

CHAPTER 2

INNOVATIONS IN THE MANAGEMENT OF EDUCATIONAL INSTITUTIONS

OVERVIEW OF THE METHODOLOGY OF UNIVERSITIES' INTERNATIONAL RANKINGS FOR MEETING THE CHALLENGES OF OPEN SCIENCE

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Abstract. *International rankings directly affect the development of universities around the world, especially in the context of Open Science. The purpose of the article is a comparative analysis of the methodology for calculating the main international university rankings and establishing the readiness of their transformation to meet the requirements of open science. The methodological basis of the study was the methodology of the main international universities presented on their websites. The article analyzes the methodologies of the main international university rankings and highlights the main criteria by which the rankings are calculated. According to the results of the conducted research, the main sources of information necessary for determining international ratings were systematized, namely: Information from official sources external to the university, which is publicly available; Results of a survey of the academic community; University survey results; Student survey results; The results of the survey of employers; Information from the university website; Information on scientific profiles of the university; Information on scientific profiles of university employees; Information from the websites of scientific journals; Information from university repositories. The main features that universities should take into account in order to achieve higher positions in international rankings, which will become possible if they comply with the requirements of Plan S regarding Open Science, have been clarified.*

Keywords: *Open Science; Plan S; methodology; international university rankings.*

JEL Classification: A23, A29, I28

Formulas: 0; **fig.:** 1; **tabl.:** 6; **bibl.:** 15

Introduction. In the world of globalized higher education, international rankings of universities are becoming more and more relevant every year. First, they guide applicants in choosing a place of study. Secondly, for universities, such ratings are an opportunity to attract the attention of applicants, foreign students, the best teachers and researchers, grant funds and investments due to high positions in the rating or the very fact of being included in the rating.

For more than ten years, we have analyzed the methodologies of the most popular international ratings, as well as their potential impact.

Rating methodologies include, in the vast majority, indicators related to the results of scientific research.

In 2023, the Scientific Center of Innovative Researches became a support organization for the "More Than Our Rank" initiative promoted by the International Network of Research Management Societies (INORMS). We believe that the

positions of universities cannot be based only on the results of the publishing activity of its researchers but should also include other indicators of the quality of education [1].

We believe that one of the components of ratings should analyze the results of universities' participation in open science projects, such as publishing articles in open access journals, holding conferences and publishing monographs using open access platforms, as well as organizing the process of reviewing materials using them.

Literature review. Before examining the international rankings of universities, it should be noted that on May 18-20, 2006, the conference "Methodology and quality standards of university rankings" [2], organized by the International Expert Group on Ranking (IREG) [3] was held in Berlin (Germany). The result of the conference was a kind of "constitution" for the development and application of university rankings around the world, the "Berlin Principles of Ranking of Higher Education Institutions" [4].

The founders of this "constitution" were the Center for the Development of Higher Education (CHE) (Germany) [4], the Institute for Higher Education Policy (USA) [5], the UNESCO-CEPES Center (Bucharest, Romania) [6] and other authoritative institutions from 19 countries the world [7].

To determine these ratings, the reliability of the data used, the possibility of their verification and confirmation, considering the specifics of universities of various types, as well as the peculiarities of the higher education system of each country, are important. Another important requirement for the formation of the rating is the publication of a clear and accessible methodology for its compilation. This level of openness is primarily necessary for clarity, in which way and which indicators were considered, what weight they had, and from which sources the information was obtained.

We believe that one of the components of ratings should analyze the results of universities' participation in open science projects, such as publishing articles in open access journals, holding conferences and publishing monographs using open access platforms, as well as organizing the process of reviewing materials using them.

Aims. The purpose of the article is a comparative analysis of the methodology for calculating the main international rankings of universities and establishing the readiness of their transformation to meet the requirements of open science.

Methodology. The methodological basis of the study was the methodology of the main international universities presented on their websites.

We will analyze the main international rankings of the university, which are the most popular in Ukraine and the world.

1. Shanghai ranking - The Academic Ranking of World Universities (ARWU) [8]. The academic ranking of world universities was created with the aim of evaluating the effectiveness of state programs to stimulate scientific activity in Chinese universities, in particular Shanghai University Jiao Tong, the founder of the ranking.

That is why the indicator indicates to a greater extent the scientific activity of universities.

