EVALUATING THE IMPACTS OF SCIENTOMETRIC INDICATORS: A GENERAL APPROACH TO AZERBAIJAN UNIVERSITIES

S. ALIZADE, U. MAMMADOVA

Shefa Alizade[1], Ulviyya Mammadova[2]
[1][2] Azerbaijan State University of Economics (UNEC), Azerbaijan
[1] https://orcid.org/0000-0002-4695-6804 E-mail: shefa_alizade@unec.edu.az
[2] https://orcid.org/0009-0009-5980-8446 E-mail: ulviya.mammedova@gmail.com

Abstract: *In recent decades, scientometric indicators have become essential tools for assessing research productivity and impact in academic institutions worldwide. This paper examines the impact of these indicators on Azerbaijani universities, providing a comprehensive and contextual evaluation of their current status and implications. The main objective of the study is to analyze the relationship between scientometric indicators and the performance of higher education institutions in Azerbaijan. The research employs a bibliometric analysis using data from international databases such as Scopus and SciVal, focusing on key metrics including publication count, citation count, h-index, Field-Weighted Citation Impact (FWCI), and collaboration patterns. The results show that Azerbaijani universities have significantly increased their scientific output, with a notable 27% surge in publications in 2024 alone. While the overall FWCI (1.34) indicates above-average citation performance globally, challenges persist, including limited academic-industry collaboration and an overemphasis on quantitative indicators at the expense of qualitative assessments. The study highlights the need for national guidelines on responsible metric use and recommends capacity-building initiatives, interdisciplinary collaboration, and diversified evaluation frameworks to enhance research quality and integrity. These findings are valuable for policymakers, university administrators, and researchers seeking to align Azerbaijan's research ecosystem with international standards while addressing local needs and priorities.*

Keywords: Scientometric evaluation, Azerbaijani higher education, research impact, academic collaboration, citation analysis

1.INTRODUCTION

In contemporary times, the monitoring and analysis of scientific indicators have become a significant methodological approach, maintaining its relevance in contemporary academic and policy discourse. Specifically, the evaluation of scientific performance across countries and the provision of statistical accountability have emerged as critical issues. Ensuring such accountability enables the establishment of strategic target plans, facilitates tracking the pace of development, and provides a foundation for building an effective model for organizing and managing new scientific activities, based on the results derived from these indicators.

The positive evolution of scientific indicators clearly reflects the influence of science on the social and moral development of society. Over the past decade, scientometrics, the field focused on the calculation of scientific indicators, has increasingly relied on precise mathematical computations, statistical analyses, and indexing systems. The key evaluation

parameters commonly employed include the Number of Publications, Number of Citations, Citations per Publication (C/P), Field-Weighted Citation Impact (FWCI), Collaborations, Top 10% Citation Percentile, Top 10% Journal Percentile, Source Normalized Impact per Paper (SNIP), Journal Rank, SDG's among others. In its essence, scientometrics is a field that examines the evolution and current state of science, encompassing the structure and dynamics of scientific activity, the flow and mass of scientific information, through various mathematical-statistical analyses and both quantitative and qualitative indicators.

Furthermore, it is important to highlight that, The United Nations Sustainable Development Goals (SDGs) serve as a global roadmap to address critical challenges and build a more equitable and sustainable future (United Nations, 2015). Universities play a multifaceted role in advancing these goals and are key actors in promoting social change.

Firstly, through education and awareness, universities equip students with the principles of sustainable development, preparing them to become responsible global citizens (Leal Filho et al., 2018, pp. 112–129). Additionally, academic institutions conduct research addressing major SDG targets such as climate change, poverty reduction, renewable energy, public health, and gender equality, providing innovative solutions to global challenges (Sachs et al., 2022, pp. 805–814). Universities also collaborate with local and international partners to implement SDG-related projects and social initiatives, contributing to inclusive and sustainable community development (Findler et al., 2019, pp. 59-73). Finally, by adopting sustainable practices within institutional governance and operations—such as energy efficiency, waste reduction, and promoting diversity and equity—universities work towards creating sustainable campuses (Lozano et al., 2015, pp. 10–19).

This context highlights the importance of SDGs in universities' research and strategic development and provides a foundation for exploring their role within the academic environment in Azerbaijan.

