology is one of THE and QS drawbacks (Van Raan, 2005b), as it does not provide complete confidence in Reputation Survey data. And that is because peer judgment can be influenced by their conservatism and prejudices (Anowar, Helal, Afroj, Sultana, Sarker & Mamun, 2015; Jöns & Hoyler, 2013). In addition, THE depends on data provided by universities, and it is unclear whether this data has been appropriately standardized or to what extent it has been manipulated by universities (Baty, 2014). Besides, the experts' selection process to participate in Reputation Survey is not transparent (Anwar et al., 2015). THE, therefore, relies heavily on subjective data, accounting for more than a third of the total ranking score in the Reputation Survey (Rauhvargers, 2013). QS is also biased towards some countries by allocating half of the total ranking score to the Reputation Survey (Aguillo, Bar-Ilan, Levene & Ortega, 2010) so that research-intensive universities have good reputations (Ismail, 2010). In addition, in QS, respondents are limited to a specific region and cannot report a university as a reputable one outside the designated region (Hossein et al., 2017; Anwar et al., 2015). Hence, the above-complicated systems are less efficient in terms of features such as the number of indicators, variety of indicators, scope of data collection, the need for documentation, the need to interact with the evaluated departments, and the ranking systems' higher costs in comparison to the simpler ones (Moshtagh & Sotudeh, 2021).

On the other hand, along with the efforts of international ranking systems to improve their criteria and indicators, new ranking systems (such as ISC WUR) are entering scientific life. Unlike simple Leiden and Nature index rankings, ISC WUR focuses not only on the university's research performance but also on the university's educational performance and industry-related performances in addition to research performance. At the same time, it does not use university surveys because of their weaknesses, in contrast to the complicated THE and QS. Hence, ISC WUR was not based on subjective criteria. Therefore, this ranking does not have the significant drawbacks of the simple Leiden and Nature index and the complicated THE and QS.

However, ISC WUR, like THE, places great weight on research. Allocating too much weight to the research criterion leads to the weakness of universities that do not use English as the main language (Van Raan, 2005a, b). On the other hand, countries that allocate less or no funding to research are ranked lower (Hussein, Buhari, Tsaramirsis, & Basheri, 2017). In addition, ISC WUR places less weight on education than THE and QS. In addition to the

university's industrial activities, this system ranks the university's innovations according to the number of patents. However, ISC WUR, unlike THE and QS, does not include international students and faculty members in its ranking.

Therefore, the ISC WUR, like other systems, has similarities and differences in methodology with other global ranking systems. In this regard, various studies focus on examining the existing methodologies in global rankings (for example, Bookstein, Seidler, Fieder & Winckler., 2010; Florian, 2006; Holmes, 2006; Liu and Cheng, 2005; Soh, 2011; Van Raan, 2005a, b;) and sometimes criticize the present methodologies and suggest modifications to do so (e.g. Billaut, Bouyssou & Vincke, 2010; Daraio, Bonaccorsi & Simar, 2015; Dobrota & Dobrota, 2016; Jajo & Harrison, 2014; Soh, 2015; 2017; Sohail, Siddiqui, Shakil, Ubaid, Ahmed & Alam, 2020; Tofallis, 2012). A group of studies also compare the results of different rankings with different methodologies and showed that the results of different rankings have a moderate to strong correlation (for example, Moshfeghi & Nadi, 2018; Shehatta & Mahmood, 2016; Khosrowjerdi & Kashani, 2013; Cheng, 2011; Ioannidis et al., 2007; Aguillo et al., 2010; Huang, 2011; Chen & Liao, 2012; Çakır, Acartürk, Alaşehir & Çilingir, 2015; Chen, Li & Hildebrand, 2019). But so far, no research has examined ISC WUR methodology and results as an emerging system. However, given the methodological similarities and differences between ISC WUR and other university ranking systems, it is unclear to what extent this system achieves different or similar results to other global ranking systems. Because, on the one hand, the weighting coefficients of similar and different elements are involved. On the other hand, seemingly different indicators can overlap (Soh, 2011). In addition, the diversity of ranking systems with different methodologies and indicators has made it difficult for universities to select the appropriate system to monitor their global position and compare it with competitors.

Hence, due to the importance and widespread use of rankings to apply their results in various matters such as planning and research targeting on the one hand (Alma, Coşkun, & Övendireli, 2016; Chen, Zhu, Jia, 2021) and the other hand, systems' methodological differences and similarities that can lead to differences in efficiency (speed, cost). Upon the results' effectiveness (realistic evaluation of universities), the research on results' divergence or convergence in ISC WUR compared with other global ranking systems seems necessary to clarify the need to monitor universities in one or more ranking systems. Given that no previous research has been done on ISC WUR, it is necessary first to examine the correlation between the results of each criterion in this system and the total score of universities to clarify the representation of the total score in universities from each of its functional criteria in this system. For this purpose, the internal correlation of all ISC WUR criteria with the total score of universities is examined. Then, to determine its results' divergence and convergence with the results of other systems, the results' external correlation in total score and similar criteria and indicators in Leiden and Nature Index (as simple ranking systems) and THE and QS (as complicated ranking systems) are examined. In conclusion, the similarity and differences between ISC WUR and other ranking systems have been checked.

Research questions

This study aims to answer the following questions:

1. Is there a significant correlation between the total score and the universities' criteria in ISC WUR?
2. Is there a significant correlation between universities' total score in ISC WUR on the one

side and Leiden, Nature Index, THE, and QS on the other side?
3. Is there a significant correlation among universities' scores in indicators and criteria similar to ISC WUR and Leiden, Nature Index, THE, and QS?

