The *Shanghai Global Ranking of Academic Subjects*: Room for improvement

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Abstract

Global university rankings have achieved public popularity as they are portrayed as an objective measure of the quality of higher education institutions. One of the latest rankings is the *Shanghai Global Ranking of Academic Subjects*, which classifies institutions according to five fields –Engineering, Life Sciences, Medical Sciences, Natural Sciences and Social Sciences– which are divided into 54 subjects. Despite being introduced in 2017, no study has analyzed the methodology applied by this ranking. The results of our analysis show that the methodology currently used by the *Shanghai Global Ranking of Academic Subjects* presents several issues, which negatively affect a large proportion of universities around the world. Needless to say, if the *Shanghai Global Ranking of Academic Subjects* is meant to be global, it needs to expand its surveys to countries located in the Global South.

Keywords

ARWU; *Shanghai Ranking*; Academic subjects; Categories; *WoS*; *JCR*; Topics; Issues; Disciplines; Rankings; Classifications; Universities; Higher Education; Institutions; Bibliometrics; Research performance; Research evaluation; Critical perspective; Flaws; Indicators; Global South.

1. Introduction

Global university rankings have achieved public popularity as they are portrayed as an objective measure of the quality of higher education institutions. Not surprisingly, prospective students ponder the information published by these rankings as they search for a place to continue their education (**Krauskopf**, 2013). This is not a current trend, as for over ten years these rankings have influenced, on different levels, the final decision of prospective students (**Sauder**; **Espeland**, 2009). In fact, **González-Riaño**, **Repiso** and **Delgado-López-Cózar** (2014) showed that the media, in particular newspapers, take note of these rankings, bringing them closer to citizens, hence increasing their impact.

Despite their widespread use, global university rankings have not been without controversy. As early as 2005, **Van-Raan** (2005) described methodological problems in ranking universities using bibliometric methods, identifying issues such as language bias that still persist until today. A later study by **Marginson** and **Van-der-Wende** (2007) expressed their concern with the use of these global university rankings as they were being utilized for comparative purposes, while not considering the uniqueness of their mission (**Marginson**; **Van-der-Wende**, 2007; **Pusser**; **Marginson**, 2013). In fact, to maximize their institu-

> Global university rankings have achieved public popularity as they are portrayed as an objective measure of the quality of higher education institutions, but despite their widespread use, global university rankings have not been without controversy

tional ranking position, some universities may wander from their own mission (**Van-der-Wende**; **Westerheijden**, 2009; **Fauzi** *et al.*, 2020). Another issue that has been raised by some studies is the weightings given to each indicator (**Kehm**, 2014; **Olcay**; **Bulu**, 2017). Furthermore, while many of these indicators are built on hard data (i.e., research productivity), some are based on soft data (i.e., reputation surveys), which make these indicators subjective to bias (**Williams**; **Van-Dyke**, 2008; **Marginson**, 2014).

Among the various global rankings is the *Shanghai Academic Ranking of World Universities* (*ARWU*), which was first issued in June 2003. This ranking is based on six indicators:

- "Alumni" that considers alumni of an institution winning Nobel prizes and Fields medals;
- "Award" which considers the total number of the staff of an institution winning Nobel Prizes and Fields medals;
- "N & S" that considers the number of papers published in *Nature* and *Science*;
- "HICI" which considers the number of highly cited researchers of the institution;
- "PUB" which corresponds to the number of papers indexed in *Science Citation Index-Expanded* and *Social Sciences Citation Index*, and
- "PCP" that considers the weighted scores of the above five indicators divided by the number of full-time equivalent academic staff.

In 2017, the *Shanghai Global Ranking of Academic Subjects* was introduced, which covered 54 academic subjects among five categories: Natural Sciences, Engineering, Life Sciences, Medical Sciences and Social Sciences. The methodology used to build this ranking is based on slightly different indicators:
http://www.shanghairanking.com/Shanghairanking-Subject-Rankings/Methodology-for-ShanghaiRanking-Global-Ranking-of-Academic-Subjects-2020.html

Q1: Number of papers authored by an institution in an academic subject in journals ranked Q1 according to their impact factor, during a 5-year period (2014-2018). Only type of documents considered are "articles". Data is collected from *Web of Science* and *InCites*.

CNCI: Category Normalized Citation Impact is the ratio of citation of papers published by an institution in an academic subject during the 5-year period to the average citations of papers in the same category of the same year and same type. Only "article" document-type is considered. Data is collected from *InCites* database.

IC: International collaboration is the number of publications that have been found with at least two different countries in addresses of the authors divided by the total number of publications in an Academic Subject for an institution during the 5-year period. Only "article" document-type is considered.

TOP: is the number of papers published in top journals in an academic subject for an institution during the 5-year period. Top journals are identified through *Shanghai Rankings´s Academic Excellence Survey* or by Journal Impact Factor. In case no journals are identified by the survey, the top 20% journals of the *Journal Citation Reports* (*JCR*) subject category are selected. Only "article" document-type is considered.

AWARD: refers to the total number of the staff of an institution wining a significant award in an academic subject since 1981. The significant awards in each subject are identified through an *Academic Excellence Survey*. Applicable to staff that work full-time at an institution at the time of winning the prize.