Generally, scientometric indicators have become indispensable tools in evaluating research productivity and impact across academic institutions worldwide. In Azerbaijan, where higher education institutions are increasingly integrated into global academic networks, understanding the implications of these indicators is essential for policy development, institutional strategy, and performance assessment.

Research Gap: While scientometric indicators have been widely adopted globally, there is a lack of systematic research assessing their application, interpretation, and strategic use in Azerbaijani universities. In particular, there is a need to explore how local academic institutions utilize these indicators for policy development, strategic planning, and quality assessment.

Objective: This article aims to provide a comprehensive and contextual evaluation of the impact of scientometric indicators on Azerbaijani universities, addressing both quantitative and qualitative dimensions.

Research Question: How do Azerbaijani universities currently apply scientometric indicators, and what are the implications and limitations of these indicators in shaping institutional strategy, performance assessment, and sustainable development?

Drawing from international literature and local data sources, this article analyzes the current scientometric performance of key institutions, evaluates the potential and limitations of commonly used indicators, and proposes a general evaluative approach tailored to Azerbaijan's

academic context. Finally, the study presents recommendations for policy improvements and strategic planning to guide future developments.

Additionally, scientometric indicators play a pivotal role in assessing the performance of academic institutions, researchers, and publications (Bornmann & Marx, 2014, pp. 1228–1232). Metrics such as citation counts, h-index, Field-Weighted Citation Impact (FWCI), and journal impact factors now inform decisions regarding funding, promotion, and institutional rankings. In Azerbaijan, the emphasis on scientific output has intensified in response to national development goals and participation in global education frameworks (UNESCO, 2021). However, the integration and interpretation of scientometric indicators within local academic policy remains an underdeveloped area.

2.METHODS
2.1. Overview of Scientometric Indicators

Scientometric indicators serve to quantify the output, impact, and visibility of scholarly research. These metrics provide valuable insights into research productivity and influence, and commonly include:

- ✓ *Publication count:* This metric measures the productivity of research output.
- ✓ *Citation count:* Reflects the influence and impact of publications within the academic community.
- ✓ *h-index:* A metric that combines both research productivity and citation impact, as introduced by Hirsch (Hirsch, 2005. pp. 16569–16572).
- ✓ *Field-Weighted Citation Impact (FWCI):* This indicator compares the actual citations received by a publication to the expected citations within the same field.
- ✓ *Source Normalized Impact per Paper (SNIP) & SCImago Journal Rank (SJR):* These metrics normalize journal impact based on the subject field and citation behavior.
- ✓ *The United Nations Sustainable Development Goals (SDGs):* assess the impact of scientific activity on society's sustainable development and to strengthen the role of science in building a more sustainable and equitable future.

Globally, such indicators are widely employed by organizations such as QS, Times Higher Education (THE), and Scimago to rank universities and influence public perceptions of academic institutions. However, the application of these metrics without a proper contextual understanding can result in unintended strategic behaviors. For example, excessive focus on publication quantity, publishing in predatory journals, or misinterpreting indicators of quality can undermine the integrity of academic work (Moher, Naudet, Cristea et al., 2018).

2.2. Data Sources and Sample

This study focuses on universities in Azerbaijan that are included in global databases such as Scopus and Web of Science. Data were collected on key scientometric indicators (publication count, citation count, h-index, FWCI, SNIP, SJR, SDG) for the period [2019–2025]. The sample includes the top 4 universities with the highest research output based on available data.

