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Do ranking systems reflect competition among HEIs through variability? Probing global university ranking systems for an answer and implications

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Abstract

Many stakeholders of higher education systems consult global ranking systems to make decisions. In the meantime, their validity and dependability for the same purpose are frequently questioned. In this research, the rank and score variability of 122 institutions from the Academic Rank of World Universities (ARWU) and 142 universities from THE times that were ranked among the top 100 between 2011 and 2019 were tested using Friedman's ANOVA and repeated ANOVA. The result indicated that there is no significant variability of rank in both systems. Hence, annual rank result don't indicate significant variability and by extension competition. These ranking methods also employ measures that omit HEIs in developing nations, such as Ethiopia, and the current dynamics in institutions' research and innovation missions. The implications of ranking systems for further research and use by stakeholders are highlighted at the conclusion.

Keywords: ranking, competition, score and rank variability, HEIs.

Introduction

Contemporary Higher Education Institutions (HEIs) environment is characterized by increasing competition (Teichler and Höhle, 2013; Mause, 2009; Etzkowitz and Leydesdorff, 2000), which is enhanced through differentiation (Fumasoli and Huisman, 2013). Ranking systems are the proxies of this competition, enabling it at the global level (Huisman et al., 2010) and creating "perception of prestige and excellence" (Hazelkornb, 2012a, p.838). The significance of ranking systems in Higher education discourse pertains to its marketing and promotion value and influence on stakeholders' decision making.

This research examines whether ranking systems reflect competitiveness and their implications for application in developing nations such as Ethiopia. The essential questions are: Do ranking systems show rank and score variability over time, hence

competition? What are the implications of using ranking systems in developing nations like Ethiopia? What future research agendas can be established about ranking systems?

In many countries, rankings are an indication of economic competitiveness on a global scale (Harvey, 2008), sprung in tandem with fostering financially viable HEIs that rely on alternate funding sources outside public support (Zelkorn in Soh and Ho, 2014; Miklavič, 2012). Hence, ranking systems became a driver for their role in promoting competition (Harvey, 2008) and "reputation race" (van Vught, 2008, p.172). As an entrepreneurial entity in the midst of globalization, and as a result of globalization's spill over influence on HEIs, ranking systems grapple with multifaceted questions. The global ranking system covers a small proportion of universities by excluding the rest (Rauhvargers, 2011). Yet, ARWU ranked more than 1800 universities and published the top 1,000 in 2019 (ARWU, 2023a) compared to ranking 1,000 and publishing the top 500 when launched first in 2003. Beyond their expansion, the impact of ranking systems on the decision making processes of management, teachers, students, government, and other stakeholders is both adverse and positive (Abhishek et al., 2018; Harvey, 2008). As a result of these expansions and influences, ranking system is now one of the most important research areas in Higher Education, and there is an abundance of relevant critical literature.

The critics have a strong foundation spanning from the epistemological dilemma of ranking as a whole (Van Vught et al., 2012, p. 1) to the identification of specific flaws in ranking systems (Moed, 2016). To cite one criticism, Harvey (2008) says that rating systems reinforce the pre-existing notion of the world's biggest universities. The statement in the 2019 press release of the ARWU ranking, states Harvard University is ranked number one for the seventeenth consecutive year a. offers evidence for Harvey's claim. The primary objective of this research is to test such observations statistically using large data sets. Do ranking systems show competition via variability?

Despite the criticism, global ranking systems continue to influence policy decisions (Hazelkorn, 2012b). Notwithstanding its significance, Altbach (2010) emphasizes the need for a critical understanding of how to utilize ranking systems. As such, this paper is based on the idea that critical understanding of ranking systems is more prevalent than outright rejection of the system (Hazelkorn, 2009).

Literature review

Ranking systems serve multiple functions, varying from informing students (Hazelkorn, 2009) and their families to encouraging competition and cooperation, displaying differences among HEIs and their programs, serving as quality standards and bases for funding allocation (Harvey, 2008) and promotion (Mause,2009). This widespread use of ranking systems elicits research problems ranging from the validity (Huisman et al., 2010) to the significance of authority in establishing the indicators (Van Vught et al., 2012). For the purposes of this study, the ranking system literature is categorized according to its purpose, context, methodology, and dynamics.