While several studies have discussed controversial issues with the *ARWU* methodology and criteria that affect its results and reproducibility (**Florian**, 2007; **Billaut**; **Bouyssou**; **Vincke**, 2010; **Pandiella-Dominique** *et al*., 2018; **Fernández-Cano** *et al*., 2018; **Fernández-Tuesta** *et al.*, 2019; **Fauzi** *et al*., 2020), none have questioned the methodology used by the S*hanghai Global Ranking of Academic subjects*. Thus, the objective of this study is to attract attention to some issues identified in the methodology used by the *Shanghai Global Ranking of Academic Subjects* that limit its effectiveness as a global ranking.

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2. Methodology

Data was extracted from *Web of Science* (*WoS*) and *InCites* for the 2014-2018 time-period and analyzed using excel. In addition, the Classification of *Web of Science* categories into Academic Subjects was downloaded from
http://www.shanghairanking.com/Shanghairanking-Subject-Rankings/attachment/Mapping_between_Web_of_Science_categories_and_54_academic_subjects.pdf

The list of the top journals and conference was downloaded from
http://www.shanghairanking.com/subject-survey/top-journals.html

The *Shanghai Ranking's Academic Excellence Survey* was downloaded from
http://www.shanghairanking.com/subject-survey/index.html

The list of the significant awards in each subject was obtained from *http://www.shanghairanking.com/subject-survey/awards.html*

The list of *WoS Research areas* was downloaded from the following URL: *https://images.webofknowledge.com/images/help/WOS/hp_research_areas_easca.html*

3. Results and discussion

3.1. Academic subjects

The *Shanghai Global Ranking of Academic Subjects* provides information on 54 academic subjects that are grouped into one of five research fields. In order to create these academic subjects, the creators of this ranking generated an equivalency table which contains a list of academic subjects and *WoS* categories. Though this list is a valuable guide towards understanding how each academic subject breaks down, it also reflects some imbalances. For instance, while the academic subject of Clinical Medicine gathers 31 *WoS* categories, the academic subject of Oceanography is made up of just one *WoS* category.

"The creators of this ranking generated an equivalency table which contains a list of academic subjects and *WoS* categories, but it reflects some imbalances. For instance, while the academic subject of Clinical Medicine gathers 31 *WoS* categories, the academic subject of Oceanography is made up of just one *WoS* category"

What is puzzling is the fact that 57 *WoS* categories have not been considered by the *Shanghai Global Ranking of Academic Subjects*. As Table 1 shows, the vast majority of these *WoS* categories belong either to Arts & Humanities or Social Sciences. Since this ranking is based on bibliometric data, one could argue that perhaps the number of articles published in these categories is not significant. However, this is not the case. To illustrate this, a total of 69,729 articles were published by researchers in the *WoS* category of History between 2014-2018, compared to 35,842 articles published in Oceanography. Moreover, 14 *WoS* categories which have not been considered by the *Shanghai Global Ranking of Academic Subjects* (Table 1), have published more articles that Oceanography in the same time period.

Table 1. List of *Web of Science* categories and research areas. For each *Web of Science* category, the total number of documents (Total docs), article-type documents (Total articles), highly cited papers (Total HCP) is provided. % Articles stands for the proportion of article-type documents while % HCP represents the proportion of highly cited papers. Data was collected for the 2014-2018 time period.

WoS categories	*WoS* research areas	Total docs.	Total articles	Total HCP	% Articles	% HCP
Agricultural Economics & Policy	Life Sciences & Biomedicine	8,066	7,361	20	91.3%	0.2%
Agricultural Engineering	Life Sciences & Biomedicine	19,920	19,004	199	95.4%	1.0%
Anthropology	Social Sciences	38,642	20,434	60	52.9%	0.2%
Archaeology	Social Sciences	26,624	18,266	15	68.6%	0.1%
Architecture	Arts & Humanities	54,831	42,522	285	77.6%	0.5%
Art	Arts & Humanities	37,745	17,639	0	46.7%	0.0%
Asian Studies	Arts & Humanities	16,342	7,691	1	47.1%	0.0%
Classics	Arts & Humanities	14,152	5,521	0	39.0%	0.0%
Cultural Studies	Social Sciences	11,956	8,644	19	72.3%	0.2%
Dance	Arts & Humanities	8,004	1,727	0	21.6%	0.0%
Demography	Social Sciences	8,771	6,830	28	77.9%	0.3%
Development Studies	Social Sciences	14,232	12,136	126	85.3%	0.9%
Engineering. Geological	Technology	26,817	25,303	90	94.4%	0.3%
Engineering. Industrial	Technology	29,368	26,834	240	91.4%	0.8%
Engineering. Multidisciplinary	Technology	267,295	244,338	1,236	91.4%	0.5%
Ethics	Social Sciences	20,135	13,428	54	66.7%	0.3%
Ethnic Studies	Social Sciences	8,788	5,687	17	64.7%	0.2%
Family Studies	Social Sciences	18,024	15,308	68	84.9%	0.4%
Film, Radio, Television	Arts & Humanities	22,831	7,441	2	32.6%	0.0%
Folklore	Arts & Humanities	3,942	1,642	0	41.7%	0.0%
Green & Sustainable Science & Technology	Life Sciences & Biomedicine	60,763	50,792	1,404	83.6%	2.3%
History	Arts & Humanities	171,835	69,729	38	40.6%	0.0%
History & Philosophy of Science	Arts & Humanities	23,590	13,335	34	56.5%	0.1%
History of Social Sciences	Arts & Humanities	11,061	5,838	1	52.8%	0.0%