2.3. Data Collection Procedure

EVALUATING THE IMPACTS OF SCIENTOMETRIC INDICATORS: A GENERAL APPROACH TO AZERBAIJAN UNIVERSITIES

Data on scientometric indicators were extracted from Scopus and Web of Science databases using institutional affiliations. Data cleaning procedures included checking for duplicate records, verifying author affiliations, and standardizing institutional names to ensure consistency.
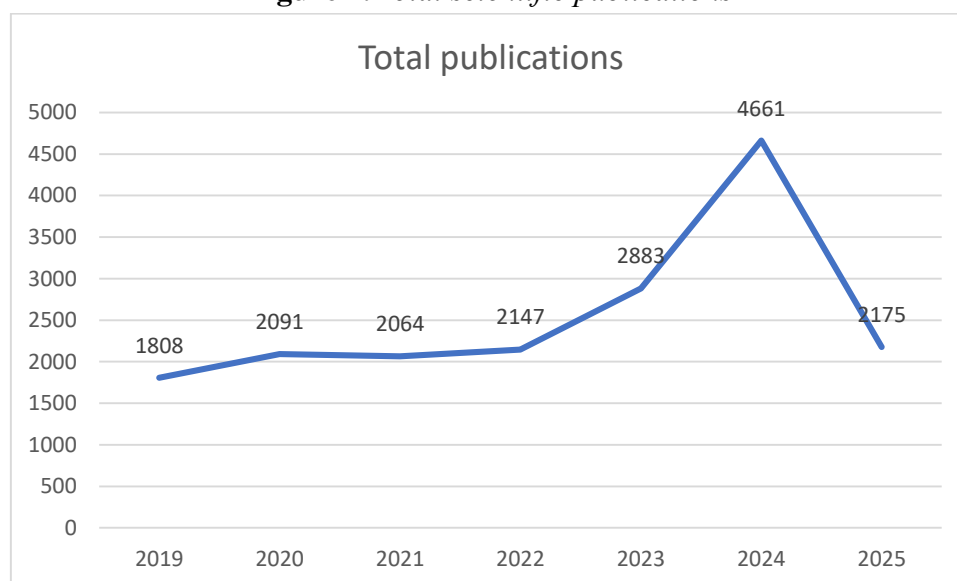
2.4. Analytical Approach

Descriptive statistics were used to summarize the main scientometric indicators for each university. Comparative analyses were performed to assess differences in research output and impact among institutions. Additionally, potential limitations of these indicators in the Azerbaijani context were identified through qualitative analysis of institutional research policies and national higher education strategies.

RESULTS

According to SciVal, an analytical database based on Scopus, Azerbaijan produced 17,445 scientific publications over the past seven years, with 27% of these published in 2024 alone, indicating a recent surge in research output (Figure 1).
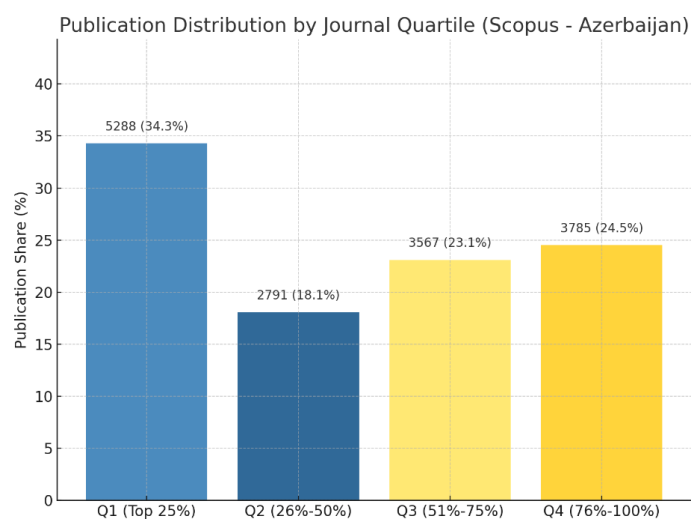
Figure 1. *Total scientific publications*

Source: Prepared by the author

Over the past seven years, scientific publications affiliated with institutions in Azerbaijan and indexed in the Scopus database have accumulated a total of 157,278 citations. The average Field-Weighted Citation Impact (FWCI) for these publications stands at 1.34, indicating that Azerbaijani research outputs perform above the global average in terms of citation impact. Furthermore, 1,929 publications (approximately 11.2%) are among the most highly cited research outputs globally, while 2,852 publications (18.5%) appear in the top 10% of journals ranked by CiteScore metrics. These figures demonstrate both the growing global visibility of Azerbaijani research and the increasing quality of its scholarly output (Figure 2).
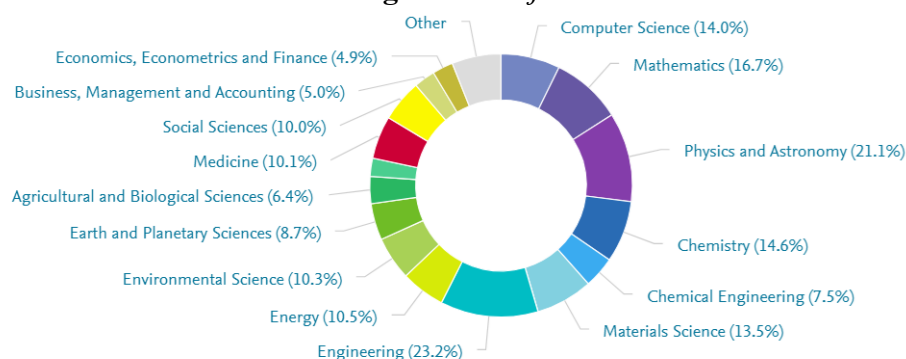
Figure 2. *Journal Quartile*

