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National university rankings based on open data: A case study from Serbia

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Abstract

We investigate the potential of using open data about higher education and research activities as a basis for constructing university rankings at the national level. In our case study, open data from the Ministry of Education, Science, and Technological Development of Serbia served as a foundation for deriving indicators of university performance and calculating ranks of universities from Serbia. In addition to reviewing notable international rankings of universities, we extracted the international standings of universities from Serbia and discussed the national university rankings that were generated during our investigation.

Keywords: university ranking ; performance indicator ; open data ; higher education ; research; Serbia

1. Introduction

For over a decade, international ranking lists of universities have been scrutinized by scholars and policy makers from all over the world. The increasing prestige associated with some rankings of elite institutions has been a motivating factor for many universities to invest more into their research activities and adapt institutional policies with the hope of attaining a better global rank. However, many ranking lists feature only a limited number of entries and most universities usually do not get ranked.

For many universities, it would be a great challenge to enter one of the exclusive lists and obtain evaluations according to accepted performance criteria. Even if a university managed this, the interpretation of the attained rank and any comparison with other similarly ranked institutions would still be a difficult task. Universities from different parts of the world most probably operate in dissimilar socioeconomic and political circumstances and face different demands from the society. Many such institutions might have their own unique objectives that are not aligned with

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criteria used in global rankings. As a result, for a lot of institutions, the informativeness and overall value of global rankings might be lower than expected.

For these reasons, we look into the possibilities offered by open data to create rankings for a selected group of universities across a meaningful set of performance indicators. Our goal was to investigate if available open data may provide a sound basis for construction of university rankings for a particular country. To achieve this, we conducted a case study for Serbia that included usage of open data about education and research. We reviewed some of the more prominent international ranking systems, retrieved international rankings of universities from Serbia, used open data from the Ministry of Education, Science, and Technological Development of Serbia to identify potential performance indicators, constructed necessary indicators, calculated their values, and discussed the resulting rankings of selected universities from Serbia.

2. Related work

We briefly introduce several international ranking systems for higher education institutions. We provide an overview of a diverse selection of ranking systems that includes both new and well-established systems, as well as reveals different types of ranking indicators currently in use. The provided background on ranking methodologies corresponds to the editions of the respective rankings that were considered latest at the time of the research. As some of the used indicators are coupled with complex data processing and non-trivial calculation procedures, the provided descriptions are not exhaustive and treat only the main aspects of the listed indicators without acknowledging every detail. Moreover, we concentrate on the published overall rankings of universities, and do not discuss rankings by individual fields, regions, or countries, which are also available for many ranking systems.

2.1. International rankings of universities

The Academic Ranking of World Universities[1], commonly known as Shanghai Ranking, is a widely cited ranking that primarily utilizes indicators of research achievement associated with the institution. It relies on data about researchers' accomplishments, namely earning a prestigious prize, having a paper published in a renowned journal, and being a highly cited scholar. The 2017 edition of this ranking (ARWU) lists the top 500 universities together with the 300 candidate universities and provides their ranks based on the weighted scores for the following six indicators [1]:

- number of alumni winning a Nobel Prize or a Fields Medal,
- number of staff members with a Nobel Prize in Physics, Chemistry, Medicine, or Economics, or a Fields Medal,
- number of researchers regarded as highly cited in 2016 by Clarivate Analytics, a company widely known for providing bibliometric information about international research results,
- number of articles published in the journals Nature and Science during the 2012-2016 period,
- number of articles indexed in the Science Citation Index Expanded and the Social Sciences Citation Index, the two indices maintained by Clarivate Analytics, and
- overall performance across the previous five indicators, adjusted for the number of full-time academic staff members.

The Leiden Ranking[2] is also focused on evaluating research output of universities. The 2017 edition of the Leiden ranking (CWTS-LR) lists 903 institutions and offers two groups of indicators including the following principal indicators [2]:

- research impact indicators
  - number of publications (articles and reviews) published during the 2012-2015 period that are indexed in the Science Citation Index Expanded, the Social Sciences Citation Index, and the Arts & Humanities Citation Index, all of which are maintained by Clarivate Analytics,

[1] http://www.shanghairanking.com/
[2] http://www.leidenranking.com/

  - number of publications in the top 10% of publications in their field,
  - proportion of publications in the top 10% of publications in their field,
- research collaboration indicators
  - number of publications co-authored with people from other organizations, and
  - proportion of publications co-authored with people from other organizations.