Purpose

The ranking system has been the subject of discussions regarding its origins and purpose. According to the Berlin principle (Harvey, 2008), ranking systems are accountable for self-regulation, assuring the quality of the data they collect, and remaining neutral. This is crucial in light of their de facto function. For instance, Enserink (2007) states:

> France's poor showing in the Shanghai (ARWU] ranking ... helped trigger a national debate about higher education that resulted in a new law... giving universities more freedom (p.1026)

It appears that ranking systems are a factor in policy decisions. Hence, the topic of reliability, validity, and accountability of ranking systems emerges. For instance, a study conducted by Stolz et al. (2010) on 25 European ranking systems and their adherence to the Berlin criteria revealed that German ranking systems are primarily aligned positively in the area of transparency, but is deficient in the area of methodology. For global ranking systems, there are no frameworks or accountability links that have been developed between the ranking entities and stakeholders so far, despite the crucial role they play in decision-making.

Context and scope

HEIs operate in various political and economic jurisdictions which make it difficult to assess these diverse contexts using a similar metric (Harvey, 2008). Moreover, picking one specific indicator from a wide range of HEIs activities is practically questionable

(Van Vught et al., 2012; Harvey, 2008). Kaiser et al. (2012) argue that current global ranking systems favour general research universities and English speaking universities Vis à-vis specialized HEIs and social science and humanity schools.

By referring to the classical works of Harvey and Green of 1993, typology of quality, Harvey (2008) argues ranking systems don't sufficiently address quality as excellence, and value for money is scarcely incorporated, if any. The fitness for purpose, a widely used quality paradigm among HEIs, and the Transformation paradigm, the core quality indicator of the teaching learning process are not concrete components of ranking systems either (Harvey, 2008.p 45). In addition, Harvey (2008) argues that global ranking systems are a random method of describing quality compared to quality agencies that employ indicators supported by theory. Pitman et al. (2020) states that varied methodologies and ranking indicators contribute to decision-making confusion. Such characteristics of global rankings raise problems about the system's validity, applicability, and implications for nations with various political and socioeconomic conditions.

Ranking methodology

A large part of the literature so far focuses on questioning the methodology of ranking systems. The use of league tables derived from the sports industry in the HE context (Van Vught et al., 2012; Harvey, 2008) is a prevailing critique. In the list of league table criticism by Kaiser et al (2012, p.888) are :

- The Merging of different indicators and assigning random weights (Harvey, 2008), which are found to be negatively correlated (Soh in Moed, 2017), to inform the aggregate rank of HEIs
- The focus on the old outputs of research publications (Moed, 2017; Hazelkor in Soh and Ho, 2014) systems to use in the ranking system.

In practical terms, teaching and research are very relevant for competitiveness. For example, Lahiri and Kumar (2012) asserted the importance of research output for competitiveness in academia. Yet, new developments in research and the addition of new missions such as innovation in HEIs begs for a new look at the future of ranking systems. Finally, the ranks from global ranking systems are based on statistically insignificant results (Kaiser et al., 2012, p.888; Harvey, 2008). Indubitably, exhaustive statistical

analysis on the impact of merging and weighting indicator values should be conducted to address methodological issues, inter alia. Grewal et al. (2008) used a logit analysis on the ranking system by using the parameters of the national ranking system in USA. In their ultimate conclusion, they recommended analyzing time series and cross-section dependence challenges. This research evaluates the utility of doing annual rankings by focusing on the time component of analysis.