Universities are ranked by several academic or research performance indicators, including alumni and staff winning Nobel Prizes and Fields Medals, highly cited researchers, papers published in Nature and Science, papers indexed in major citation indices, and the per capita academic performance of an institution. For each indicator, the highest scoring institution is assigned a score of 100, and other institutions are calculated as a percentage of the top score. The data distribution for each indicator is examined for any significant distorting effect; standard statistical techniques are used to adjust the indicator if necessary. Scores for each indicator are weighted as shown below to arrive at a final overall score for an institution. The highest scoring institution is assigned a score of 100, and other institutions are calculated as a percentage of the top score.

The evaluation criteria of the Shanghai Ranking's Academic Ranking of World Universities are presented in Table 1.

Table 1. The evaluation criteria of the Shanghai Ranking's Academic Ranking of World Universities

Criteria	Indicator	Weight
Quality of Education	Alumni of an institution winning Nobel Prizes and Fields Medals	10%
Quality of Faculty	Staff of an institution winning Nobel Prizes and Fields Medals	20%
	Highly Cited Researchers	20%
Research Output	Papers published in Nature and Science	20%
	Papers indexed in Science Citation Index-Expanded and Social Science Citation Index	20%
Per Capita Performance	Per capita academic performance of an institution	10%

Sources: [8]

2. Webometrics Internet presence rating. Ranking Web started in 2004 (current is the 20th year of publication) with the aim of offer full coverage of universities whatever the country or discipline involve. Currently we ranked 31 000 HEIs from more than 200 countries [9].

The Ranking Web or Webometrics is the largest academic ranking of Higher Education Institutions offering every six months an independent, objective, free, open scientific exercise for providing reliable, multidimensional, updated and useful information about the performance of universities from all over the world.

Published figures are RANKS (lower is better), intended for showing individual performances, but they are not the values used in the calculations.

The developers note that, when compiling the rating, they do not take into account the number of visitors to the sites and their design. In the ranking model, based on the analysis of the network presence of higher education institutions, 3 generalizing directions are defined, which provide for the analysis of activities according to the following sections (Table 2) [9].

Table 2. The evaluation criteria of the Ranking Web or Webometrics

Indicators	Meaning	Methodology	Source	Weight
Visibility	Web contents Impact	Number of external networks (subnets) linking to the institution's webpages (normalized and then the maximum value is chosen)	Ahrefs Majestic	50%
Transparency (or openness)	Top cited researchers	Number of citations from Top 310 authors (excluding the top 30 outliers)	Google Scholar Profiles	10%
Excellence (or scholar)	Top cited papers	Number of papers amongst the top 10% most cited in each one of the all 27 disciplines of the full database Data for the five-year period: 2017-2021	Scimago	40%

Sources: [9]

3. The SCImago Institutions Rankings (SIR). The SCImago Institutions Rankings is a classification of academic and research-related institutions ranked by a composite indicator that combines three different sets of indicators based on research performance, innovation outputs and societal impact measured by their web visibility [10].

Every year, starting from 2009, the SCImago company publishes a report that presents the results of evaluating the scientific activity of universities and other research institutions according to parameters that characterize the volume, thematic diversity and academic influence of scientific publications. In 2023, such indicators are three groups of parameters presented in the table 3.

Table 3. The evaluation criteria of the SCImago Institutions Rankings

Criteria	Indicator	Weight
Research (50%)	Normalized Impact (NI)	13%
	Excellence with Leadership (EwL)	8%
	Output (O)	8%
	Scientific Leadership (L)	5%
	Not Own Journals (NotOJ)	3%
	Own Journals (OJ)	3%
	Excellence (Exc)	2%
	High Quality Publications (Q1)	2%
	International Collaboration (IC)	2%
	Open Access (OA)	2%
	Scientific Talent Pool (STP)	2%
Innovation (30%)	Innovative Knowledge (IK)	10%
	Patents (PT)	10%
	Technological Impact (TI)	10%
Societal (20%)	Altmetrics (AM)	10%
	Inbound Links (BN)	5%
	Web Size (WS)	5%

Sources: [10]

Indicators are divided into three groups intended to reflect scientific, economic and social characteristics of institutions. The SIR includes both, size-dependent and size-independent indicators; that is indicators influenced and not influenced by the size of the institutions. In this manner, the SIR provides overall statistics of the scientific publication and other output of institutions, while enables comparisons

between institutions of different sizes. It needs to be kept in mind that, once the final indicator has been calculated out of the combination of the different indicators (to which a different weigh has been assigned) the resulting values have been normalized on a scale of 0 to 100.