Publication Distribution by Journal Quartile (Scopus - Azerbaijan)

Source: Prepared by the author

The scientific journals in which Azerbaijani researchers have most frequently published include Azerbaijan Medical Journal, Lecture Notes in Networks and Systems, Azerbaijan Chemical Journal, and SOCAR Proceedings, among others.

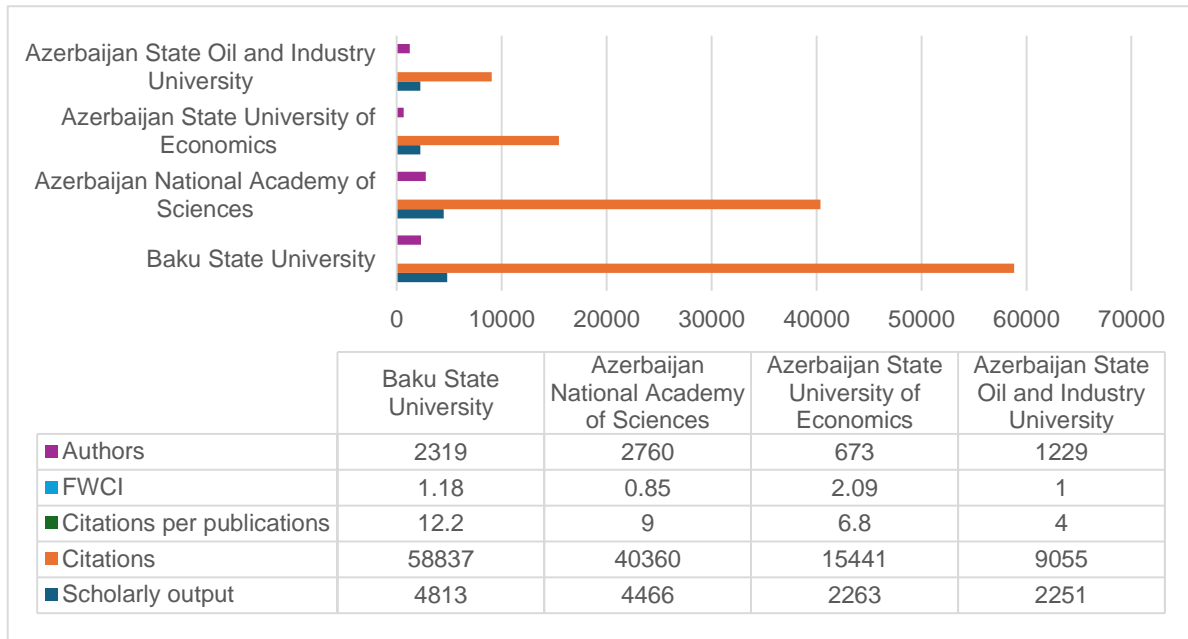**Figure 3**. *Subject Areas*

Source: SCIVal database

As illustrated in the figure, most scientific publications authored by Azerbaijani researchers are concentrated in the fields of Engineering, Physics and Astronomy, Mathematics, Chemistry, and Computer Science (Figure 3).

Azerbaijan has made strides in modernizing its higher education system, especially in scientific research. Universities such as Baku State University, Azerbaijan State Economic University (UNEC), and Khazar University are increasingly visible in international databases like Scopus and Web of Science (Elsevier, 2022).

Currently, thirty research and higher education institutions in Azerbaijan have institutional profiles in the Scopus database. Over the past seven years, the Azerbaijan National Academy of Sciences ranks first in terms of the number of authors, Baku State University leads in the number of scientific publications and citations, Azerbaijan State University of Economics is first according to the Field-Weighted Citation Impact (FWCI), and Khazar University ranks highest in the citations per publication indicator (Figure 4).