Materials and Methods

The present study examines ISC WUR as a newfound ranking system, where the correlation between the total ranking score and its criteria has been first investigated. Then, this ranking correlation and its criteria and indicators with other valid global rankings and their similar criteria have been investigated (Figure 1). In this regard, THE, QS, Leiden, and Nature Index rankings were selected for comparison with ISC WUR. The reason for choosing these ranking systems in the present study (rather than other ranking systems) is that Leiden and Nature Index, focusing solely on universities' research performance and investigating objective indicators are known as the simple rankings (Olcay & Bulu, 2017; Moshtagh & Sotudeh, 2021). In contrast, THE and QS are complicated because they rely on the diverse and comprehensive criteria of universities' academic performance, including education, research, industry collaboration, and world reputation. At the same time, to collect relevant data, subjective data will be counted in this ranking (Luke & Walsh, 2010; Lukman et al., 2010; Huang, 2012; Moshtagh & Sotudeh, 2021; Ismail, 2010). Therefore, each of the two rankings, which have different efficiencies (Moshtagh & Sotudeh, 2021), was used to examine the correlation with ISC WUR. In addition, since universities' top list in ranking systems is not the same, it was necessary to select a sample that is common to them. Therefore, the ranked universities in the studied ranking systems were examined, and the overlap between them was obtained. The results showed that 355 universities are common in the five ranking systems in this study. Therefore, this number of universities formed the sample size in the present study.

In the following, ISC WUR and its indicators will be described. However, THE, QS, Leiden, and Nature Index rankings won't be discussed in detail because of their global reputation. Hence, only their criteria will be mentioned in Figure 1.

ISC WUR

ISC has been publishing a global ranking since 2018. ISC WUR lists universities that have recorded at least 850 articles in the Web of Science database over the past three years (ISC, 2019a). ISC WUR uses thirteen indicators in four general criteria. These indicators and their weighting coefficients are as follows.

- Research (60%) (A): In the research criterion, five indicators exist, including the total number of publications (25%) (A1), total number of citations (15%) (A2), normalized citation effect (1%) (A3), Citation effects for the whole world (4%) (A4), and the number of articles in top journals (15%) (A5). "The number of articles" indicator among the top journals includes the articles published in Nature, Science, and Nature Index Q1 journals. It should be noted that the information related to the research has been extracted from the InCites database over three years.

- Education (10%) (B): The education criteria are based on two indicators: the ratio of students to faculty members (5%) (B1) and the number of highly cited faculty members (5%) (B2). It should be noted that information about the first indicator is extracted from the universities' websites. The information about highly cited faculty members is extracted from WoS highly cited researchers.

- International activity (15%) (C): This criterion is based on three indicators: the number of university collaborations in publishing international articles (10%) (C1), the number of partner countries in international journals (4%) (C2) and the universities' reputation (1%) (C3) which is measured here. The first indicator has been measured over three years. In addition to universities' international reputation, based on their presence in three popular QS, THE, and Shanghai rankings, the number of retracted articles will also measure universities' negative reputation (C4) since 2020.

- Innovation (15%) (D): The innovation criteria include two indicators: the number of patents (10%) (D1) and co-publication percentage with industry (5%) (D2). Notably, the information on the number of patents was collected from the United States Patent and Trademark Office database. In addition, three years have been considered for data collection of both indicators (ISC, 2019b).