Ranking dynamics

There are new developments in the ranking system at various levels and within existing systems. Partly, these are in reaction to the gaps identified in the existing systems and as a means of presenting an alternative. The best example is the multidimensional ranking system initiative in Europe. The driver of this initiative is the failure of existing ranking systems to reflect diversity (van Vught et al., 2012; Harvey, 2008) in a different socio-political and economic context. According to Van Vught et al. (2012) and Hazelkorn, (2012b), the focus of existing popular ranking systems on research is because of easy accessibility for data. , the alternative, according to them, is a multidimensional and stakeholder focused ranking system with the objective of availing complex and detail information for users.

The problem with such a proposal on a worldwide scale is its compatibility with the message of status and prestige competition, which is the primary focus of global ranking from the users' perspective. HEIs typically fight for status, which is reflected in ranking systems (Marginson, 2004). One must examine the specifics of multidimensional ranking indications, which may be too intricate for a global newspaper's front page! The European Commission finances the European multidimensional ranking initiative (Sursock, 2012). Thus, it may be more useful for political entity-level decision making (e.g., countries and political regions such as the EU) than for marketing promotion.

Similarly, Hou et al. (2012) asserted that students are looking for a reliable ranking system than existing ones. As a remedy, they revealed an interactive system in Taiwan enabling students to choose their own combination of criteria to rank universities. Meanwhile, THE times ranking is expanding its ranks to themes such as “young university ranking”, “The Europe teaching ranking”, “impact ranking”, “world reputation ranking” (THE Times , 2019). The results of these rankings reflect different winners at the top compared to the

mainstream global ranking systems. These modifications allow ranking systems to account for new dynamics. Additionally, new inclusive ranking methods have been established. For instance, Addis Ababa University of Ethiopia celebrated its 10th rank of 2020 from Africa based on the USA news rank (AAU, n.d). Such inclusive alternatives and internal changes in established rankings should be encouraged. Just to be inclusive, the scrutiny to avoid is "trophy handout" based on inadequate methodology, indicators, and ranking systems.

Method

For this study, according to Abhishek et al. (2018) and Harvey (2008) the two most popular global ranking systems Academic Ranking of World Universities (ARWU) and Times Higher Education Supplement (i.e THE Times) are selected. Ranking data about universities that were ranked in the top 100 at least once within nine years (2011–2019) and had no more than one year of missing data in both rank and score were considered.

Universities ranked below 100 and 200 in THE Times and ARWU respectively, are displayed in a range of rankings (for example, 100-150, 201-225) and ordered alphabetically due to a similar score within the specified range. This study's analysis is based on exact successive ranks rather than ranges. Finally, 122 universities from ARWU and 142 universities from THE Times were selected for rank variability analysis, while 79 institutions from the former were selected for score variability analysis. In addition, a comprehensive literature analysis was undertaken to assess issues raised by previous researchers. Additionally, the USnews rating system is used to examine the implications of ranking systems for developing countries such as Ethiopia.

Results

HEIs participant overlap

One of the features of ranking systems is the same HEIs dominate the ranks. Moed (2017) conducted a detailed analysis of system overlap of five ranking systems based on 2016 ranking data. The study identified 416 universities overlap between ARWU and THE Times ranking on the top 500 universities. Meanwhile, in this paper, 83 universities were found to be ranked as top 100 universities, at least once in 9 years, in both ARWU and THE Times. Meanwhile, the Moed (2017) study identified 66 (p.972) universities to

appear as top 100 in both ARWU and THE times in 2016. Moreover, Moed (2017) identified 35 universities as top 100 universities in the five ranking systems studied. Hence, the participants in the global ranking systems are similar and overlap among ranking systems. From this, the question at hand is, are they using the same indicators?

Indicators overlap

Both ARWU and THE Times ranking systems claim to emphasis on research and teaching. Yet, the main difference lies in the specific indicators used, the weights assigned and the source of data (see appendix 1 for details).

ARWU uses alumni and staff Nobel Prize and other reputed awards and academic staff publications on high impact factors journals as indicators of education. The main sources of data are third party online information from the research database. THE Times, on the other hand, uses surveys, staff-to-student and doctorate holders to bachelor ratio to measure the quality of teaching. Meanwhile, both use citations and publications in high impact factors to measure research outputs. On top of this, THE Times includes international outlook based on international student and staff proportion and collaborations. It also considers innovation as an indicator based on industry income. Clearly, there are substantial commonalities in the criteria used to evaluate institutions, but changes in indicators and weights may have an impact on the ranking of universities, which is the subject of the next section.