Figure 4. *Trends in the metric indicators of Azerbaijan's leading research and higher education institutions*

	Baku State University	Azerbaijan National Academy of Sciences	Azerbaijan State University of Economics	Azerbaijan State Oil and Industry University
■ Authors	2319	2760	673	1229
■ FWCI	1.18	0.85	2.09	1
■ Citations per publications	12.2	9	6.8	4
■ Citations	58837	40360	15441	9055
■ Scholarly output	4813	4466	2263	2251

Source: Prepared by the author

In recent years, there has been a noticeable rise in Azerbaijan's scientometric indicators. One of the main contributing factors is the financial support of the Ministry of Finance of the Republic of Azerbaijan and the organizational support of the Ministry of Science and Education of Azerbaijan, which have enabled country-wide subscriptions to leading global scientometric databases and the regular monitoring of these results.

Universities are not only centers of teaching and research but also key actors in driving progress toward the SDGs by fostering knowledge, innovation, and social responsibility. Azerbaijani universities contribute to Sustainable Development Goals (SDGs) through scholarly output, with Good Health and Well-being (SDG 3) showing the highest number of publications and citations over the past seven years (Table 1)

Table 1. *Azerbaijan's SDG indicators*

SDG	Scholarly Output	Field-Weighted Citation Impact	Citation Count
SDG 1: No Poverty (2025)	128	2.73	1,514
SDG 2: Zero Hunger (2025)	306	4.06	2,915
SDG 3: Good Health and Well-being (2025)	1,229	3.91	57,289
SDG 4: Quality Education (2025)	211	2.41	7,948
SDG 5: Gender Equality (2025)	58	1.86	1,226
SDG 6: Clean Water and Sanitation (2025)	245	3.22	1,629
SDG 7: Affordable and Clean Energy (2025)	1,195	2.22	10,069
SDG 8: Decent Work and Economic Growth (2025)	1,098	2.26	7,859
SDG 9: Industry, Innovation and Infrastructure (2025)	885	1.81	4,592
SDG 10: Reduced Inequality (2025)	294	1.88	3,318

SDG	Scholarly Output	Field-Weighted Citation Impact	Citation Count
SDG 11: Sustainable Cities and Communities (2025)	340	1.06	1,399
SDG 12: Responsible Consumption and Production (2025)	503	2.14	9,664
SDG 13: Climate Action (2025)	719	2.59	9,646
SDG 14: Life Below Water (2025)	163	0.68	599
SDG 15: Life on Land (2025)	202	1.45	1,267
SDG 16: Peace, Justice and Strong Institutions (2025)	182	1.87	1,063
Total	4,734	2.27	77,876

Source: Prepared by the author

Collaboration in scientific research is a key indicator of academic integration and influence. According to the Scopus database, a significant portion of Azerbaijan's scientific output over the last seven years demonstrates active international collaboration. Approximately 53% of the publications involve co-authorship with researchers from other countries, reflecting an increasing trend toward global academic engagement. The most frequent collaborating countries include Turkey, Russia, the United States, the United Kingdom, and Germany. These partnerships have notably contributed to the visibility and citation impact of Azerbaijani research, as evidenced by a higher Field-Weighted Citation Impact (FWCI) of 1.34, which exceeds the global average. The emphasis on collaborative projects, particularly with institutions ranked in the top quartiles (Q1 and Q2), indicates a strategic shift toward improving research quality and global academic standing.

An analysis of collaboration patterns in Azerbaijani scientific publications indexed in Scopus over the last seven years reveals that only 16.7% of publications involved national collaboration (between institutions within Azerbaijan), while 12.7% were limited to intra-institutional collaboration (authors from the same institution). Notably, 17.5% of the publications were single-authored, indicating no form of collaboration. These figures suggest that while international collaboration remains the dominant mode of scientific production, internal cooperation within the country and between domestic institutions is relatively limited and may require targeted policy intervention to strengthen national research networks.

Despite increasing efforts to internationalize scientific activity, the integration of academic research with industry remains minimal in Azerbaijan. According to data retrieved from the Scopus analytical tool SciVal, only 3.2% of scientific publications from Azerbaijani institutions over the last seven years involved academic-corporate collaboration, while a dominant 96.8% of the output was produced without any industrial or corporate partnership. This data highlights a significant gap between academia and industry, suggesting the need for policies and incentives aimed at fostering stronger university-industry linkages. Academic-corporate collaborations are essential for the practical application of research outcomes, innovation, and commercialization. The underrepresentation of such partnerships may limit the country's capacity to convert research into tangible socio-economic benefits.