WoS categories	*WoS* research areas	Total docs.	Total articles	Total HCP	% Articles	% HCP
Humanities, Multidisciplinary	Arts & Humanities	99,418	43,205	1	43.5%	0.0%
Language & Linguistics	Social Sciences	57,331	40,346	20	70.4%	0.0%
Linguistics	Social Sciences	71,016	50,801	45	71.5%	0.1%
Literary Reviews	Arts & Humanities	38,257	10,257	0	26.8%	0.0%
Literary Theory & Criticism	Arts & Humanities	10,958	6,459	0	58.9%	0.0%
Literature	Arts & Humanities	96,978	46,872	1	48.3%	0.0%
Literature, African, Australian, Canadian	Arts & Humanities	3,555	1,130	0	31.8%	0.0%
Literature, American	Arts & Humanities	5,095	2,364	0	46.4%	0.0%
Literature, British Isles	Arts & Humanities	4,702	2,121	0	45.1%	0.0%
Literature, German, Dutch, Scandinavian	Arts & Humanities	5,801	2,612	0	45.0%	0.0%
Literature, Romance	Arts & Humanities	28,914	12,259	0	42.4%	0.0%
Literature, Slavic	Arts & Humanities	5,408	3,026	0	56.0%	0.0%
Logic	Technology	5,549	5,197	0	93.7%	0.0%
Mathematics, Interdisciplinary Applications	Technology	57,065	54,361	443	95.3%	0.8%
Mechanics	Technology	117,974	114,372	862	96.9%	0.7%
Medical Ethics	Life Sciences & Biomedicine	7,453	4,275	9	57.4%	0.1%
Medicine, Legal	Life Sciences & Biomedicine	13,205	10,296	11	78.0%	0.1%
Medieval & Renaissance Studies	Arts & Humanities	18,157	6,504	0	35.8%	0.0%
Multidisciplinary Sciences		418,444	354,430	8,025	84.7%	1.9%
Music	Arts & Humanities	36,129	10,614	0	29.4%	0.0%
Philosophy	Arts & Humanities	85,378	53,793	36	63.0%	0.0%
Poetry	Arts & Humanities	7,335	886	0	12.1%	0.0%
Quantum Science & Technology	Technology	11,270	10,809	52	95.9%	0.5%
Regional & Urban Planning	Social Sciences	16,370	13,350	247	81.6%	1.5%
Religion	Arts & Humanities	75,649	33,267	2	44.0%	0.0%
Social Issues	Social Sciences	16,918	10,644	35	62.9%	0.2%
Social Sciences, Interdisciplinary	Social Sciences	66,914	54,316	205	81.2%	0.3%
Social Sciences, Mathematical Methods	Social Sciences	13,748	12,488	114	90.8%	0.8%
Social Work	Social Sciences	20,451	16,145	50	78.9%	0.2%
Sport Sciences	Life Sciences & Biomedicine	78,489	48,067	189	61.2%	0.2%
Theater	Arts & Humanities	12,041	5,451	0	45.3%	0.0%
Urban Studies	Social Sciences	23,426	19,008	249	81.1%	1.1%
Women's Studies	Social Sciences	15,336	9,750	22	63.6%	0.1%

Perhaps these *WoS* categories are excluded because the proportion of published articles is low in comparison to other document types? As the ranking methodology indicates, only article-type documents are considered to estimate the four indicators (Q1, CNCI, IC and TOP) based on bibliometric data, with an exception in the subject of Pharmacy & Pharmaceutical Sciences, which also considers review-type documents for the assessment of the TOP indicator. Nevertheless, this is not the case as 31 *WoS* categories have preferentially used article (> 60%) over any other document type as shown in Table 1. But leaving aside the quantity of articles published, various journals publish important article-type "letters" that go well beyond the response to a recently published article (**Van-Raan**, 2005). Other document types such as reviews, editorial material and even meeting abstracts are not only important for knowledge dissemination, but some of them have been highly cited (**Krauskopf**, 2011; **Van-Leuween** *et al.*, 2013). In addition to this, many research areas use other research outputs that have an impact on society. In fact, the *Declaration on Research Assessment* (*DORA*) emphasizes that outputs, other than articles, will grow in importance in the near future (*DORA*, 2015).

Maybe the exclusion of *WoS* categories relates to a lack of participants in certain disciplines? After examining the academic subject associated to each participant surveyed, I noticed that three academic subjects (Biotechnology, Instrument Science & Technology, and Telecommunication Engineering) that have been evaluated by this ranking did not register participants. Thus, the question remains on the criteria used to exclude some *WoS* categories.