Competition through variability

Rank variability

Is there a variability of ranking result over years to justify the publication of annual ranking? Van Vught et al. (2012) and Harvey (2008) argue that current ranking systems manifest similar results every year. Harvard is always on the top and few dominate the subsequent rank. Friedman's ANOVA test (Field, 2009, pp.573-583) is applied to test the following hypothesis to see if a nine year rank score data disclose significant variability.

Hypothesis1:

H_0=There is no significant rank variability of HEIs over time.

H_1=There is a significant rank variability of HEIs over time.

For both ARWU and THE Times ranking system, vertical rank variability is insignificant (i.e null hypothesis accepted) from the ranking data of 9 years (see table 1). This indicates, in aggregate, there was no significant rank difference of HEIs ranked over 9 years in both ranking systems. Outright it can be said conducting ranking every year is not necessary since there is no statistically significant difference. Yet, for a practical interpretation of the result, a Wilcoxon post hoc (Field, 2009) test was run.

Table 1: Friedman's ANOVA test. Author's own analysis

Statistical result	**Ranking ARWU**	**THE Times**
n	122	142
X^2	8	8
Sig. (p)	0.945	0.151
Null hypothesis accepted (p>0.05),Rejected (p<.05)	p>.05, H_0 accepted	p>.05, H_0 accepted

Post hoc test

A post hoc Wilcoxon test was applied on details of the paired level comparison of rank changes. For THE times the test indicates statistically significant level change (p<.05) of ranks from 2018-2019 and between two to three years interval (i.e 2016-2019, 2017-2019). The variability of rank happens between 2 -3 years of interval in recent years in THE times ranking. The same test for ARWU indicated no significant change over any combination of years. This implies that, if supplemented with new data collected in the upcoming years, THE Times may indicate major rank changes every two to three years, whereas the ARWU may require more than a decade for significant rank differences among universities.

Score variability

In addition, the variation of universities scores is analyzed. Various academic studies raise

the issue of significant score change of universities in the ranking systems (Kaiser et al., 2012, p.888; Harvey, 2008). The question is, Do HEIs have a significant change in their scores over the years? If this is the case, it implies that the score of HEIs has significantly increased or decreased over time. This may or may not influence the ranking variation of universities.

Hypothesis 2:

H_0 = There is no significant score variability of HEIs over time.

H_1 = There is a significant score variability of HEIs over time.

The repeated ANOVA[1] test was conducted to see if there is a variability of the score over time (Park et al, 2009, p. 2) of 9 years.

ARWU score variability

The repeated ANOVA test (Field, 2009, pp.457-479) resulted in $F(1.48, 115.55) = 2.84$, $p > .05$, and hence the null hypothesis is accepted. There is no significant difference in the overall score of universities over the past 9 years.

THE Times ranking score

The Times ranking system repeated ANOVA test indicated that a significant score variability, $F(2.34, 330.54) = 63.24$, $p < .05$ and hence the null hypothesis is rejected and the alternative one is accepted. The score variability of THE Times could be attributed to the indicator and data source it uses compared to the ARWU. A Post hoc test –pair wise comparison, paired ANOVA, test also indicates a significant difference between consecutive years ($p < .05$) in THE Times ranking. While in the ARWU, there are no significant score differences between consecutive years, rather significant differences were observed in an interval of years.

A quest for inclusive ranking systems

Despite the expansion of ranking system, inclusivity is a concern. Moed (2017) identified the geographic affiliation of ranking systems by calculating the ratio of the number of

[1]Since Mauchy's test of sphericity assumption is significant for both the ranking scores ($p < .05$).Hence, the significance level of Greenhouse-geisser is reported.

universities expected to appear with the actual appearance of universities. The finding revealed a strong geographic attachment to current global ranking systems. As such U-Multirank is for Europe, ARWU to North America and Western Europe, LEIDEN to emerging Asian countries and North America, and QS and THE Times for English speaking countries mainly Great Britain, Canada and Australia (Moed, 2017, p.973).