There are also other variants of these indicators: research impact indicators that take into account a different percentage of top publications, indicators of citation counts of publications, and collaboration indicators acknowledging the number of countries involved, number of industrial organizations involved, or geographical distance between the collaborators. The listed universities may be ranked by a single indicator and the default one is the number of publications.

University Ranking by Academic Performance[3] is another ranking system that is directed at research output, but it encompasses a larger number of institutions as opposed to similar ranking systems. Its 2017-2018 edition (URAP-WR) lists 2500 institutions evaluated across the following six indicators [3]:

- number of articles published in 2016 in journals that belong to the top three quartiles with respect to their Journal Impact Factor,
- citation of articles published during the 2012-2016 period in journals that belong to the top three quartiles with respect to their Journal Impact Factor,
- number of publications during the 2012-2016 period,
- total article impact as calculated by using a special formula,
- total citation impact as calculated by using a special formula, and
- number of articles published jointly with foreign universities during the 2012-2016 period.

The Quacquarelli Symonds World University Ranking[4] is a notable ranking system that differs from ranking systems such as ARWU and CWTS-LR in its inclusion of indicators not primarily related to research performance. The 2018 edition of the ranking (QS-WUR) lists 959 institutions and is based on the following six indicators [4]:

- teaching and research reputation as reported in a survey,
- employability of graduates as reported in a survey,
- ratio of teaching staff members and students,
- citation of published papers, for the 2011-2016 period and based on data available in the Scopus database by Elsevier, a company widely recognized for academic publishing,
- proportion of international staff members, and
- proportion of international students.

The Times Higher Education World University Ranking[5] is an example of a well-known ranking system that, similarly to the QS-WUR ranking system, measures performance in both research and non-research activities. However, it features a more comprehensive set of indicators. In its 2018 edition (THE-WUR), there are 1103 institutions and thirteen indicators organized into five distinct groups [5]:

- teaching indicators
  - teaching reputation as reported in an annual survey,
  - ratio of staff members and students,
  - ratio of doctorates and bachelor's degrees,
  - ratio of awarded doctorates and academic staff members,
  - adjusted income of the institution,

[3] http://www.urapcenter.org/
[4] http://www.qs.com/rankings/
[5] https://www.timeshighereducation.com/world-university-rankings/

- research indicators
  - research reputation as reported in an annual survey,
  - adjusted research income of the institution,
  - number of papers published in journals indexed in the Elsevier Scopus database, adjusted for institution's size and subject,
- citation indicators
  - extent to which a paper published during the 2012-2016 period got cited during the 2012-2017 period, based on bibliometric data from Elsevier,
- internationalization indicators
  - ratio of international and domestic students,
  - ratio of international and domestic staff members,
  - adjusted proportion of journal publications with international co-authors, and
- industry collaboration indicators
  - adjusted research income from industry.

U-Multirank[6] is another broad ranking system with many indicators about institution's research output, research application, teaching, and international and regional profile. Within the group of the discussed ranking systems, it could be considered as the most comprehensive among the well-established ranking systems. It is aimed at supporting custom comparisons of institutions, but there are also predefined rankings for the categories of research, teaching, application, and science and technology institutions. Its 2017 edition of Research and Research Linkages Ranking (UM-RRLR) lists 1185 institutions and presents them across seven indicators organized in four groups [6, 7]:

- research indicators
  - citation of publications that is adjusted for publication year and academic field, for the 2012-2016 period and based on data from the Web of Science Core Collection,
  - number of publications, for the 2013-2016 period and based on data from the Web of Science Core Collection,
  - number of publications that is adjusted for the number of students, for the 2012-2016 period and based on data from the Web of Science,
  - proportion of publications in the top 10% in their field in the same year, for the 2012-2015 period for publications and until the third quarter of 2016 for citations, and based on data from the Web of Science Core Collection,
- knowledge transfer indicators
  - proportion of publications co-authored with people from industrial organizations,
- international orientation indicators
  - proportion of publications co-authored with people from other countries, and
- regional engagement indicators
  - proportion of publications co-authored with people from the same region.

This institutions listed in this ranking may be sorted by any of the individual indicators or by all the seven indicators similarly to the sorting that is typically used for tables of medals won in the Olympic Games.