> It is puzzling that 57 *WoS* categories have not been considered by the *Shanghai Global Ranking of Academic Subjects*

Another option might be that these *WoS* categories are not considered appealing enough to the people and institutions that consult university rankings in search for information about the quality of an institution. However, it is hard to believe that research on Green & Sustainable Science & Technology may not be of interest at a time when there is a widespread interest in sustainable development worldwide. Actually, this interest prompted the promulgation of 17 sustainable development goals (SDGs) by the *United Nations*, aimed at improving the sustainability of global economic and social development, while protecting the environment (**Wiesmann**; **Dayer**, 2019). Moreover, among the 17 SDGs, one refers to the topic of gender equality and women empowerment, issue that has been raised for many years by various studies (**Kabeer**, 2005; **Ridgeway**, 2011; **Stoet**; **Geary**, 2018). Nevertheless, the *WoS* category of Women's studies is one of the 57 that has not been incorporated into the *Shanghai Global Ranking of Academic Subjects*. Hence, there is clearly an obvious need to inform the criteria used to exclude some *WoS* categories from this ranking.

> "The lack of clarity in the procedure utilized to allocate indicators (and different weights) to each academic subject needs to be addressed"

3.2. Use of different indicators

This issue relates to the process used to determine the number of indicators utilized to evaluate an academic subject. One would expect that all the academics subjects that were grouped under a common research area would be assessed by the same group of indicators. However, this is not the case. As an example, the research area of Life Sciences reunites four academic subjects, of which two (Biological Sciences and Human Biological Sciences) were assessed using five indicators, one (Veterinary Sciences) was evaluated based on four indicators and one utilizing just three indicators (Agricultural Sciences). In total, 21 academic subjects were assessed using four indicators and eight academic subjects using three indicators. The two indicators that were not considered for all academic subjects were the Top journal and Top awards. Since these indicators were based on the answers provided by the participants of the survey, the information provided by the participants was analyzed. By cross-referencing the eight academic subjects that only used three indicators, with the disciplines registered by the 736 participants, one can immediately notice five correspondences (Agricultural Sciences, Food Science & Technology, Medical Technology, Oceanography and Transportation Science & Technology) among them. Consequently, one expected that at least one journal would be selected for the Top journal indicator. –For illustrative purposes, nine academics associated to Agricultural Sciences responded the survey, but no journal was chosen as a Top journal. In this case one could hypothesize that no agreement was reached as, according to the selection criteria, a journal not only needs more than one vote in an academic subject, but it must have received more than 50% of the votes or have been selected in 2019. Contrarily, for five academic subjects (Food Science & Technology, Marine/Ocean Engineering, Mining & Mineral Engineering, Oceanography and Public Administration) only two participants filled the survey, yet for three of these academic subjects the Top journal indicator was weighted heavily into the formula. Thus, the lack of clarity in the procedure utilized to allocate indicators (and different weights) to each academic subject needs to be addressed.

3.3. *Shanghai Ranking's Academic Excellence Survey*

Every year hundreds of academics fill out the *Shanghai Ranking´s Academic Excellence Survey* with the purpose of identifying the top tier journals in their research areas as well as the most influential and credible international awards. In the area of Computer Science & Engineering, academics are also asked to name top tier conferences in the subject. In order to count a journal as a Top journal it must have been selected by at least two votes and it ought to have 50% or more of the votes or had been selected in the previous year by the participants. A similar criterion has been used to define the Top awards.

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The matter in question with the survey is that it was limited to very few countries, fifteen in total. As Table 2 shows, it lacks participants from the Global South, as the surveyed academics were mainly from Europe, Asia and North America. While the only exception was Australia, the contributions of researchers from the developing world was not considered even though this ranking is meant to be global. Many studies have described inequalities in publication achievement of academics depending on their geographical location (**Van-der-Stocken**, 2016; **Snowball**; **Shackleton**, 2018; **Ordóñez-Matamoros** *et al.*, 2020). Without realizing, a language-bias has been instated in this ranking as not only the majority of the participants that filled-out the survey come from Anglo-Saxon countries, but *WoS* also has an English-language bias (**Van-Leuween** *et al.*, 2001; **Mongeon**; **Paul-Hus**, 2015). In point of fact, 94.7% of the documents registered by *WoS* between 2014-2018 were in English language. Consequently, these limitations raise a question as to whether the *Shanghai Global Ranking of Academic Subjects* is applying a fair assessment of all higher education institutions. Thus, it is of the uttermost importance to bring researchers from the Global South out of the shadows (**Rochmyaningsih**, 2018).

Table 2. Number of participants that answered the survey, by academic subject. "EG" represents Engineering; "LS" stands for Life Sciences; "MS" represents Medical Sciences; "NS" stands for Natural Sciences, and "SS" represents Social Sciences.