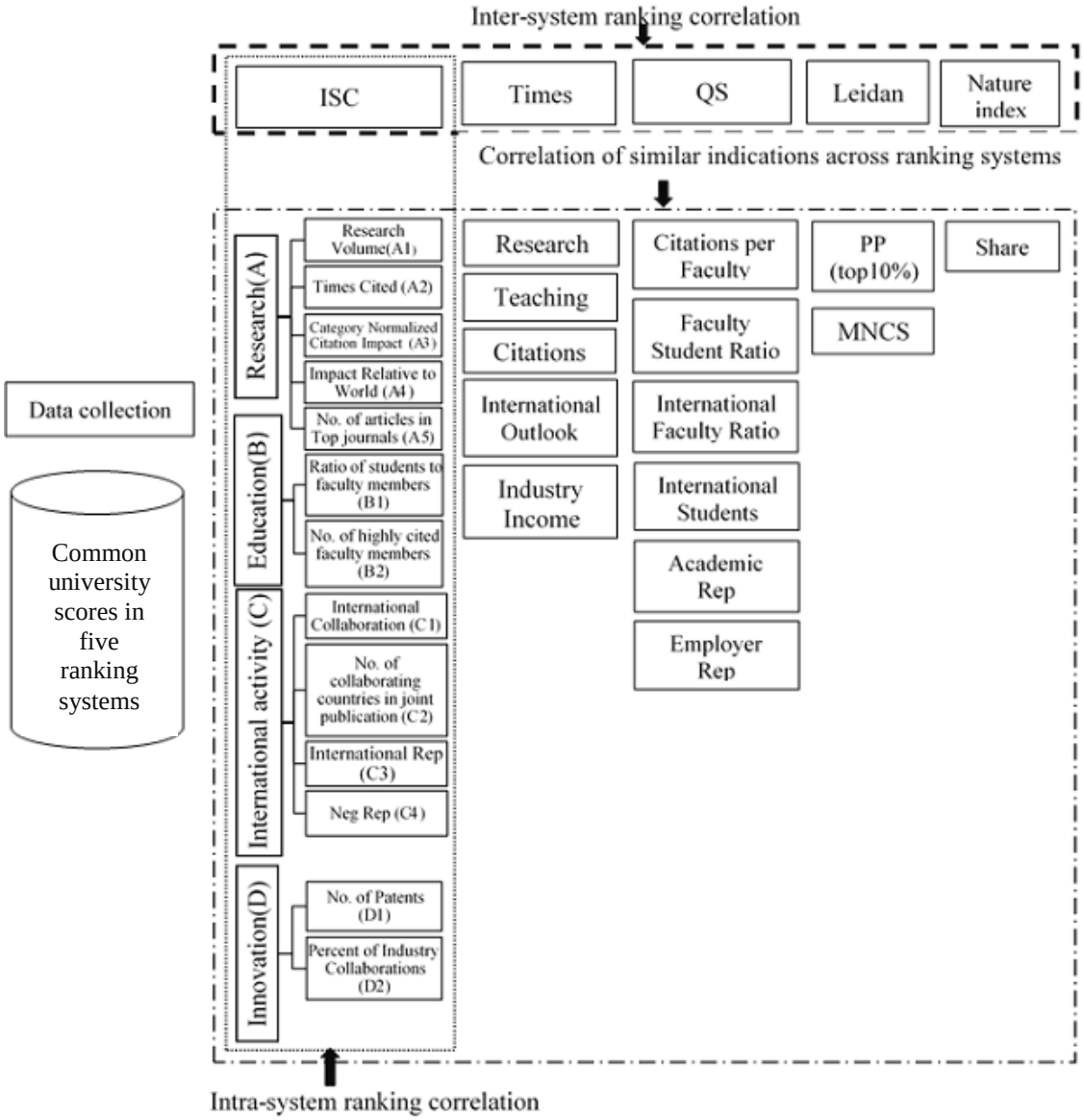

Figure 1: Research procedure

Data collection

University ranking data were obtained from five global ranking systems, including ISC, THE, QS, Leiden, and Nature Index in 2020. Notably, in THE and QS, the exact rank and total score of all universities are not announced. Still, a specific score is provided for each university in each criterion. Therefore, it was necessary to calculate these universities' total scores manually. For this purpose, using THE and QS methodology, each university's score in each of the criteria in a certain weight (declared by each ranking system) was multiplied and then added. The score calculated by the researcher is somewhat different from the score reported in these ranking systems due to some normalizations in their algorithms. Therefore, to validate the calculation method used by the researcher, the correlation analysis between the scores presented in the ranking systems with the scores calculated manually for those universities in which scores were reported. The results showed that in both THE and QS, on the one hand, there is a positive and complete linear correlation between the total score variables calculated and, on the other hand, the total score reported by both systems. The correlation coefficient obtained in both THE and QS systems equals one ($r = 1.00$).

On the other hand, the multiplicity and diversity of indicators in the Leiden and Nature Index, on the one hand, and the lack of aggregation of these indicators in a single and coherent criterion led to making good indicators for these systems. Accordingly, among the various indicators presented in the Leiden ranking, the average number of journals' citations (MNCS) and the proportion of a university's publications belong to the top 10% most frequently cited (PP) at the fractional counting level are the most critical indicators for the universities' evaluations, which were selected (Waltman, van Eck, van Leeuwen, Visser & van Raan, 2011). The fractional counting for these two indicators was chosen because, between the fractional counting and complete counting of the two indicators, there is a strong and significant correlation, (MNCS ($r = 0.87$, $P = 0.000$) and PP(top 10%) ($r = 0.93$, $P = 0.000$)) Therefore, it was not necessary to examine both counting levels. Leiden also declares the fraction counting level as the preferred counting level, which provides fairer results than the total counting level compared with universities in different fields of study (CWTS, 2019). Waltman and Van Eck (2015), also show the importance of using the fraction counting level relative to the total counting in the Leiden ranking system (Waltman & Van Eck, 2015).

In Nature Index, the share was selected among the "count" and "share" indicators. The reason for choosing this was the strong and significant correlation between the "count" and "share" ($r = 0.88$, $P = 0.000$). In addition, Nature Index 2018 ranking reformation declares the shared indicator as the main indicator for evaluation (Nature Index, 2018). ISC WUR considers the research outcomes of the last three years; in contrast, Nature Index examines only the last year's research outcomes. To neutralize the effect of the timespan on the results of the Nature Index, it should be close to ISC WUR. Hence, the mean-to-share indicator (2018-2020) is used as the university score in Nature Index. It is worth noting that the other ranking systems in 2020, which are studied here, will have more or less the same timespan as ISC WUR. In a way, THE and QS research outputs will be reviewed and evaluated during the last five years and the Leiden ranking system during the last four years.

Data Analysis Method

Data analysis was performed using SPSS version 22. Due to the lack of normal distribution

of data from the Kolmogorov-Smirnov test, a partial Spearman correlation test was used to answer the research questions. The nonparametric partial correlation test was used to control the university's reputation indicator in ISC WUR. The degree of correlation was interpreted based on its coefficients (r). Accordingly, the correlation is very strong if $r \geq 0.8$, marginally strong if $0.6 \leq r < 0.8$, moderate if $0.4 \leq r < 0.6$, marginally weak if $0.2 \leq r < 0.4$, and very weak if $r < 0.2$ (Moed, 2017).

Results

The Correlation among universities' total score in ISC WUR and its criteria (Intra-system correlation)

Table 1 shows a significant and positive correlation between universities' total score in ISC WUR and its various criteria at a 99% confidence level. The value of the correlation coefficient indicates that the research criterion (A) (r = 0.96) and international activities (C) (r = 0.83) have a very strong correlation with the total score. However, educational criteria (B) (r = 0.57) and innovation criteria (D) (r = 0.49) show a moderate correlation with the total score.

Table 1

Spearman correlation among universities' total score in ISC WUR and its criteria

criterion	correlation coefficient	criterion	correlation coefficient	criterion	correlation coefficient
Research (A1)	0.92**	Education (B1)	0.17**	International Activity (C1)	0.91**
Research (A2)	0.94**	Education (B2)	0.70**	International Activity (C2)	0.74**
Research (A3)	0.59**	Education (B total)	0.57**	International Activity (C3)	0.17**
Research (A4)	0.49**	Innovation (D1)	0.35**	International Activity (C4)	0.26**
Research (A5)	0.94**	Innovation (D2)	0.41**	International Activity (C total)	0.83**
Research (A total)	0.96**	Innovation (D total)	0.49**		

** P<0.01

The Correlation among universities' total scores in ISC WUR concerning Leiden, Nature, THE, and QS (Inter-system ranking correlation)

As can be seen in Table 2, there is a positive and significant correlation between universities' scores in ISC WUR and their scores (as a simple ranking) at the confidence level of 99%. Due to this, the correlation coefficient value in ISC WUR total score and Leiden score at the fraction counting level for both pp (top 10%) and MNCS is equal to (r = 0.51), which indicates the significance and moderate correlation between ISC WUR and Leiden scores. Also, the correlation coefficient between ISC WUR total score and Nature Index score shows a significant and positive correlation (r = 0.74, P = 0.000) between them.

In addition, Table 2 shows a significant correlation between universities' scores in ISC WUR with THE and QS at the 99% confidence level. The correlation coefficient between ISC WUR and THE total score shows a positive and very strong correlation (r = 0.80). The

correlation coefficient value between ISC WUR and QS total score also shows a positive and marginally strong correlation between these two variables (r = 0.74). Nevertheless, since universities' reputation indicator score in ISC WUR is measured by their presence in THE, QS, and Shanghai rankings, a strong correlation was likely observed between ISC WUR and THE and QS due to this indicator. Therefore, the nonparametric partial correlation test has been used to examine the correlation between ISC WUR, THE, and QS by controlling the universities' reputation indicators. According to the table of contents, ISC WUR, after controlling the universities' reputation indicator, has a significant and marginally strong correlation with THE (r = 0.79, P = 0.000) and QS (r=0.73, P=0.000).