Moscow International University Ranking[7] is a new ranking system that emphasizes performance across the three university missions, namely education, research, and contribution to the society. In 2017, the pilot version of the ranking (MOSIUR) lists 200 institutions across a wide range of 17 indicators [8]:

- education indicators
  - number of wins in international student competitions,
  - proportion of international students,

[6] https://www.umultirank.org/
[7] https://mosiur.org/

  - university budget per student,
  - ratio of students to academic staff members,
- research indicators
  - number of academic staff members and alumni winning a recognized international academic award,
  - global citation impact of publications from the 2012-2015 period, based on data from the Scopus database,
  - global citation impact of publications from the 2012-2015 period, based on data from the Web of Science,
  - national citation impact of publications from the 2012-2015 period, based on data from the Scopus database,
  - national citation impact of publications from the 2012-2015 period, based on data from the Web of Science,
  - research income per academic staff member,
  - paper view impact of publications from the 2012-2015 period that is adjusted for the field, based on data from the Scopus database,
- contribution to the society indicators
  - number of available online courses published at the platforms Coursera and edX,
  - proportion of publications within the all university publications from the same country,
  - number of university's web pages that are indexed by search engines Google, Baidu, and Yandex,
  - number of views of the university's Wikipedia pages,
  - number of followers of the university's Twitter account, and
  - number of alumni with a Wikipedia page.

The Ranking Web of Universities (Webometrics)[8] is a ranking system that adopts a different approach to ranking when compared to most other systems. It utilizes data from the Web and measures the levels of presence and impact of an institution on the Web. It has distinguished itself also by the much greater global coverage of institutions. The January 2018 edition of Webometrics (WEBM) lists 12001 entries ranked across the following four indicators [9]:

- number of web pages within the institution's main web domain, including the subdomains,
- number of external networks with links to the web pages of the institution,
- number of citations from top authors, based on data from Google Scholar Citations, and
- number of publications in the top 10% for the 2011-2015 period, based on data from SCImago.

In Table 1, there is a summary of the main characteristics of the presented ranking lists. In addition to the ranking title and assigned code, the table contains geographical origin of the ranking system, number of entries in the ranking, i.e., length, and X marks denoting which performance dimensions are covered by the indicators used in the ranking. Three dimensions of performance are isolated, namely performance in research, in teaching, and on the Web.

Table 1. An overview of selected international rankings of universities.

Code	Ranking title	Geographical origin	Length	Performance dimension		
				Research	Teaching	Web
ARWU	Academic Ranking of World Universities 2017	China	800	X		
CWTS-LR	CWTS Leiden Ranking 2017	Netherlands	903	X		
URAP-WR	URAP 2017-2018 World Ranking	Turkey	2500	X		
QS-WUR	QS World University Rankings 2018	United Kingdom	959	X	X	
THE-WUR	THE World University Rankings 2018	United Kingdom	1103	X	X	
UM-RRLR	U-Multirank 2017 Research and Research Linkages Ranking	International/Europe	1185	X		
MOSIUR	Moscow International University Ranking 2017	Russia	200	X	X	X
WEBM	Webometrics January 2018	Spain	12001	X		X

[8] http://www.webometrics.info/

The main shared feature of the considered rankings is the reliance on a set of indicators, which typically yield absolute counts, relative values, or results of more complicated calculations. In general, the values of indicators are weighted and combined to determine the overall rank of an institution. Various versions of publication and citation counts are prominently used as measures of research performance, while numbers of staff members and students are commonly included in the calculation process of some teaching performance indicators. Another commonality is the inclusion of indicators for research performance, which is evaluated in all eight rankings, but only in four out of eight instances at least one additional performance dimension was considered. MOSIUR is the lone example of a ranking covering all performance dimensions, but it also has the fewest entries. However, it may be expected that its future versions will be more extensive, as the present MOSIUR is only a pilot version. Moreover, a majority of rankings features 1000 ± 200 entries. Only two rankings, namely URAP-WR and WEBM, are moving into the direction of providing a truly global list of universities and not only enumerating top tier institutions of the world.

2.2. *Universities from Serbia in international rankings*

Over the past several years, universities from Serbia have increased their presence in international rankings. In Table 2, we report the latest standings of universities from Serbia in the rankings presented in Section 2.1. We included a university in this table only if the university or one of its faculties has been nationally accredited as a research institution. The current list of such institutions is provided by the Ministry of Education, Science, and Technological Development of Serbia [10].