Research area	Academic subject	# Participants	Countries
EG	Aerospace Engineering	6	Australia, United States
	Agricultural Economics	4	United States
LS	Agricultural Sciences	9	Australia, Canada, Finland, Germany, Switzerland
	Archaeology	1	Australia
NS	Atmospheric Science	6	Australia, Switzerland, United States
EG	Automation & Control	11	Australia, Belgium, Switzerland, United States
	Bioethics and Health Policy	1	United States
LS	Biological Sciences	31	Australia, Canada, Finland, Germany, Switzerland, United Kingdom, United States
EG	Biomedical Engineering	17	Australia, Canada, Germany, Singapore, Switzerland, United Kingdom, United States
SS	Business Administration	16	Australia, Canada, Finland, Germany, Netherlands, Singapore, Switzerland, United Kingdom, United States
EG	Chemical Engineering	25	Australia, Belgium, China, Germany, Singapore, Switzerland, United Kingdom, United States
NS	Chemistry	35	Australia, Belgium, Canada, China, Germany, Japan, Switzerland, United Kingdom, United States
EG	Civil Engineering	15	Australia, China, Germany, Singapore, United Kingdom,United States
MS	Clinical Medicine	13	Australia, Belgium, Germany, United Kingdom, United States
SS	Communication	9	China, Germany, United States
EG	Computer Science & Engineering	46	Australia, China, Finland, Germany, Singapore, Switzerland, United Kingdom, United States
MS	Dentistry & Oral Sciences	10	Canada, Singapore, United Kingdom, United States
NS	Earth Sciences	24	Australia, Belgium, China, Finland, Switzerland, United Kingdom, United States
NS	Ecology	7	Australia, Switzerland, United States
SS	Economics	36	Australia, Canada, China, Germany, Singapore, Switzerland, United Kingdom, United States
SS	Education	13	Australia, Canada, Finland, United Kingdom, United States
EG	Electrical & Electronic Engineering	22	Australia, China, Singapore, Switzerland, United Kingdom, United States
EG	Energy Science & Engineering	5	Australia, United Kingdom, United States
EG	Environmental Science & Engineering	16	Australia, Canada, China, Germany, United Kingdom, United States
SS	Finance	24	Australia, Canada, China, Germany, Switzerland, United Kingdom, United States
EG	Food Science & Technology	2	Belgium, United States
NS	Geography	6	Australia, Belgium, Canada, Germany, United Kingdom
	Geological Engineering	1	Germany
SS	Hospitality & Tourism Management	9	Australia, Canada, Hong Kong, United States
LS	Human Biological Sciences	3	Japan, United Kingdom
SS	Law	22	Australia, Belgium, China, Finland, Germany, Singapore, Switzerland, United Kingdom, United States
SS	Library & Information Science	4	United States
	Linguistics	1	United Kingdom
SS	Management	26	Australia, Belgium, Canada, China, Germany, Netherlands, Singapore, Switzerland, United Kingdom, United States
EG	Marine/Ocean Engineering	2	Australia, United States
	Marketing	1	United States

Research area	Academic subject	# Participants	Countries
EG	Materials Science & Engineering	29	Australia, Canada, China, Germany, Singapore, Switzerland, United Kingdom, United States
NS	Mathematics	38	Australia, Belgium, China, Germany, Singapore, Switzerland, United Kingdom, United States
EG	Mechanical Engineering	28	Australia, Canada, China, Germany, Singapore, Switzerland, United Kingdom, United States
MS	Medical Technology	1	Switzerland
EG	Metallurgical Engineering	7	Australia, Canada, Switzerland
EG	Mining & Mineral Engineering	2	Australia, United Kingdom
EG	Nanoscience & Nanotechnology	4	Australia, China, United States
	Nuclear Engineering	1	United States
MS	Nursing	9	Australia, Canada, Singapore, United Kingdom, United States
NS	Oceanography	2	Australia, Germany
MS	Pharmacy & Pharmaceutical Sciences	11	Australia, Belgium, Germany, United Kingdom, United States
NS	Physics	33	Australia, Belgium, Finland, Germany, Switzerland, United Kingdom, United States
	Political Sciences	11	Australia, Canada, China, Netherlands, United Kingdom, United States
SS	Psychology	16	Australia, Canada, Germany, United Kingdom, United States
SS	Public Administration	2	Canada, China
MS	Public Health	8	Australia, Canada, Denmark, Finland, Taiwan, United States
EG	Remote Sensing	3	Germany, Switzerland, United States
SS	Sociology	4	Canada, United States, United Kingdom
	Sports Science	3	Australia, Canada
SS	Statistics	20	Australia, Canada, China, Germany, Switzerland, United Kingdom, United States
	Textiles and Clothing	1	United States
EG	Transportation Science & Technology	1	Australia
LS	Veterinary Sciences	18	Australia, Belgium, Finland, Switzerland, United Kingdom, United States
EG	Water Resources	4	Canada, Switzerland, United Kingdom, United States

3.4. Top journals

The first problem identified relates to the process used to select the journals that make up the list. According to the ranking methodology, these journals are identified after applying a survey to hundreds of participants. However, eight academic subjects (Agricultural Sciences, Biotechnology, Food Science & Technology, Instruments Science & Technology, Medical Technology, Oceanography, Telecommunication Engineering, and Transportation Science & Technology) are assessed without considering this indicator. As previously mentioned, in five of these academic subjects, one could assume that none of the journals proposed by the participants received more than 50% of the votes. However, it also seems that none of these journals were selected in 2019, which is an alternative criterion used to appoint a journal in case none received over 50% of the votes.