Table 2
Spearman correlation between universities' total score in ISC WUR and Leiden, Nature Index, THE, and QS

Ranking System	Level	correlation coefficient
Leiden (PP (top10%))	-	0.51**
Leiden (MNCS)	-	0.51**
Nature Index (Share)	-	0.74**
Times	Before control	0.80**
	After control	0.79**
QS	Before control	0.74**
	After control	0.73**

** P<0.01

The correlation among similar criteria and indicators of universities in ISC WUR and Leiden, Nature, THE, and QS

Since Leiden and Nature Index rankings are based only on research criterion, the correlation between ISC WUR research criterion and Leiden and Nature Index has been investigated. The results in Table 3 show that in general, there is a significant and moderate correlation between ISC WUR research criterion (A total) and pp indicator (top 10%) (r = 0.49, P = 0.000) and MNCS (r = 0.49, P = 0.000) which is present in Leiden ranking, where the highest correlation between category normalized citation impact indicator (A3) and pp indicator (top10%) (r = 0.79), P = 0.000) and MNCS (r = 0.80, P = 0.000) are observed in Leiden ranking. Also, the correlation between the ISC WUR research criterion (A total) and the shared indicator of Nature Index was significant (r = 0.78, P = 0.000), and the highest correlation exists between the number of top articles indicator (A5) with Nature Index share indicator (r = 0.81, P = 0.000).

Investigating the results' correlation between the ISC WUR research criterion and THE also showed that in general, a positive and significant correlation between the ISC WUR research criterion (A total) and THE research criterion (r = 0.69, P = 0.000) and its citation (r = 0.55, P = 0.000) exists. There ISC WUR the highest correlation between the number of articles in top journals' indicator (A5) in ISC WUR with THE research criterion (r = 0.70, P = 0.000) and ISC WUR category normalized citation impact indicator (A3) with THE citation criterion (r = 0.94, P = 0.000). In addition, a significant and positive correlation is observed between the ISC WUR research criterion (A total) and QS (r = 0.39, P = 0.000) (Table 3).

Table 3
Spearman correlation between ISC WUR research-based indicators with Leiden, Nature, THE, and QS

	Leiden PP(top10%)	Leiden MNCS	Nature Index (Share)	THE Research	THE Citations	QS Citations/faculty
ISC Research (A1)	0.37**	0.36**	0.73**	0.64**	0.41**	0.31**
ISC Research (A2)	0.51**	0.51**	0.75**	0.68**	0.56**	0.39**
ISC Research (A3)	0.79**	0.80**	0.33**	0.50**	0.94**	0.33**
ISC Research (A4)	0.71**	0.71**	0.40**	0.42**	0.77**	0.40**
ISC Research (A5)	0.48**	0.48**	0.81**	0.70**	0.53**	0.38**
ISC Research (A total)	0.49**	0.49**	0.78**	0.69**	0.55**	0.39**

** P<0.01

ISC WUR results' correlation with THE and QS in the educational citation is also shown in Table 4. Based on the table contents, there is a positive and significant correlation between ISC WUR educational criterion (B total) with THE educational criterion (r = 0.51, P = 0.000) and QS educational criterion (r = 0.59). THE and QS educational criterion has the highest correlation with the number of highly cited faculty members' indicator (B2) (r = 0.51, P = 0.000) and the ratio of students to faculty members (B1) (r = 0.58, P = 0.000) respectively.

An investigation of other similar criteria between ISC WUR and THE and QS showed that ISC WUR in terms of international activities (C total) due to the International collaboration indicator (C1) and in terms of Innovation (D total) is similar to THE due to its co-publication percentage with industry (D2). That is because of THE investigated International collaboration in the international outlook criterion and industry income in a different criterion. Therefore, investigating the correlation between the International Activity criterion (C total) (generally) and the International collaboration indicator (C1) (specifically) in ISC WUR with the international outlook criterion in THE showed a positive and significant correlation between international activities criterion in general (C total) (r = 0.55, P = 0.000). And also, the international collaboration indicator (C1) (r = 0.47, P = 0.000) in ISC WUR with the international outlook criterion in THE. In addition, a positive and significant correlation between innovation criterion in general (D total) (r = 0.19, P = 0.000) and the percentage of industry co-publishing indicator (D2) (r = 0.21, P = 0.000) has been seen in ISC WUR with the industry income indicator in THE. It should be noted that there are no similar criteria between ISC WUR and QS in terms of international activity and innovation (Table 4).

Table 4

Spearman correlation between indicators based on education, international activities, and innovation in ISC WUR and THE, and QS

	THE Teaching	QS faculty/ Students	THE International Outlook	THE Industry Income
ISC Education (B1)	0.24**	0.58**	-	-
ISC Education (B2)	0.51**	0.29**	-	-
ISC Education (B total)	0.51**	0.59**	-	-
ISC International collaboration (C1)	-	-	0.47**	-
ISC International Activity (C total)	-	-	0.55**	-
ISC Innovation (D2)	-	-	-	0.21**
ISC Innovation (D total)	-	-	-	0.19**

** P<0.01

Discussion

Ranking systems use a variety of approaches and methods to evaluate universities. Each approach can have different efficiency according to its strengths and weaknesses. Simple rankings such as Leiden and Nature Index are more efficient, focusing solely on university research criteria and objective data. In contrast, complicated rankings like THE and QS focus on the comprehensive and diverse criteria of universities' academic performance and are highly effective (Moshtagh & Sotudeh, 2021). However, the reason that they need to spend more time and money on data collection that requires experts' reviews or universities' reports (Luke & Walsh, 2010; Ismail, 2010; Lukman et al., 2010; Huang, 2012), are less efficient (Moshtagh & Sotudeh, 2021).