DISCUSSIONS/CONCLUSIONS

This study highlights a significant research gap: While scientometric indicators have been widely adopted globally, there is a lack of systematic research assessing their application, interpretation, and strategic use in Azerbaijani universities. In particular, there is a need to explore how local academic institutions utilize these indicators for policy development, strategic planning, and quality assessment (Hicks et al., 2015, pp.429-431; San Francisco Declaration on Research Assessment [DORA], 2013).

The analysis revealed that Azerbaijani universities have increasingly integrated into international scientometric databases, demonstrating notable achievements in scholarly output and citation impact. However, these gains have often been accompanied by challenges stemming from an overemphasis on quantitative metrics (Moed, 2005, pp.247-257; Abramo, D'Angelo, & Di Costa, 2019, pp. 920-936). As the objective of this article states—to provide a comprehensive and contextual evaluation of the impact of scientometric indicators on Azerbaijani universities, addressing both quantitative and qualitative dimensions—it becomes evident that current practices require a more balanced approach (Hicks, 2012, 251-264; Moed et al., 2019, pp. 837-862).

In addressing the research question—How do Azerbaijani universities currently apply scientometric indicators, and what are the implications and limitations of these indicators in shaping institutional strategy, performance assessment, and sustainable development?—the findings suggest that while Azerbaijani institutions use scientometric indicators for visibility and performance benchmarking, several limitations persist:

Limited academic-industry collaboration: Only 3.2% of scientific publications involve corporate partnerships, hindering the translation of research into practical applications.

Uneven international research partnerships: Despite a strong presence in global collaborations (53%), domestic collaboration remains low (16.7% national, 12.7% intra-institutional), which can fragment the national research landscape.

Overreliance on metric-driven publishing: A tendency to prioritize quantity over quality has led to academic inbreeding and potentially superficial publication strategies (Hicks, 2012, pp.251-265; Abramo et al., 2019, 920-936).

Low patent performance and minimal engagement with alternative impact frameworks (e.g., Altmetrics), highlighting a disconnect between institutional performance evaluation and broader societal and policy relevance (Sugimoto, Work, Larivière, & Haustein, 2017, pp. 2037-2062; Larivière, Sugimoto, & Tsou, 2015, pp. 1420-1435.).

To bridge these gaps and align with best practices, several strategic recommendations are proposed:

Formulate National Scientometric Guidelines: Azerbaijani universities need comprehensive guidelines for the responsible use of research metrics, drawing from frameworks like the San Francisco Declaration on Research Assessment (DORA) and the Leiden Manifesto. These guidelines should emphasize multidimensional research quality rather than narrow quantitative targets (Hicks et al., 2015, pp.429-431; San Francisco Declaration on Research Assessment [DORA], 2013)..

Strengthen Research Training and Capacity Building: Systematic investments in researcher development—including training in publication ethics, journal selection strategies,

and impact measurement—are essential to align with global standards and foster integrity (Moed, 2005, pp.247-257).

Foster Interdisciplinary and Collaborative Research: Incentivizing interdisciplinary and international collaborations, especially with high-impact institutions, can enhance innovation and global competitiveness. This approach aligns with SDG targets and broadens the societal impact of research (OECD, 2021).

Diversify Evaluation Metrics: Adopting a balanced evaluation framework that incorporates both quantitative and qualitative indicators—such as peer recognition, policy relevance, and societal impact—can shift the focus from metric-driven publishing to meaningful scientific contributions (Hicks, 2012, 251-264; Moed et al., 2019, pp. 837-862).

Overall, scientometric indicators can serve as powerful tools in advancing academic excellence in Azerbaijan. However, they should be applied thoughtfully and contextually to ensure that the academic system contributes not only to global competitiveness but also to local development and societal well-being. Establishing a transparent, nuanced, and nationally relevant approach to scientometric evaluation is essential for shaping institutional strategies, guiding performance assessments, and fostering sustainable research ecosystems.