A global rank for Africa and its implication

The reliance of global ranking systems on data availability and their primary focus on research indicators largely exclude African universities. African universities are barely represented in both ARWU and THE Times. Yet, developing countries in Africa such as Ethiopia participate in ranking systems. For example, Addis Ababa University's rank as the top 10 universities in Africa for 2020, with a score of 45, through the global ranking system, US news ranking, was headline news in Ethiopia (AAU, n.d.). Its position in 2019 was 13th.

The indicators used are considerate of the African universities' scenario. The indicators include conferences, international collaborations, books, international research reputation among others (Morse and Vega-Rodriguez, 2019). The ranking also encourages universities to be compared in their own region and used for collaboration worldwide, and claims to "accurately compare institutions". This is vital for Ethiopian universities, which recently started to allocate resources for research, technology transfer and innovation for local needs and embark on international collaboration. The implication is, there is a will and need for ranking and competing for prestige in countries like Ethiopia. As such, outlining indicators which are inclusive for Africa is important.

Discussion and conclusion

Discussion

Do Ranking Systems Reflect Competition among HEIs through Variability? The result of Friedman's ANOVA test indicates that there is no significant rank difference observed over nine years. Hence, for a policymaker, for instance, annual rank results don't manifest significant difference among HEIs.

The logic behind the static rank is the research performance focused indicators used to rank universities, especially in ARWU. ARWU ranking focuses on research which is academic contribution (Soh and Ho, 2014, p.774). ARWU rank is based on Nobel award, highly cited researches, a four-year paper published in Nature and Science (ARWU, 2019b), among others, which hardly changes annually. For THE Times, the result is the same yet promising in indicating a difference in some interval of years.

Research competitiveness is built through policy guide and there are countries, mainly USA, with this competitive advantage (Janger et al., 2019). This is the likely reason for the less variability of both rank and score. Lahiri and Kumar (2012) also found a decade long time to observe a significant rank variability of business schools based on research contribution.

A test on the score of universities indicates the significant change on the THE Times, even if it doesn't have an impact on ranks every successive year. This may pertain to the extensively used survey method (see appendix1), which makes it possible for regular changes in score value.

For ARWU, not only the score change over time is insignificant, but there are also considerable universities with zero score in four of the indicators (see table 2). For instance, in 2011, 76% of the top 500 universities scored zero in award indicator and in 2019 it was 84% of the top 1000 universities. Similar missing values were found in U-Multirank for instance by Moed (2017, p.974).

Table 2: Zero Score based on indicators in ARWU

Indicator	**2011**	**2019**
Alumni- The total number of the alumni of an institution winning Nobel Prizes and Fields Medals -10%	296 (59.2%)	757(75.70%)
Award The total number of the staff of an institution winning Nobel Prizes in Physics, Chemistry, Medicine and Economics and Fields Medal in Mathematics (20%)	358 (71.60%)	843 (84.30%)

HiCi The number of highly cited researchers in 21 subject categories	85(1 7%)	364 (36.40%)
N&S The number of papers published in Nature and Science between 4 years	60 (12%)	68(6.8%)
Total ranked universities	500	1000

The focus on high impact factor research indicators and the design of the ranking systems attracted HEIs from a few regions and countries of the world. In general, western and English speaking countries are more favoured by ranking systems. Meanwhile, Universities in developing countries like Ethiopia are eager to participate in ranking systems and are looking for inclusive rankings, rankings that accommodate their context.

Conclusion

The role of the global university ranking is undoubtedly prominent in times of globalization and competition. Its popularity and wide use to make decisions from students to policymakers made the research agenda to focus on fixing it than contesting the whole idea of ranking. "University Ranking is here to stay" (Moed, 2017, p.968). The concluding remarks revolve in three areas of ranking systems, their focus, methodology and use.