The second problem is the number of Top journals selected as an indicator for the remaining 46 academic subjects. For 11 of these academic subjects, only one journal was considered a Top journal. This poses a real problem as one journal is not representative of all the research topics that may be associated to one academic subject. Furthermore, in some academic subjects the selected journal published a low proportion of article-type documents within the five-year period. Bewildering was the selection of one of the journals for the academic subject of Sport Science, entitled Medicine and Science in Sports and Exercise, whose content consisted main-

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ly of meeting abstracts (89.9% of all documents published). Not to mention the particular case of Pharmacy & Pharmaceutical Sciences, where the methodology considers exceptionally the total number of articles and reviews published. However, the solely selected journal mainly publishes reviews. As Table 3 illustrates, both document types make up only 16.3% of all the documents published by the journal *Nature reviews drug discovery*.

> For 11 academic subjects, only one journal was considered a Top journal. This poses a real problem as one journal is not representative of all the research topics that may be associated to one academic subject

Table 3. List of top journals as determined by the surveyed participants. For each journal, the proportion of votes toward a specific journal and the proportion of articles and reviews published is provided.
* indicates that these parameters were not estimated as its indexation was discontinued in 2013 due to a journal title change.

Academic subject	Title	ISSN	% voted	% articles	% reviews
Aerospace Engineering	*Journal of spacecraft and rockets*	0022-4650	83%	98%	0.4%
	AIAA journal	0001-1452	83%	99%	0.1%
	Journal of propulsion and power	0748-4658	50%	98%	0.2%
	Journal of aircraft	0021-8669	50%	98%	0.0%
Agricultural Economics	*American journal of agricultural economics*	0002-9092	100%	89%	0.0%
	European review of agricultural economics	0165-1587	75%	90%	0.0%
	Journal of environmental economics and management	0095-0696	75%	97%	0.0%
	Land economics	0023-7639	50%	99%	0.0%
	Agricultural economics	0169-5150	50%	99%	0.3%
Atmospheric Science	*Nature climate change*	1758-678X	83%	45%	2.0%
	Journal of climate	0894-8755	67%	97%	0.8%
	Climate dynamics	0930-7575	50%	98%	0.0%
	Bulletin of the American Meteorological Society	0003-0007	50%	76%	0.5%
	Journal of geophysical research-atmospheres	2169-897X	50%	99%	0.3%
	Atmospheric chemistry and physics	1680-7316	33%	99%	0.3%
Automation & Control	*Automatica*	0005-1098	82%	98%	0.0%
	IEEE transactions on automatic control	0018-9286	82%	99%	0.0%
	SIAM journal on control and optimization	0363-0129	55%	100%	0.0%
	International journal of robotics research	0278-3649	55%	96%	0.0%
	IEEE transactions on robotics	1552-3098	55%	99%	0.0%
Biological Sciences	*Cell*	0092-8674	61%	61%	7.0%
Biomedical Engineering	*Biomaterials*	0142-9612	53%	96%	3.8%
Business Administration	*Journal of consumer research*	0093-5301	38%	93%	0.8%
	Journal of marketing research	0022-2437	31%	94%	1.0%
	Journal of marketing	0022-2429	31%	94%	0.9%
Chemical Engineering	*Industrial & engineering chemistry research*	0888-5885	56%	97%	1.7%
	Energy & environmental science	1754-5692	52%	85%	11.2%
Chemistry	*Journal of the American Chemical Society*	0002-7863	83%	97%	0.7%
	Angewandte Chemie-international edition	1433-7851	75%	93%	3.5%
	Nature chemistry	1755-4330	69%	59%	1.5%
	Nature materials	1476-1122	36%	53%	2.3%
Civil Engineering	*Journal of structural engineering*	0733-9445	53%	94%	0.8%
Clinical Medicine	*New England Journal of medicine*	0028-4793	92%	19%	3.0%
	Lancet	0140-6736	77%	12%	2.6%
Communication	*Journal of communication*	0021-9916	100%	69%	1.4%
	Communication research	0093-6502	78%	96%	3.8%
	Human communication research	0360-3989	78%	98%	1.5%
	New media & society	1461-4448	56%	78%	2.8%
	Communication theory	1050-3293	44%	82%	3.1%
Dentistry & Oral Sciences	*Journal of dental research*	0022-0345	90%	75%	14.9%