On the other hand, there is no complete trust in subjective data for various reasons such as the possibility of data manipulation by universities, inconsistent data, and lack of standard selection and bias of respondents (Anwar et al., 2015; Aguillo et al., 2010; Jöns & Hoyler, 2013; Baty, 2014). These are significant weaknesses of the complicated rankings (THE and QS) (Ismail, 2010; Anwar et al., 2015; Hussein et al., 2017; Van Raan, 2005b). Therefore, by improving the existing methodologies while examining the various criteria, universities' ranking systems should also have good efficiency. In this regard, ISC WUR, a newfound ranking system, has tried to address the significant drawbacks of the previous ranking systems. Unlike simple rankings, it does not only base on universities' research performance, like complicated rankings that use various indicators. At the same time, unlike complicated rankings, it does not put subjective data into rankings. In some ways, most of the data is collected independently from reputable international databases and is free of any report. Therefore, there are no problems with the lack of documentation and verification. However, ISC WUR has similarities in indicators and coefficients with the simple and complicated

Leiden, Nature, THE, and QS. Therefore, the differences and similarities of ISC WUR methodology compared to other ranking systems, to evaluate the representation of the overall university performance from each of the functional criteria in ISC WUR, the various criteria correlation in this ranking with its total score were examined. Then, the degree of results' convergence and divergence and its criteria with other systems and similar criteria were examined to clarify, on the one hand, the effectiveness of this system and, on the other hand, the ground for further research to discover and improve possible shortcomings and upgrade its strengths. However, due to the importance and widespread use of rankings to apply its results in various matters such as research planning and targeting (Alma et al., 2016; Chen, Zhu, Jia, 2021), this research regarding the relation and correlation of its criteria with other ranking systems. It shows that their similarities can prevent universities from monitoring several ranking systems to understand their proper position and whether or not to multiply the ranking systems.

The internal correlation results in ISC WUR and its total score analysis showed that all criteria describe a positive and significant correlation with its total score, taking a proportion of 24% to 92% of the total score. Among the various criteria, research and international activity show the highest correlation and innovation with the lowest correlation in total score (Table 1). This is while the innovation criterion has the same coefficient weight as the international activities. It seems that the strong correlation between the criterion of international activities and the total score refers to its dependence on research activities. And that is because research activities strongly correlate with the total score in other valid rankings (Soh, 2011; 2015).

This part of the research is in line with the research of Soh (2011) and Chen and Liao (2012) since they showed that in other universities' valid rankings, all criteria of each ranking show a positive and significant correlation with its total score. However, the findings of this study are inconsistent with the findings of Soh (2011; 2015) regarding the criterion of international activities, since Soh (2015) showed that in THE, there is no significant relationship between the total score and the international outlook criterion. Hence, the university's overall performance cannot represent the international outlook criterion in THE. However, the university's overall performance with a significant correlation with all ISC WUR criteria, including international activities, can represent the university's performance in all criteria. In addition, Soh (2011) showed that in THE, the university's overall performance is a very poor representation of the university's international outlook. However, in ISC WUR, the university's overall performance is a very strong representative of the university's international activities.

In addition, the results of this study are inconsistent with the results of Chen and Liao (2012) and Soh (2011) in terms of research criteria. they showed that the total score moderately correlates with the research criterion in universities' global ranking (THE-QS). In ISC WUR, however, there is a very strong correlation between the total score and the research criterion. Hence, the overall performance of the university can well represent the research criterion in this ranking.

The correlation results' analysis between ISC WUR scores and other ranking systems showed a significant and moderate correlation between universities' scores in ISC WUR and their scores in simple ranking systems (i.e. Leiden) (Table 2). The variation fraction in ISC WUR results can be explained by Leiden's results, estimated to be about 26% ($r^2 = 0.257$). This finding can be attributed to the similarities in ISC WUR methodology and Leiden in research and citation indicators. This is since in ISC WUR, a major part of the total ranking score (70%)

belongs to research volume, citation, and international collaboration, and on the other hand, the research performance of the university has a significant impact on their position in various ranking systems (Soh, 2011; 2015). Besides, this finding can be attributed to the similarity of the two systems regarding university selection methods, the bias toward English-language journals, and the use of the Web of Science (Waltman et al., 2012; Frenken, Heimeriks & Hoekman, 2017). This part of the finding can be considered in line with Moshtagh & Sotudeh (2021) and Aguillo et al. (2010), because they also showed a positive and significant correlation between Leiden as a simple ranking system and complicated ranking systems' methodologies. However, the strength of the correlation observed in this study is the same as in previous studies, so it cannot be claimed that these systems provide the exact evaluation of universities.

Moreover, a relatively large percentage of the variance in the correlation between ISC WUR and Leiden has not been explained, indicating differences in their methodology and criteria. This is because, in addition to the universities' research performance, ISC WUR is allocated a part of the total ranking score (30%) to other criteria such as educational performance, international activity, and universities' innovation, while Leiden takes into account only universities' research performance (Waltman et al., 2012; Bornmann & Glänzel, 2018; Frenken et al., 2017). In addition, Leiden's ranking, unlike ISC WUR, focuses only on research and review articles and does not consider other types of journals (Waltman et al., 2012). This part of the research aligns with Olcay & Bulu (2017). That is because they also showed that a large part of the variance is not explained in the correlation between Leiden and rankings based on various criteria such as THE and Shanghai.

The correlation results between ISC WUR and Nature Index indicate a significant and positive correlation between the two systems (Table 2). Through this, the fraction of the variation in ISC WUR results can be explained by Nature Index results as about 55% (r^2 = 0.546). This part of the finding can be attributed to the top publications according to ISC WUR and Nature Index (Bornmann & Haunschild, 2017). This part of the finding aligns with the results of Moshtagh & Sotudeh (2021) because they also showed a significant positive correlation between Nature Index and complicated rankings. The lack of explanation for the variance in the correlation between ISC WUR and Nature Index can be attributed to the limitations of the journals investigated in Nature Index (Haunschild & Bornmann, 2014).