4. Times Higher Education rating [11]. This international ranking is based on the ranking of research universities, not academic ones. The condition for inclusion in the rating is the publication of university teachers - at least 1,000 scientific articles over the past five years in journals included in the Scopus database.

When compiling the rating, 13 indicators are taken into account, which are grouped into 5 groups (Table 4).

Table 4. The evaluation criteria of the Times Higher Education

Criteria	Indicator	Weight
Teaching (the learning environment) – 30%	Reputation survey	15%
	Staff-to-student ratio	4.5%
	Doctorate-to-bachelor's ratio	2.25%
	Doctorates-awarded-to-academic-staff ratio	6%
	Institutional income	2.25%
Research (volume, income and reputation) - 30%	Reputation survey	18%
	Research income	6%
	Research productivity	6%
Citations - 30%	<i>Research influence</i>	30%
International outlook (staff, students, research) - 7.5%	Proportion of international students	2.5%
	Proportion of international staff	2.5%
	International collaboration	2.5%
Industry income	<i>Knowledge transfer</i>	2.5%

Sources: [11]

Every year, the methodology for calculating the ranking of world universities of Times Higher Education is checked by the independent audit company PricewaterhouseCoopers (PwC).

5. The QS World University Rankings [12]. The rating is compiled by the British company Quacquarelli Symonds, which provides advice on studying abroad. The rating is based on surveys of employers and teachers from around the world. The main criteria for calculating the rating presented in the table 5:

Table 5. The evaluation criteria of the QS World University Rankings

Parameters	Weightage
Academic Reputation	40%
Employer Reputation	10%
Faculty/Student Ratio	20%
Citations per faculty	20%
International Faculty Ratio /International Student Ratio	10%

Sources: [12]

The criteria of this rating are quite different from the previous one, but the indicator itself poses a threat to the front-end security of non-American universities.

Almost 20% of respondents from the academic community are US residents, so American universities receive a higher score. The uneven distribution affects both employers and industries. Another significant threat is the calculation of the "number of students to the number of teachers" indicator due to the impossibility of checking the reliability of the data provided by the universities themselves. In the survey, the category of teachers includes both those who are directly engaged in teaching and scientific workers, which also slightly distorts the final indicator. The reliability of the rating is generally influenced by the number of foreign teachers and students, as both those who are full-time foreign workers and those who only teach a "guest course" are taken into account. The situation is similar with the calculation of the number of students.

6. U-Multirank [13]. U-Multirank takes a different approach to the existing global rankings of universities. It is multi-dimensional and compares university performances in the different activities that they are engaged in. It is not confined to research but takes into account different aspects and dimensions of the performance of universities: teaching and learning, research, knowledge transfer, international orientation and regional engagement. The U-Multirank does not produce a combined, weighted score across these different areas of performance and then use these scores to produce a numbered league table of the world's 'top' 100 universities. The underlying principle is that there is no theoretical or empirical justification for such composite scores. Empirical studies have shown that the weighting schemes of existing global rankings are not robust: small changes in the weights assigned to the underlying measures (the indicator scores) will considerably change the composite scores and hence the league table positions of individual universities.

Therefore, the U-Multirank methodology looks at the scores of universities on individual indicators and places these in five performance groups ("very good" through to "weak").

The evaluation criteria of the U-Multirank are presented in Figure 1.