Academic subject	Title	ISSN	% voted	% articles	% reviews
Earth Sciences	*Earth and planetary science letters*	0012-821X	58%	97%	0.0%
	Geophysical research letters	0094-8276	58%	99%	0.0%
	Nature geoscience	1752-0894	58%	57%	2.0%
	Geochimica et cosmochimica acta	0016-7037	38%	96%	0.0%
Ecology	*Ecology letters*	1461-023X	100%	85%	9.5%
	Trends in ecology & evolution	0169-5347	71%	11%	46.4%
	Annual review of ecology evolution and systematics	1543-592X	71%	0%	100.0%
Economics	*Econometrica*	0012-9682	92%	95%	0.0%
	American economic review	0002-8282	81%	95%	0.0%
	Journal of political economy	0022-3808	75%	96%	1.2%
	Quarterly journal of economics	0033-5533	72%	98%	0.0%
	Review of economic studies	0034-6527	72%	97%	0.4%
Education	*American educational research journal*	0002-8312	77%	93%	5.3%
	Review of educational research	0034-6543	54%	57%	41.1%
	Educational researcher	0013-189X	46%	73%	15.7%
	Journal of research in science teaching	0022-4308	31%	94%	0.0%
	Journal of teacher education	0022-4871	31%	83%	2.3%
	Teaching and teacher education	0742-051X	31%	94%	4.3%
Electrical & Electronic Engineering	*Proceedings of the IEEE*	0018-9219	55%	73%	1.9%
Energy Science & Engineering	*Energy & environmental science*	1754-5692	80%	85%	11.2%
	Advanced energy materials	1614-6832	60%	90%	8.2%
Environmental Science & Engineering	*Environmental science & technology*	0013-936X	94%	91%	2.1%
Finance	*Journal of finance*	0022-1082	79%	96%	0.0%
	Journal of financial economics	0304-405X	75%	99%	0.0%
	Review of financial studies	0893-9454	75%	96%	0.2%
Geography	*Progress in human geography*	0309-1325	67%	66%	6.2%
	Annals of the Association of American Geographers	0004-5608	67%	94%	1.5%
	Global environmental change-human and policy dimensions	0959-3780	50%	97%	1.4%
	Journal of rural studies	0743-0167	50%	95%	1.9%
	Political geography	0962-6298	50%	78%	2.4%
	Transactions of the Institute of British Geographers	0020-2754	50%	95%	2.1%
	Urban geography	0272-3638	33%	72%	2.5%
Hospitality & Tourism Management	*Annals of tourism research*	0160-7383	78%	55%	1.0%
	International journal of hospitality management	0278-4319	78%	89%	3.9%
	International journal of contemporary hospitality management	0959-6119	67%	90%	6.4%
	Tourism management	0261-5177	67%	85%	1.7%
	Journal of travel research	0047-2875	56%	92%	7.4%
	Journal of hospitality & tourism research	1096-3480	44%	89%	8.2%
Human Biological Sciences	*Nature immunology*	1529-2908	67%	45%	7.8%
	Immunity	1074-7613	67%	57%	8.2%
	Nature medicine	1078-8956	67%	50%	2.4%
Law	*Harvard law review*	0017-811X	59%	73%	0.6%
	Yale law journal	0044-0094	59%	74%	3.1%
Library & Information Science	*MIS quarterly*	0276-7783	75%	444%	5.0%
	Journal of the American Society for Information Science and Technology	1532-2882	75%	*	*
	Journal of the American Medical Informatics Association	1067-5027	50%	82%	8.3%
	Government information quarterly	0740-624X	50%	84%	3.2%
	Information & management	0378-7206	50%	95%	3.2%
	Journal of information science	0165-5515	50%	97%	0.7%

Academic subject	Title	ISSN	% voted	% articles	% reviews
Management	*Academy of Management journal*	0001-4273	70%	93%	0.0%
	Management science	0025-1909	67%	98%	0.1%
	Academy of Management review	0363-7425	67%	64%	0.9%
	Strategic management journal	0143-2095	63%	93%	3.2%
	Organization science	1047-7039	59%	97%	0.0%
	Administrative science quarterly	0001-8392	48%	49%	1.9%
Marine/Ocean Engineering	*Applied ocean research*	0141-1187	100%	99%	1.1%
Materials Science & Engineering	*Nature materials*	1476-1122	66%	53%	2.3%
	Advanced materials	0935-9648	59%	92%	6.9%
Mathematics	*Annals of mathematics*	0003-486X	72%	97%	0.0%
	Inventiones mathematicae	0020-9910	49%	97%	0.0%
	Journal of the American Mathematical Society	0894-0347	46%	100%	0.0%
Mechanical Engineering	*Journal of fluid mechanics*	0022-1120	43%	99%	0.1%
	International journal of heat and mass transfer	0017-9310	23%	97%	1.8%
	Journal of the mechanics and physics of solids	0022-5096	20%	97%	0.3%
	Combustion and flame	0010-2180	20%	99%	0.0%
	Journal of sound and vibration	0022-460X	17%	97%	0.5%
	IEEE-ASME transactions on mechatronics	1083-4435	17%	98%	0.4%
	Proceedings of the Combustion Institute	1540-7489	13%	99%	1.0%
	Journal of engineering for gas turbines and power	0742-4795	13%	99%	0.4%
	Journal of turbomachinery-transactions of the ASME	0889-504X	13%	99%	0.2%
Metallurgical Engineering	*Acta materialia*	1359-6454	71%	99%	0.0%
	Scripta materialia	1359-6462	43%	98%	0.1%
	Corrosion science	0010-938X	43%	98%	1.1%
	Metallurgical and materials transactions A-Physical metallurgy and materials science	1073-5623	43%	97%	0.0%
Mining & Mineral Engineering	*International journal of rock mechanics and mining sciences*	1365-1609	100%	99%	0.0%
Nanoscience & Nanotechnology	*Advanced materials*	0935-9648	100%	92%	6.9%
	Nano letters	1530-6984	100%	98%	0.1%
	Advanced functional materials	1616-301X	75%	97%	1.6%
	ACS nano	1936-0851	75%	96%	1.0%
	Nature nanotechnology	1748-3387	75%	53%	2.9%
	Nano today	1748-0132	50%	15%	48.3%
	Small	1613-6810	50%	91%	8.3%
Nursing	*International journal of nursing studies*	0020-7489	89%	57%	28.1%
	Research in nursing & health	0160-6891	67%	71%	2.5%
Pharmacy & Pharmaceutical Sciences	*Nature reviews drug discovery*	1474-1776	64%	3%	12.9%
Physics	*Physical review letters*	0031-9007	73%	96%	0.0%
Political Sciences	*American political science review*	0003-0554	82%	91%	0.3%
	World politics	0043-8871	73%	89%	5.0%
	International organization	0020-8183	64%	95%	1.8%
	American journal of political science	0092-5853	45%	97%	0.3%
Psychology	*Psychological science*	0956-7976	69%	88%	0.0%
	Psychological bulletin	0033-2909	56%	67%	18.1%
	Psychological review	0033-295X	50%	88%	0.0%
	Trends in cognitive sciences	1364-6613	44%	57%	0.0%
Public Administration	*Public administration review*	0033-3352	100%	41%	0.7%