The correlation results' analysis between ISC WUR and THE and QS show a correlation between universities' scores in ISC WUR and universities' scores in these complicated rankings. A significant positive correlation exists between THE and QS (Table 2). Since the university's reputation score in ISC WUR has been driven by THE, QS, and Shanghai, a strong correlation was likely observed between ISC WUR and THE and QS. Therefore, the correlation analysis between universities' scores in ISC WUR with the universities' scores in THE and QS was repeated by controlling the university reputation indicator. The results showed that by controlling the university reputation indicator, there is still a significant positive correlation between ISC WUR and the complicated THE and QS systems (Table 2). The variation fraction in ISC WUR results can be explained by THE and QS, estimated at 62% (r^2 = 0.62) and 53% (r^2 = 0.53), respectively. The significant correlation between ISC global rankings and complicated rankings can be attributed to the similarity in these systems' methodology. ISC WUR, like THE and QS systems, considers similar criteria for universities' performance, including research and teaching performance. The findings of this part of the study can be considered in line with the research of Shehatta and Mahmood (2016), Khosrowjerdi and

Kashani (2013), Ioannidis et al. (2007), Huang (2011) and Chen and Liao (2012). They also showed a significant correlation among ranking systems based on various criteria in part of their research. Also, the finding of this part of the study is consistent with Aguillo et al. (2010) in terms of logical similarity between ranking systems despite their different methods.

In this way, a significant percentage of the variance is not explained in the correlation between ISC WUR and THE and QS as the complicated rankings. This indicates differences in these ranking systems' methodology, criteria, and coefficients. THE spends more than a third of its total ranking score, and QS spends half of its total ranking score on reputation surveys, leading to a bias toward some countries (Aguillo Et al., 2010). This is because countries that are strong in research are more famous (Rauhvargers, 2013; Ismail, 2010). On the other hand, ISC WUR accounts for only 1% of the total ranking score for the reputation indicator. In addition, ISC WUR places less weight on education rather than THE and QS. By the way, ISC WUR does not include international students and faculty members among indicators, unlike THE and QS. Secondly, THE and QS use Scopus to measure the research indicator (Aguillo et al., 2010). This is while ISC WUR uses the Web of Science for this purpose.

However, the correlation between ISC WUR and THE is slightly higher than QS. In explaining the reasons for this correlation, we can point to the significant contribution of research criterion in ISC WUR and THE compared to QS. In a way, ISC WUR (70%), like THE (62.5%) places a lot of emphasis on the Research criterion and devotes a large part of the total score of each university to this criterion. However, in QS, only 20% of the total ranking score belongs to the research criterion. Additionally, QS does not consider industrial activity, unlike ISC WUR and THE.

On the other hand, the differences between THE and QS systems can affect their correlation with ISC WUR. These two systems are different in some criteria, indicators, and weighting algorithms. For example, THE account for 5% and QS for 10% of the total ranking score for the International Student and Faculty member indicator.

In addition, due to the differences in ISC WUR and QS criteria and coefficients, especially in research criterion, it is expected that there is no weak correlation between their results. Contrary to expectations, the correlation between ISC WUR and QS was not weak either (Table 2). This finding could indicate the impact of research performed on the position of universities in international rankings. This is because Soh (2015; 2011) showed that although QS allocates only 20% of the total ranking score to research criterion, universities that performed better in research indicators have a more appropriate position in this ranking.

The results of the correlation analysis between similar indicators of ISC WUR and Leiden show a significant and moderate correlation between the research criterion in ISC WUR and the indicators used in the Leiden ranking. This is how there is a correlation between the category normalized citation impact indicator (A3) and the citation impact to the world (A4) with pp (top 10%) and MNCS indicators in Leiden (Table 3). This finding is in line with Moed's (2017) Research. He showed a significant correlation between THE citation criterion and these two Leiden ranking indicators. This finding can be attributed to the citation nature of the MNCS indicator and pp (top 10%) (Moed, 2017).

In addition, the correlation between the ISC WUR research criterion and the Nature Index share indicator is marginally strong and significant, where there is the highest correlation between the number of articles among top journals (A5) and the Nature Index share indicator (Table 3). The reason for the strong and significant correlation observed here is the use of Q1

and Nature Index journals in the top journals' number of articles indicator (A5).

The results of the correlation between the research criterion in ISC WUR and the similarity criteria in THE showed that a marginally strong correlation is observed between these two variables. However, there is a moderate correlation between the research criterion in ISC WUR and the citation criterion in THE (Table 3). This finding could indicate that more weight is assigned to the number of articles (40%) than citations to articles (20%) in calculating the research criterion in ISC WUR. This part of the finding is in line with Chen and Liao's (2012) research. This is why they also showed a positive and significant correlation between the research criteria in different rankings. Among the various indicators of WUR research criteria in ISC, the category normalized citation impact indicator shows a strong and significant correlation with THE citation criterion. This finding can be attributed to the similarity of the nature of these two indicators. In addition, the results of the correlation between the research criterion in ISC WUR and QS showed a significant and weak correlation between these two variables (Table 3). However, Moed (2017), has shown a moderate correlation between QS and THE research criteria. This difference can be attributed to the difference between the citation databases used in the two rankings.

The results of other similar criteria in ISC WUR and the studied ranking systems showed that despite the similarities in the International Collaboration Indicator between ISC WUR and THE, a significant and moderate correlation between the international Collaboration Indicator and the International Outlook criterion of THE exists. (Table 4). This finding is likely to indicate the difference between the citation databases used in the two rankings and the attention to other indicators in THE International Outlook criterion and their impact on calculating the final score of this criterion. Despite the similarities between ISC WUR and THE regarding industrial relations, these two variables' correlations were poorly estimated (Table 4). This finding may indicate that industry income is considered in THE, but in ISC WUR, the co-publication indicator is essential.

Conclusion

In general, the results of the present study showed that the overall performance score of universities could represent the score of all functional criteria of ISC WUR. They represent some criteria, such as international and research activities, better than the previous rankings. The results of this part of this study can help these ranking planners to identify very effective criteria with less impact on this total ranking score and, if necessary, modify them so that criteria with a high degree of discriminativeness or representativeness and criteria with a low share in the total score to be determined among other criteria. In addition, the results of the present study confirmed the fraction of the variation in ISC WUR results could be explained by simple and complicated ranking systems, estimated to be about 26% to 62%. Therefore, it can be concluded that although ISC WUR has similarities and differences in methodology with other systems, their results have some similarities. However, the similarities between the results of ISC WUR and other ranking systems are not significant enough to claim that the results of the ranking systems are the same. Therefore, keeping attention on ISC WUR as an emerging system, its different aspects, innovative approach, and methodology compared with other ranking systems (as well as differences in indicators and methodologies) with other ranking systems (Doğan & Al, 2019) seem necessary.