REFERENCES

1. Bornmann, L., & Marx, W. (2014). How good is research really? Measuring the citation impact of publications with percentiles increases correct assessments and fair comparisons. *EMBO Reports, 15*(12), 1228–1232. https://doi.org/10.15252/embr.201439608
2. Elsevier. (2022). *Scopus database overview*. https://www.elsevier.com/solutions/scopus
3. Hicks, D., Wouters, P., Waltman, L., de Rijcke, S., & Rafols, I. (2015). The Leiden Manifesto for research metrics. *Nature, 520*(7548), 429–431. https://doi.org/10.1038/520429a
4. Hirsch, J. E. (2005). An index to quantify an individual's scientific research output. *Proceedings of the National Academy of Sciences, 102*(46), 16569–16572. https://doi.org/10.1073/pnas.0507655102
5. Moher, D., Naudet, F., Cristea, I. A., Miedema, F., Ioannidis, J. P. A., & Goodman, S. N. (2018). Assessing scientists for hiring, promotion, and tenure. *PLOS Biology, 16*(3), e2004089. https://doi.org/10.1371/journal.pbio.2004089
6. Elsevier. (2024). *SciVal - Research Performance Analysis Tool*. Retrieved from https://www.scival.com
7. UNESCO. (2021). *Higher education in Azerbaijan: Trends and challenges*. https://unesdoc.unesco.org/
8. Findler, F., Schönherr, N., Lozano, R., & Stacherl, B. (2019). Assessing the impacts of higher education institutions on sustainable development—An analysis of tools and indicators. *Sustainability*, 11(1), page 59-73. https://doi.org/10.3390/su11010059
9. Leal Filho, W., Manolas, E., & Pace, P. (2018). The future we want: Key issues on sustainable development in higher education after Rio+20. *International Journal of Sustainability in Higher Education*, 16(1), 112–129. https://doi.org/10.1108/IJSHE-03-2013-0020

10. Lozano, R., Lukman, R., Lozano, F. J., Huisingh, D., & Lambrechts, W. (2015). Declarations for sustainability in higher education: Becoming better leaders, through addressing the university system. *Journal of Cleaner Production*, 48, 10–19. https://doi.org/10.1016/j.jclepro.2011.10.006

11. Sachs, J., Schmidt-Traub, G., Mazzucato, M., Messner, D., Nakicenovic, N., & Rockström, J. (2022). Six transformations to achieve the Sustainable Development Goals. *Nature Sustainability*, 2(9), 805–814. https://doi.org/10.1038/s41893-019-0352-9

12. United Nations. (2015). *Transforming our world: The 2030 Agenda for Sustainable Development*. https://sdgs.un.org/2030agenda

13. San Francisco Declaration on Research Assessment (DORA). (2013). *American Society for Cell Biology*. Retrieved from https://sfdora.org/read/

14. Moed, H. F. (2005). *Citation Analysis in Research Evaluation*. Springer. Page 247-257 https://link.springer.com/book/10.1007/1-4020-3714-7?page=1#toc

15. Abramo, G., D'Angelo, C. A., & Di Costa, F. (2019). National research assessment exercises: A comparison of peer review and bibliometrics rankings. *Journal of Informetrics*, 13(3), page 920-936. https://doi.org/10.1016/j.joi.2019.05.002

16. Glänzel, W., & Schoepflin, U. (1999). A bibliometric study of reference literature in the sciences and social sciences. *Information Processing & Management*, 35(1), 31-44. https://doi.org/10.1016/S0306-4573(98)00044-2

17. Larivière, V., Sugimoto, C. R., & Tsou, A. (2015). Big data bibliometrics: Issues and opportunities. *Journal of the Association for Information Science and Technology*, 66(7), 1420-1435. https://doi.org/10.1002/asi.23309

18. Hicks, D. (2012). Performance-based funding for public research: A review of international practice. *Research Policy*, 41(2), 251-264. https://doi.org/10.1016/j.respol.2011.09.003

19. Moed, H. F., Colledge, L., Reedijk, J., Moya-Anegón, F., Guerrero-Bote, V., Plume, A., & Amin, M. (2019). Citation-based metrics are appropriate tools in journal assessment provided that they are accurate and used in an informed way. *Scientometrics*, 118(2), 837-862. https://doi.org/10.1007/s11192-018-2969-2

20. Sugimoto, C. R., Work, S., Larivière, V., & Haustein, S. (2017). Scholarly use of social media and altmetrics: A review of the literature. *Journal of the Association for Information Science and Technology*, 68(9), 2037-2062. https://doi.org/10.1002/asi.23833

21. OECD (2021). *The State of Higher Education 2021: Innovation, Impact and Inclusive Growth*. OECD Publishing. https://doi.org/10.1787/dae9c4e1-en