Academic subject	Title	ISSN	% voted	% articles	% reviews
Public Health	*International journal of epidemiology*	0300-5771	63%	40%	1.8%
	Environmental health perspectives	0091-6765	50%	64%	5.5%
	Annual review of public health	0163-7525	38%	0%	95.1%
Remote Sensing	*IEEE transactions on geoscience and remote sensing*	0196-2892	100%	99%	0.0%
	Remote sensing of environment	0034-4257	100%	97%	1.3%
	ISPRS journal of photogrammetry and remote sensing	0924-2716	67%	95%	3.2%
Sociology	*American journal of sociology*	0002-9602	100%	20%	0.0%
	American sociological review	0003-1224	100%	85%	10.2%
Sports Science	*Journal of applied physiology*	8750-7587	67%	71%	7.3%
	Medicine and science in sports and exercise	0195-9131	67%	9%	0.0%
	Journal of sports sciences	0264-0414	67%	95%	1.6%
Statistics	*Annals of statistics*	0090-5364	90%	95%	0.0%
	Journal of the American Statistical Association	0162-1459	90%	84%	1.3%
	Journal of the Royal Statistical Society Series B-Statistical methodology	1369-7412	70%	96%	1.6%
	Biometrika	0006-3444	60%	98%	0.0%
Veterinary Sciences	*Veterinary microbiology*	0378-1135	61%	94%	2.8%
	Veterinary research	0928-4249	44%	91%	8.2%
Water Resources	*Water resources research*	0043-1397	100%	94%	1.5%
	Journal of hydrology	0022-1694	50%	96%	1.8%

Unexpectedly, the *Journal of the American Society for Information Science and Technology* (ISSN 1532-2882) was voted among the Top 100 even though this journal no longer exists as it changed its title in 2014 (it is currently known as *Journal of the Association for Information Science and Technology*) as well as its ISSN (2330-1635). While some of the researchers that voted for this journal may still retain in their mind the old journal title, the fact that the former ISSN was included in the list –instead of the new one– was disconcerting. What data was collected from this journal? A *Web of Science* search query using the former journal title or ISSN only listed records up to the year 2013, an outcome that should have raised red flags. Another option is that the authors of the ranking used the current journal title or ISSN to collect the "article"-type documents but did not update this information in the Top journals list. Either way, such errors distort the quantitative assessment and reliability of the Top indicator.

A major and valid concern is the reason why these journals are chosen by the participants. Besides being first quartile journals, their other common attribute is that all the journals publish in English-language. But what makes these journals Top? Is it their citation level or impact factor? A quick analysis of the *Journal Citation Reports* revealed that plenty of other journals surpass the citation level and impact factor of Top journals. Conceivably, these journals may have been selected due to top-of-mind associations based on the participant´s own experience with the journal. A simplified, clear explanation of the full process by which Top journals have been selected would enlighten all users of the *Shanghai Global Ranking of Academic Subjects*.

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4. Conclusions

For many years, global university rankings have been acknowledged has a valid instrument to compare universities worldwide. Unfortunately, most users focus primarily on the ranking results and not the methodology used to elaborate the ranking. The results of this study show that the methodology currently used by the *Shanghai Global Ranking of Academic Subjects* presents several issues, which negatively affect a large proportion of universities around the world. Needless to say, if the *Shanghai Global Ranking of Academic Subjects* is meant to be global, it needs to expand its surveys to countries located in the Global South. This will not only assure a fair country representation, but it will also contribute to a more diverse collection of data that would drive an improved understanding on how universities succeed at certain academic subjects. It is important to note that in a globalized context, the performance of one university is not autonomous as it depends on how other universities are performing too.

Lastly, it is important to emphasize that while this study was possible due to the methodology supplied by the ranking provider on their website, there is a need for more clarity. By providing more information, perhaps some of these incongruities could be easily avoided.

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