Due to the correlation between ISC WUR and THE, and QS (as complicated rankings) and

the lower cost and time (consequently, the greater efficiency of this ranking), this study proposal help in different aspects (saving time and money, helping research policymakers, universities, and other stakeholders) to use these results to understand their proper position. Moreover, this achieves more or less close results to the complicated systems. Since this system pursues a global perspective, it recommends achieving a comparative analysis with other university ranking systems such as Shanghai and others.

References

Aguillo, I., Bar-Ilan, J., Levene, M. & Ortega, J. (2010). Comparing university rankings. *Scientometrics*, 85(1), 243-256. https://doi.org/10.1007/s11192-010-0190-z

Alma, B., Coşkun, E. & Övendireli, E. (2016). University ranking systems and proposal of a theoretical framework for ranking of Turkish universities: A case of management departments. *Procedia-Social and Behavioral Sciences*, 235, 128-138. https://doi.org/10.1016/j.sbspro.2016.11.008

Anowar, F., Helal, M. A., Afroj, S., Sultana, S., Sarker, F. & Mamun, K. A. (2015). A critical review on world university ranking in terms of top four ranking systems. In: Elleithy, K., Sobh, T. (Eds) *New Trends in Networking, Computing, E-learning, Systems Sciences, and Engineering* (pp. 559-566). Springer, Cham. https://doi.org/10.1007/978-3-319-06764-3_72

Baty, P. (2011). *THE Global Rankings: Change for the better*. Retrieved from https://www.timeshighereducation.com/world-university-rankings/2011-12/world-ranking/analysis/the-global-rankings

Baty, P. (2014). Times higher education world university rankings, 2004-2012. *Ethics in science and environmental politics*, 13(2), 125-130. http://dx.doi.org/10.3354/esep00145

Billaut, J. C., Bouyssou, D. & Vincke, P. (2010). Should you believe in the Shanghai ranking? An MCDM view. *Scientometrics*, 84(1), 237-263. https://doi.org/10.1007/s11192-009-0115-x

Bookstein, F., Seidler, H., Fieder, M. & Winckler, G. (2010). Too much noise in Times Higher Education rankings. *Scientometrics*, 85(1), 295-299. https://doi.org/10.1007/s11192-010-0189-5

Bornmann, L. & Glänzel, W. (2018). Which differences can be expected when two universities in the Leiden Ranking are compared? Some benchmarks for institutional research evaluations. *Scientometrics*, 115(2), 1101-1105. https://doi.org/10.1007/s11192-018-2700-3

Bornmann, L. & Haunschild, R. (2017). An empirical look at the nature index. *Journal of the Association for Information Science and Technology*, 68(3), 653-659. https://doi.org/10.1002/asi.23682

Çakır, M. P., Acartürk, C., Alaşehir, O. & Çilingir, C. (2015). A comparative analysis of global and national university ranking systems. *Scientometrics*, 103(3), 813-848. https://doi.org/10.1007/s11192-015-1586-6

Chen, K. H. & Liao, P. Y. (2012). A comparative study on world university rankings: a bibliometric survey. *Scientometrics*, 92(1), 89-103. https://doi.org/10.1007/s11192-012-0724-7

Chen, W., Li, Q., & Hildebrand, A. J. (2019). Comparing University Rankings: Statistical Analysis of Four Global University Ranking Systems. Nebraska Conference for Undergraduate Women in Mathematics, Lincoln, NE, Jan 25-27.

Chen, W., Zhu, Z. & Jia, T. (2021). The rank boost by inconsistency in university rankings: Evidence from 14 rankings of Chinese universities. *Quantitative Science Studies*, 2(1), 335-349. https://doi.org/10.1162/qss_a_00101

Cheng, S. K. (2011). World university rankings: Take with a large pinch of salt. *European Journal of Higher Education*, 1(4), 369-381. https://doi.org/10.1080/21568235.2012.662837

CWTS (2019). *Leiden Ranking 2019, Methodology*. Retrieved from https://www.leidenranking.com/Content/CWTS%20Leiden%20Ranking%202019.pdf

Daraio, C., Bonaccorsi, A. & Simar, L. (2015). Rankings and university performance: A conditional multidimensional approach. *European Journal of Operational Research*, 244(3), 918-930. https://doi.org/10.1016/j.ejor.2015.02.005

Dobrota, M. & Dobrota, M. (2016). ARWU ranking uncertainty and sensitivity: What if the award factor was excluded? *Journal of the Association for Information Science and Technology*, *67*(2), 480-482. https://doi.org/10.1002/asi.23527

Doğan, G. & Al, U. (2019). Is it possible to rank universities using fewer indicators? A study on five international university rankings. *Aslib journal of information management*, 71(1), 18-37. https://doi.org/10.1108/AJIM-05-2018-0118

Florian, R. V. (2007). Irreproducibility of the results of the Shanghai academic ranking of world universities. *Scientometrics*, 72(1), 25-32. https://doi.org/10.1007/s11192-007-1712-1

Frenken, K., Heimeriks, G. J. & Hoekman, J. (2017). What drives university research performance? An analysis using the CWTS Leiden Ranking data. *Journal of informetrics*, 11(3), 859-872. https://doi.org/10.1016/j.joi.2017.06.006

Haunschild, R. & Bornmann, L. (2015). Discussion about the new Nature Index. *Scientometrics*, 102(2), 1829-1830. https://doi.org/10.1007/s11192-014-1505-2

Holmes, R. (2006). THES university rankings: Are they really world class? *Asian Journal of University Education (AJUE)*, 2(1). Retrieved from https://education.uitm.edu.my/ajue/wp-content/uploads/2019/04/Chapter-1-The-THES-University-Rankings-Are-They-Really-World-Class.pdf

Huang, M. H. (2011). A comparison of three major academic rankings for world universities: From a research evaluation perspective. *Journal of Library & Information Studies*, 9(1), 1-25. http://doi.org/10.6182/jlis.2011.9(1).001

Huang, M. H. (2012). Opening the black box of QS World University Rankings. *Research Evaluation*, 21(1), 71-78. https://doi.org/10.1093/reseval/rvr003

Hussein, K., Buhari, S. M., Tsaramirsis, G. & Basheri, M. (2017). A new methodology for ranking international universities. *Indian Journal of Science and Technology*, 10(36). https://doi.org/10.17485/ijst/2017/v10i36/104094

Ioannidis, J. P., Patsopoulos, N. A., Kavvoura, F. K., Tatsioni, A., Evangelou, E., Kouri, I., Contopoulos-Ioannidis, D. G. & Liberopoulos, G. (2007). International ranking systems for universities and institutions: A critical appraisal. *BMC medicine*, 5(1), 30. https://doi.org/10.1186/1741-7015-5-30

ISC (2019a). *The results of the ISC global ranking in 2019 have been published*. News. Retrieved from https://b2n.ir/g29525 [in Persian].