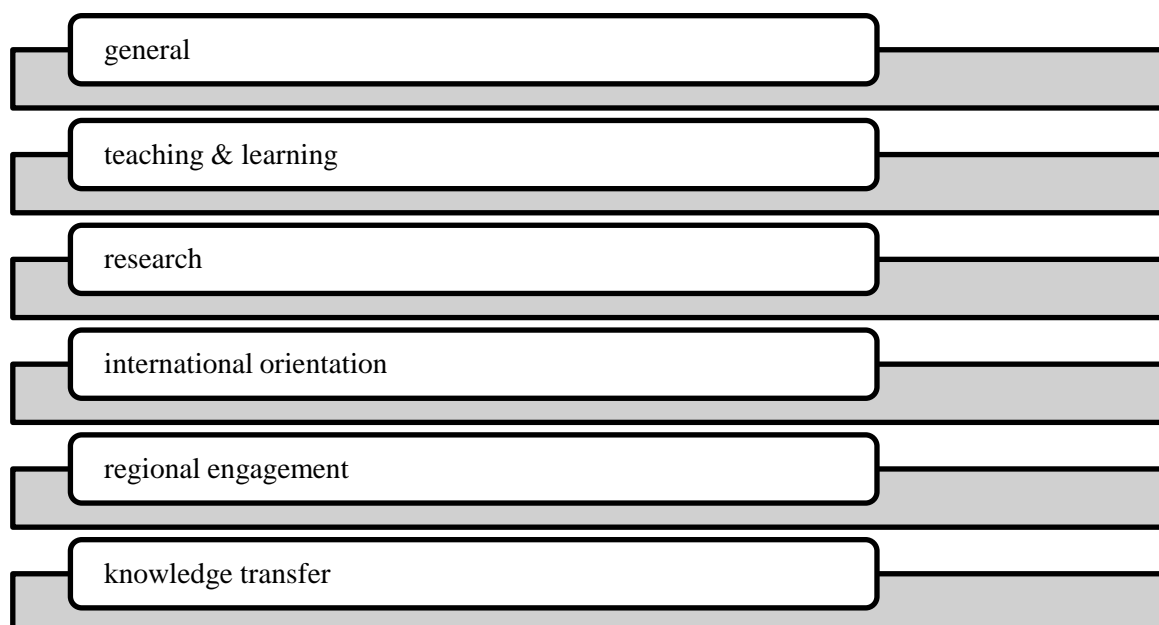


Figure 1. The evaluation criteria of the U-Multirank

Sources: [13]

Results. On the basis of the conducted research, the main criteria for evaluating universities in international rankings are summarized (Table 6).

It has been established that the Shanghai Ranking's Academic Ranking of World Universities pays more attention to the quality of: educational services, teaching staff, research, as well as the representation of universities in the educational space.

Instead, the Ranking Web or Webometrics pays attention to quantitative parameters such as: the number of external links to the university's website, the number of citations and the number of the most cited scientific works of the university's researchers. SCImago Institutions Rankings is more multifaceted and focuses on research, innovation and social aspects of university development.

Times Higher Education rating involves evaluating universities based on: quality of educational services; quality, productivity and funding of scientific research; citation of scientific publications; international integration and collaboration of the university; as well as commercialization of scientific research results. The QS World University Rankings also pay great attention to university quality by assessing: academic reputation, reputation of graduates among employers, faculties, students and international integration. U-Multirank is a multi-vector rating that allows you to evaluate the university's activities based on various sources of information, both official and expert, according to such types of information as: general; teaching & learning; research; international orientation; regional engagement; knowledge transfer.

Table 6. Main sources of information for international university rankings

No	Sources	ARWU	Webometrics	SCImago	THE	QS	U-Multirank
1	Information from official sources external to the university, which is publicly available	+					
2	Results of a survey of the academic community				+	+	
3	The results of the university survey						
4	Results of the student survey						
5	The results of the survey of employers				+	+	
6	Information from the university website				+	+	
7	Information from scientific profiles of the university			+	+	+	
8	Information from scientific profiles of university employees						
9	Information from the websites of scientific journals						
10	Information from university repositories						

Source: compiled by the author based on [7-15]

Discussions. Since the websites of universities do not contain sufficient information provided for in the criteria specified for the ratings, this does not allow most universities to achieve high positions in the mentioned international ratings, which negatively affects their competitiveness.

Analysis of information sources for determining international rankings made it possible to find out that most universities do not effectively use their own websites to inform the public about their achievements.

The low level of interest of researchers in maintaining their own scientific profiles also significantly lowers the positions of universities in the specified ratings. Administrative efforts by university management and incentives, along with outreach among researchers, can significantly improve universities' positions [profile article].

Also, the majority of universities do not use the advantages provided by Open Science and Plan C, which indicates a low level of transparency of the results of their scientific research and a low level of use of modern information technologies that create opportunities for such transparency.

The closedness of the results of scientific research also narrows the opportunities for attracting additional investments through the commercialization of the results of scientific research.

Conclusions. Based on the results of the research, it is appropriate to draw the following conclusions.

The article analyzes the methodologies of the main international university rankings and highlights the main criteria by which the rankings are calculated.

According to the results of the conducted research, the main sources of information necessary for determining international ratings were systematized, namely: Information from official sources external to the university, which is publicly available; Results of a survey of the academic community; University survey results; Student survey results; The results of the survey of employers; Information from the university website; Information on scientific profiles of the university; Information on scientific profiles of university employees; Information from the websites of scientific journals; Information from university repositories.

The main features that universities should take into account in order to achieve higher positions in international rankings, which will become possible if they comply with the requirements of Plan S regarding Open Science, have been clarified.

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