The focus and content of ranking systems should be seen from "Glonacal" (Global, National and Local) concept developed by Marginson (2004) and further explained by Patel and Lynch (2013). Global Ranking systems can't accommodate all HEIs from the indicators perspective. Hence, it is vital for HEIs in developing countries like Ethiopia to use ranking systems that focus on their scenario and for regional competition.

In terms of the content of ranking systems, the current ones focus on teaching and research. Trans disciplinary research and mode 3 universities (Carayannis et al, 2018) contain features of universities that violate the existing assumptions of ranking systems such as in ARWU. There are also new dynamics in HEIs that are overlooked by the current ranking systems. For instance, the necessity for university engagement in complex innovation systems (Campbell, 2018; Carayannis and Campbell, 2014) might be included in university ranking systems in order to incorporate current priorities beyond teaching and research.

The methodology used, which includes indicator identification, measurement calculation of results should be analyzed through rigorous statistical analysis and empirical research. The epistemological question of ranking systems as indicators of quality is questionable, to say the least. Conducting ranking annually is less informative to imply changes in the performance of HEIs and portray competition among them. Moreover, how stakeholders such as students and policymakers use ranking systems is a significant research agenda of the future. The reliability and validity of the ranking systems discourse will continue building new dynamics in the whole idea and practice of ranking.

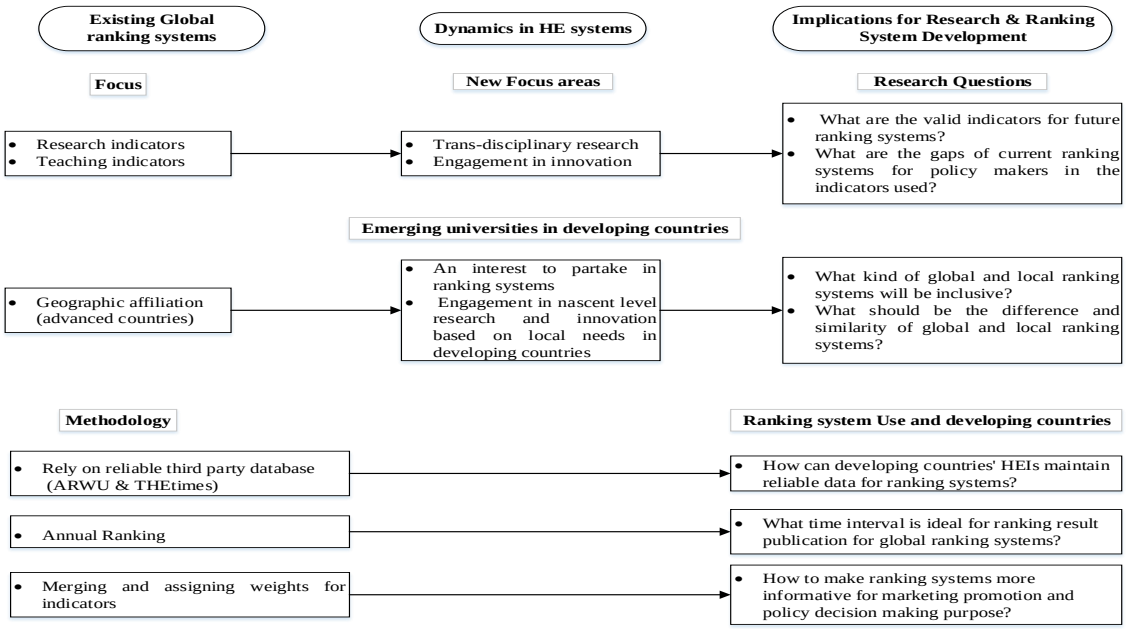
Implications for further research and use

First, the current global ranking systems focus on research and teaching. There are dynamics in HEIs systems such as trans-disciplinary research and innovation that need to be used as ranking indicators. Further research should focus on the potential rankings with new indicators that can be developed.