Table 2. International ranks of universities in Serbia.

University	Rank							
	ARWU	CWTS-LR	URAP-WR	QS-WUR	THE-WUR	UM-RRLR	MOSIUR	WEBM
University of Belgrade	201-300	155	231	801-1000	/	1031	/	512
University of Novi Sad	/	721	860	/	/	1108	/	1108
University of Kragujevac	/	/	1377	/	/	829	/	1840
University of Nis	/	/	1187	/	/	/	/	1498
Educons University	/	/	/	/	/	857	/	5640
Singidunum University	/	/	/	/	/	/	/	3294
Megatrend University	/	/	/	/	/	/	/	4477
University of Pristina	/	/	/	/	/	/	/	4639
State University of Novi Pazar	/	/	/	/	/	/	/	4658
Metropolitan University	/	/	/	/	/	/	/	8460

According to the data from Table 2, the University of Belgrade, which is the largest university in Serbia, represents the best university in Serbia with respect to the number of rankings in which it is listed and its overall ranks. It is followed by the University of Novi Sad, and then by the University of Kragujevac, University of Nis, and Educons University. Five more universities from Serbia are featured in the considered rankings.

Although the presented rankings are based on different indicators and exhibit performance across different dimensions, the order of universities from Serbia is fairly consistent across different rankings. In this respect, the main inconsistency is due to the ranks provided by UM-RRLR. Another inconsistency may be observed in the fact that two rankings, THE-WUR and MOSIUR, do not feature a single university from Serbia. In the case of MOSIUR, this inconsistency may be attributed to it being a pilot version with a limited number of entries. However, it is not obvious why there are not any universities from Serbia in THE-WUR, which lists more than 1000 institutions, when all the other similarly sized or longer ranking lists feature at least one such university.

3. Data and methods

We describe the input data and methods used to devise rankings of universities in Serbia. The data originate from an open data web page devoted to the national education and research system of Serbia. The ranking method relies on a combination of several indicators of university performance that are based on the available open data.

3.1. Data

The main source of data about universities is based on an open collection of individual data sets about education and research in Serbia. These data sets were published by the Ministry of Education, Science, and Technological Development of Serbia on its dedicated web page[9]. They cover different levels of the education system, as well as accredited research institutions and research activities supported by the Ministry.

In a previous study [11], selected open data sets about higher education and research activities were processed and integrated into a single data source, namely a database that could better support more complex data analyses. The database contains summarised data concerning higher education institutions and their staff, institution income and expenditure, study programmes, student enrolment and graduation, research institutions, and research projects and research funds provided by the Ministry. These data primarily cover years 2015 and 2016.

The database that was created in the previous study served as the main data source in the present study. Moreover, we had to extend the available data about a research institution with the data about its superordinated university. These additional data were not directly available in the source database, but they were needed because we focused on calculating ranks for a university as a whole and not ranking its individual institutions,

3.2. Methods

We inspected the available data with respect to the indicators of university performance that are presented in Section 2.1. The goal of this inspection was to determine which of the previously described performance indicators could be applied in our study, i.e., for which indicators we had the required data. However, we also considered variations of these indicators and some related but essentially different indicators.

As a result, we formed ten basic indicators providing absolute values as measures of performance and ten corresponding adjusted indicators providing relative values, i.e., there is an adjusted indicator version for each basic indicator. There are two values regarding a university that are prominently used in the formed indicators:

- *ENROL* – number of enrolled students including all years of study and all study programmes organized by institutions belonging to the university and
- *STAFF* – number of staff members.

The ten basic indicators of university performance are:

- *INC_BUDG* – income originating from the country budget,
- *INC_OWN* – income originating from university's own activities,
- *LIBRA* – total number of resources in the libraries of the university, e.g., books, different kinds of theses, and periodicals,
- *PROJE* – number of national projects supported by the Ministry for which the university or one of its member institutions is the project coordinator,
- *MOB_STU* – number of incoming and outgoing student mobilities lasting at least a semester,
- *MOB_STAFF* – number of teachers and researchers who stayed at a foreign institution for at least a month,
- *ECTS_EARN* – number of ECTS (European Credit Transfer and Accumulation System) credit points earned by students,
- *COMPL* – number of students who completed their studies,
- *ENROL_PHD* – number of enrolled doctoral students, and
- *STAFF_ACAD* – number of academic staff members.