ISC (2019b). *Our methodology*. Retrieved from https://wur.isc.ac/Home/Methodology

Ismail, E. M. (2010, December). Ranking of universities. In *2nd International Conference on Assessing Quality in Higher Education* (pp. 6-8).

Jajo, N. K. & Harrison, J. (2014). World university ranking systems: An alternative approach using partial least squares path modelling. *Journal of Higher Education Policy and Management*, 36(5), 471-482. https://doi.org/10.1080/1360080X.2014.936090

Jöns, H. & Hoyler, M. (2013). Global geographies of higher education: The perspective of world university rankings. *Geoforum*, 46, 45-59. https://doi.org/10.1016/j.geoforum.2012.12.014

Khosrowjerdi, M. & Kashani, Z. S. (2013). Asian top universities in six world university ranking systems. *Webology*, 10(2). Retrieved from https://www.webology.org/data-cms/articles/20200515052750pma114.pdf

Liu, N. C. & Cheng, Y. (2005). The academic ranking of world universities. *Higher education in Europe*, 30(2), 127-136. https://doi.org/10.1080/03797720500260116

Luke, G. & Walsh, A. (2010).World University Ranking. Retrieved from https://documents.manchester.ac.uk/display.aspx?DocID=8422

Lukman, R., Krajnc, D. & Glavič, P. (2010). University ranking using research, educational and environmental indicators. *Journal of cleaner production*, 18(7), 619-628. https://doi.org/10.1016/j.jclepro.2009.09.015

Moed, H. F. (2017). A critical comparative analysis of five world university rankings. *Scientometrics*, 110(2), 967-990. https://doi.org/10.1007/s11192-016-2212-y

Moshfeghi, N. & Nadi, M. A. (2018). The comparative study of ranking system of islamic countries universities and national ranking of universities in iran using the most famous ranking systems in the world. *Czech-Polish Historical & Pedagogical Journal*, 10(2), 77-106. https://doi.org/10.5817/cphpj-2018-016

Moshtagh, M. & Sotudeh, H. (2021). Correlation between universities' Altmetric Attention Scores and their performance scores in Nature Index, Leiden, Times Higher Education and Quacquarelli Symonds ranking systems. *Journal of Information Science*, https://doi.org/10.1177/01655515211030868

Nature Index (2018). Revisions to the Nature Index: A revised list of journals improves the balance of disciplines between the natural sciences. Retrieved from https://www.natureindex.com/news-blog/revisions-to-the-nature-index

Olcay, G. A. & Bulu, M. (2017). Is measuring the knowledge creation of universities possible?: A review of university rankings. *Technological Forecasting and Social Change*, *123*, 153-160. https://doi.org/10.1016/j.techfore.2016.03.029

Rauhvargers, A. (2013). *Global university rankings and their impact: Report II* . Brussels: European University Association. Retrieved from https://eua.eu/downloads/publications/global%20university%20rankings%20and%20their%20impact%20-%20report%20ii.pdf

Shehatta, I. & Mahmood, K. (2016). Correlation among top 100 universities in the major six global rankings: policy implications. *Scientometrics*, 109(2), 1231-1254. https://doi.org/10.1007/s11192-016-2065-4

Soh, K. C. (2011). Don't read university rankings like reading football league tables: Taking a close look at the indicators. *Higher Education Review*, 44(1), 15-29. Retrieved from file:///C:/Users/Reza/Downloads/DontReadUniversityRankingsLikeReadingFootballLeaguesTableHER44-1.pdf

Soh, K. C. (2015). Multicolinearity and indicator redundancy problem in world university rankings: An example using THEWUR 2013-2014 data. *Higher Education Quarterly*, 69(2), 158-174. http://dx.doi.org/10.1111/hequ.12058

Soh, K. (2017). The seven deadly sins of world university ranking: A summary from several papers. *Journal of Higher Education Policy and Management*, 39(1), 104-115. https://doi.org/10.1080/1360080X.2016.1254431

Sohail, S. S., Siddiqui, J., Shakil, M. T., Ubaid, S., Ahmed, J. & Alam, M. A. (2020). *Sustainable Approach for University Ranking System*. ICIDSSD. http://dx.doi.org/10.4108/eai.27-2-2020.2303115

Tofallis, C. (2012). A different approach to university rankings. *Higher Education*, 63(1), 1-18. https://doi.org/10.1007/s10734-011-9417-z

Van Raan, A. F. (2005b). Challenges in ranking of universities. In *Invited paper for the First International Conference on World Class Universities, Shanghai Jaio Tong University, Shanghai* (pp. 133-143).

Van Raan, A. F. (2005a). Fatal attraction: Conceptual and methodological problems in the ranking of universities by bibliometric methods. *Scientometrics*, 62(1), 133-143. https://doi.org/10.1007/s11192-005-0008-6

Waltman, L., van Eck, N. J., van Leeuwen, T. N., Visser, M. S. & van Raan, A. F. (2011). Towards a new crown indicator: Some theoretical considerations. *Journal of informetrics*, 5(1), 37-47. https://doi.org/10.1016/j.joi.2010.08.001

Waltman, L., Calero-Medina, C., Kosten, J., Noyons, E. C., Tijssen, R. J., van Eck, N. J., van Leeuwen, T. N., van Raan, A.F. J., Visser, M. S. & Wouters, P. (2012). The Leiden Ranking 2011/2012: Data collection, indicators, and interpretation. *Journal of the American society for information science and technology*, 63(12), 2419-2432. https://doi.org/10.1002/asi.22708

Waltman, L. & Van Eck, N.J. (2015). Field-normalized citation impact indicators and the choice of an appropriate counting method. *Journal of Informetrics*, 9(4), 872-894. https://doi.org/10.1016/j.joi.2015.08.001