Second, there is a global interest to join ranking systems; yet, the inherent design of current ranking systems favour some regions. Future research agendas should address local, regional and global ranking systems that can accommodate the diverse HEIs systems of the world.

Third, to mitigate the pitfalls, new and existing ranking systems should focus on enhancing their informative nature in terms of data, the time interval of the ranking period, and the capacity of higher education institutions to organize and provide data for ranking purposes (see Fig. 1).

Figure 1: Implications for further research and ranking system development



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Appendix 1: Ranking indicators in ARWU & THE Times

Criteria	ARWU indicator and weight	THEtimes Criteria	TTHETimes	Main source of data Key (color match)
Quality of Education	Alumni: alumni of a institution winning Nobel Prizes and Fields Medals 10%	Teaching: The learning environment (30%).	Reputation survey 15% based on survey from experts	Independent global website
Quality of Faculty	Award :Staff of an institution winning Nobel Prizes and Fields 20%		Staff-to-student ratio 4.5%	Third party regional /national organizations
			Doctorate-to-bachelor-ratio 2.25%	
	HiCi : (The number of Highly Cited Researcher selected by Clarivate Analytics) 20%		Doctorate-awarded-to academic staff ratio 6%	Survey
Research Output	N&S: Papers published in Nature and Science *20%		Institutional income 2.25%	
	PUB: Papers indexed in Science Citation			
	Index-Expanded and Social Science Citation Index 20%			
Per Capita Performance	The weighted scores of the above five indicators divided by the number of full-time Equivalent academic staff10%	Research (volume income and reputation)	Reputation survey (18%)	
			Research income 6% (controversial since it is influenced by national economic policy)	
			Research productivity (number of publications published in the academic journals indexed by Elsevier's Scopus database per scholar) 6%	
		Citations (research influence) 30%	The average number of times a university's published work is cited by scholars globally	
		International outlook (staff, student, research) 7.5%	International-to-domestic-student ratio2.5%	
			International-domestic staff ratio 2.5%	
			International collaboration 2.5%	
		Innovation/industry	Income (knowledge transfer) 2.5%	

Appendix 2: Descriptive statistical outputs

Rank Descriptive Statistics - ARWU

	N	Mean	Std. Deviation	Minimum	Maximum
R11	122	60.51	33.328	1	104
R12	122	60.35	33.154	1	104
R13	122	60.32	32.999	1	104
R14	122	60.39	33.028	1	103
R15	122	60.39	33.002	1	104
R16	122	60.49	33.088	1	102
R17	122	60.65	33.114	1	101
R18	122	60.43	33.043	1	102
R19	122	60.53	33.22	1	102

Rank Descriptive Statistics - THE Times

	N	Mean	Std. Deviation	Minimum	Maximum
RT11	142	78.46	52.207	1	197
RT12	142	77.92	51.28	1	204
RT13	142	77.05	50.343	1	201
RT14	142	77.18	50.947	1	201
RT15	142	77.59	51.302	1	202
RT16	142	77.21	51.13	1	207
RT17	142	77.72	51.869	1	208
RT18	142	79.05	53.753	1	208
RT19	142	80.56	54.785	1	208

ARWU Score Descriptive Statistics

	Mean	Std. Deviation	N
S11	39.235	14.0798	79
S12	39.024	14.112	79
S13	38.906	14.0116	79
S14	38.792	13.7902	79
S15	38.434	13.7796	79
S16	38.477	13.625	79
S17	39.189	13.6026	79
S18	38.911	13.5622	79
S19	39.066	13.5203	79

THE Times Score Descriptive Statistics

	Mean	Std. Deviation	N
ST11	64.137	12.684	142
ST12	62.436	14.1404	142
ST13	65.904	12.8531	142
ST14	61.72	13.1025	142
ST15	62.829	12.5487	142
ST16	66.275	12.5535	142
ST17	67.53	12.218	142
ST18	67.754	11.9572	142
ST19	68.532	12.2904	142