The ten adjusted versions of indicators of university performance are:

- $INC\_BUDG^* = INC\_BUDG \,/\, (\, ENROL + STAFF \,)$,

[9] http://opendata.mpn.gov.rs/

- *INC_OWN** = *INC_OWN* / *STAFF*,
- *LIBRA** = *LIBRA* / (*ENROL* + *STAFF_ACAD*),
- *PROJE** = *PROJE* / *STAFF_ACAD*,
- *MOB_STU** = *MOB_STU* / *ENROL*,
- *MOB_STAFF** = *MOB_STAFF* / *STAFF_ACAD*,
- *ECTS_EARN** = *ECTS_EARN* / *ENROL*,
- *COMPL** = *COMPL* / *ENROL*,
- *ENROL_PHD** = *ENROL_PHD* / *ENROL*, and
- *STAFF_ACAD** = *STAFF_ACAD* / *ENROL*.

The adjustment of basic indicators involved division by the number of enrolled students, number of staff members (all staff or only academic), or a sum of these two. In this manner, we aimed to create indicators that would not automatically favour larger universities. Moreover, use of relative indicators is common in university rankings, as it may be observed in the overview of ranking systems in Section 2.1.

The ranking process consisted of calculating ranks for each formed indicator and then forming the overall rank of a university as a function of ranks for individual indicators. For each institution there is a multiset of ranks given for individual indicators. All these multisets of ranks are treated similarly to a table of Olympic medals, so that the best rank is awarded to the institution with the largest number of individual best ranks. The second best rank is given to the institution with the second largest number of individual best ranks and the remaining institutions are ranked following the same principle. In case two institutions have the same number of individual best ranks, the numbers of the second best ranks are compared so that the higher number of such ranks leads to a better overall rank. If needed, this sort of comparison is repeatedly performed for the lower individual ranks until a difference in the number of compared ranks is observed. A similar approach to forming the overall rank is used by U-Multirank, as mentioned in Section 2.1. This process of calculation of the overall rank was performed twice, once for all the ranks across basic (absolute) indicators and once for all the ranks across adjusted (relative) indicators.

Although the available data may be considered comprehensive with respect to the coverage of higher education institutions, for certain universities there was a disproportionately lower number of records required for certain indicators. For this reason, we excluded some universities from our results, mostly private universities, as we aimed for a well-rounded ranking based on complete data. Although this exclusion somewhat reduces the scope of the created ranking, the representativeness of the higher education system should be good, because a large majority of students in Serbia is enrolled at public universities. The difference in data availability between some universities might be partially explained by the type or size of the university, as public universities are usually larger and more closely tied to the Ministry and the country budget. As a result, there are more records available and they are more varied, e.g., income information is typically present for public but not for private institutions.

4. Results and discussion

Individual ranks for selected universities from Serbia are provided in Table 3 for the ten basic indicators and in Table 4 for the ten adjusted indicators. Ranks were calculated only for seven public universities, as the data necessary for ranking were fully available only in those seven cases.

At the level of a single university, ranks across basic indicators are highly consistent, as shown in Table 3. All ten ranks are identical in two instances, for the University of Nis and the University of Kragujevac. Furthermore, there are two instances for which nine out of ten ranks are equal, namely the University of Belgrade and the University of Novi Sad. In the three remaining instances, there is somewhat greater variation in ranks, but still relatively low.

Such overall consistency could be partially explained by the character of the basic indicators. These indicators rely on counts and it could be expected that a larger university is exhibiting stronger performance than a smaller one if only absolute numbers are considered. In general, funding policies are largely tied to the number of enrolled students. Moreover, the size of the staff usually increases with the number of students and research output grows as there are more academic staff members.

When adjusted indicators are used, the variety of ranks assigned to a single university is much greater, as shown in Table 4. Such indicators were used primarily to identify greater availability of resources and better conditions, e.g.,

more academic staff members per student, or greater individual performance, e.g., more ECTS credit points earned by a student. However, some substantial changes in ranks may occur when a different type of indicator is used. For instance, the University of Arts in Belgrade appears to have much better performance if adjusted indicators are utilised. The specificities of the art field and art education, such as typically smaller education institutions, lower number of enrolled students, and better opportunities for longer interaction with teachers for each student, could be designated as the main reasons for the more favourable studying conditions.

Table 3. Ranks of universities in Serbia by basic indicators.

University	*INC_BUDG*	*INC_OWN*	*LIBRA*	*PROJE*	*MOB_STU*	*MOB_STAFF*	*ECTS_EARN*	*COMPL*	*ENROL_PHD*	*STAFF_ACAD*
State University of Novi Pazar	7	7	6	7	6	5	7	7	7	7
University of Arts in Belgrade	6	6	5	6	5	5	6	6	5	6
University of Belgrade	1	1	1	1	2	1	1	1	1	1
University of Kragujevac	4	4	4	4	4	4	4	4	4	4
University of Nis	3	3	3	3	3	3	3	3	3	3
University of Novi Sad	2	2	2	2	1	2	2	2	2	2
University of Pristina	5	5	7	5	6	5	5	5	6	5

Table 4. Ranks of universities in Serbia by adjusted indicators.

University	*INC_BUDG**	*INC_OWN**	*LIBRA**	*PROJE**	*MOB_STU**	*MOB_STAFF**	*ECTS_EARN**	*COMPL**	*ENROL_PHD**	*STAFF_ACAD**
State University of Novi Pazar	7	6	3	7	6	5	7	7	7	6
University of Arts in Belgrade	1	7	2	6	3	5	1	1	1	1
University of Belgrade	6	1	1	1	4	3	4	4	2	7
University of Kragujevac	3	3	6	4	5	4	2	3	3	3
University of Nis	4	4	5	2	2	2	5	5	5	5
University of Novi Sad	5	2	4	3	1	1	6	2	4	4
University of Pristina	2	5	7	5	6	5	3	6	6	2

In Table 5, the overall ranks of analysed institutions are given for both types of performance indicators. The use of the overall rank based on basic indicators yields a ranking that is correlated with the size of the institutions, i.e., the larger the institution the better rank it has. It could be argued that the absolute numbers which are the foundation of basic indicators provide meaningful insights. Given the historical circumstances and local traditions of education, larger and older institutions had better conditions for development and, consequently, today they exhibit better performance.

The overall ranks by adjusted indicators differ from the overall ranks by basic indicators, but the overall ordering is well preserved between the two rankings. The only two changes are the considerable increase in rank for the University of Arts in Belgrade and a slight drop in the rank of the University of Kragujevac.

Table 5. Overall ranks of universities in Serbia.

Basic indicators		Adjusted indicators	
Overall rank	University	Overall rank	University
1	University of Belgrade	1	University of Arts in Belgrade
2	University of Novi Sad	2	University of Belgrade
3	University of Nis	3	University of Novi Sad
4	University of Kragujevac	4	University of Nis
5	University of Pristina	5	University of Pristina
6	University of Arts in Belgrade	6	University of Kragujevac
7	State University of Novi Pazar	7	State University of Novi Pazar

5. Conclusion

The presented results demonstrate that currently available open data sets may provide a good basis for building a meaningful university ranking for institutions from Serbia. There is a solid agreement between the rankings in the well-known international lists and the rankings from the present study that were based on the indicators built upon open data. Moreover, both groups of rankings relied on data from the similar period. The set of indicators built in the present study is heterogeneous, as it covers finances, capacity for providing an environment supportive of learning, research activities, academic mobility, internationalization, and academic progress of students.

Nonetheless, the rankings created in the present study should not be regarded as definite indicators of worth of some university. Even values provided by a commonly used performance indicator could be misleading without adequate supporting knowledge of the education system and evaluated institutions. The used indicators were regarded as equally important, but different weighting schemes for individual indicators would have to be assessed in practice. More representative rankings would also require more data about more institutions, as well as a larger and even more varied set of indicators.

Renowned global university rankings often put emphasis on top research results and the impact of the discoveries as measured by the resulting number of citations. This may be expected as such metrics of research quality and importance currently represent a common tool for performance evaluation in the global scientific community. Education, which is generally the primary concern of universities throughout the world, gets some recognition in global rankings. Activities such as interaction with the society and collaboration with other institutions and industry get even less attention. However, the constant increase in quantity and variety of open data should serve as a catalyst for creation of useful new ranking methods that would be beneficial to the whole society.

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