A Comprehensive Framework for Assessing Scientific Research Effectiveness Among Academic and Research Staff

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Abstract: This paper addresses the crucial task of devising comprehensive criteria and indicators for evaluating the effectiveness of pedagogical research conducted by academic and research staff in higher education institutions (HEIs). Four major assessment criteria are identified: publication and dissemination, utilization, impact on the academic community, and representation-scientific. Each criterion is further broken down into specific indicators, including involvement in project competitions, scientific publications in reputable journals and conference proceedings, indices and citations in various databases, altmetric indicators such as electronic repositories and social media engagement, expert involvement in academic and research activities, and attainment of academic titles and honors. The classification of these criteria provides a systematic framework for assessing the multifaceted aspects of pedagogical research effectiveness. Further research prospects involve assigning weight coefficients to these criteria and developing a methodology that integrates digital technologies to streamline the assessment process.

1 INTRODUCTION

The Higher Education Development Strategy in Ukraine for 2021-2031 identifies "low levels of motivation, including compensation for the work of teachers and university staff" as one of the weaknesses of higher education (Strategy, 2020). The need for developing a "national system for rating the activities of HEIs" is emphasized. One of the most common approaches underlying the assessment of the performance of academic and research staff (ARS) is based on utilizing indicators obtained from bibliographic databases such as Scopus, Web of Science, and Google Scholar. This approach is driven by the clear interdependence between data from these databases, institutional positions in domestic and international rankings (Times Higher Education World University Rankings, QS World University Rankings, Transparent Ranking, Ranking Web, Webometrics, Top-200 Ukraine based on Scopus bibliometric indicators, Consolidated Ranking of Ukrainian HEIs), as well as institutions' funding.

Morze et al. (2022) have developed a structural-functional model of a ranking system to analyze the research activities of university lecturers, considering research and digital competencies. This model is built on key indicators for research effectiveness, including citation indicators from three major bibliographic databases: Scopus, Web of Science, and Google Scholar.

However, academic and research staff engage in a variety of activities beyond research publica-

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tions. A more comprehensive approach to evaluating ARS performance has been proposed at Kryvyi Rih State Pedagogical University. The ARS ranking is constructed by considering data such as: articles indexed in Scopus, Web of Science, foreign journals, and professional journals indexed by Index Copernicus; domestic/foreign monographs (single-authored/collaborative); research projects (domestic/foreign funded by the state budget of Ukraine or grants from foreign entities); winners of the All-Ukrainian competition of student research papers/All-Ukrainian Olympiads; international competitions and Olympiads (participation/winners); mobility (EU international programs, exchanges, advanced training courses, internships); participation in conferences and events abroad (with presentations); research and cultural projects without funding (in Ukraine/abroad); patents, technology implementation, authorship certificates; state budget-funded research topics; PhD thesis defenses; academic title attainment; training higher-qualified personnel (PhD defenses); international contacts, cooperation, signed cooperation agreements; dual degrees; membership in editorial boards of journals indexed by Scopus or Web of Science; professional publications indexed in bibliographic databases; academic schools; research centers, laboratories, etc. (Order, 2021; Vakaliuk et al., 2022).

2 LITERATURE REVIEW

Let's begin by examining studies dedicated to the assessment of the performance of ARS based on publication indicators. For instance, Moral-Muñoz et al. (2020) emphasize the significance of scientometrics as a crucial tool for evaluating and analyzing the outcomes not only of individual researchers but also of collaborations between institutions. They point out its role in understanding the influence of state funding on research outcomes. Among the frequently used criteria, the quantity of papers and the h-index (derived from various bibliographic databases like Scopus, Web of Science, Google Scholar) remain prominent. Masic and Begic (2016) explored quantitative indices (indicators) of research success and identified four indices: the number of papers, journal impact factor, authorship order and quantity, and citation count. Bykov et al. (2021) and Vakaliuk et al. (2021b) analyze the correlation between institutional rankings and metrics from bibliographic databases as well as the development of individual ARS rankings using such data.

In recent times, as a supplement and/or alternative to bibliometric data, alternative metrics, or "altmetrics," have gained attention for evaluating ARS performance. Altmetrics are based on measuring the impact and popularity of research and researchers using data from various social, professional, and online platforms. Altmetrics serve as a complement or alternative to traditional bibliometric metrics such as citations in scholarly journals.

Altmetric indicators encompass a wide range of data that can be used to gauge the impact of research:

1. *Views*: the number of views on scientific articles, presentations, or other scientific materials. This indicator reflects general interest in the research and its accessibility.
2. *Discussions*: the quantity of comments, discussions, or debates related to a scientific article or other research materials. This indicator represents the level of activity and interaction within the scientific community concerning the research.
3. *Saves*: the number of times research has been saved or added to users' "favorites" on a given platform. This indicator indicates interest in saving and later using the research.
4. *Citations*: the number of references to the research in scholarly articles, books, or other academic sources. This indicator is considered a fundamental measure of scientific impact and citation.
5. *Recommendations*: the number of recommendations (likes) that research has received on social media or other platforms. This reflects the satisfaction or endorsement of the research by the community.

Altmetric indicators can be obtained from various sources, including academic social networks such as ResearchGate and Twitter, as well as specialized platforms that collect data on research articles and their impact, such as Altmetrics Explorer. For instance, Singh et al. (2022) examined altmetric data from the ResearchGate network, a popular professional network for researchers. Similar to Google Scholar, ResearchGate indexing involves an automated scanning algorithm that provides bibliographic data, citations, and other information about research articles from various sources. Wiechetek and Pastuszak (2022) also analyzed the use of ResearchGate metrics and compared them to metrics from the Academic Ranking of World Universities. Although not directly addressing the participation of ARS in editorial boards, these studies highlight the importance of leveraging social networks for promoting research achievements and enhancing visibility within the academic community. Cao et al. (2022) suggested using Twitter as a source

of altmetric data. Shirazi and Valinejadi (2021) compared altmetric indicators from the Altmetrics Explorer system with citation quality metrics from Clarivate Analytics, Scopus, and Medline. Based on their findings, they recommended that journal editors ensure their presence on social networks.

Integrating altmetric indicators can help researchers, academic journals, and institutions gain a more comprehensive understanding of the impact of their research, demonstrating their visibility and popularity within the scientific community. Given the widespread availability and use of social media, altmetrics increasingly serve as a vital tool for measuring research impact and communication.

Other indicators mentioned in (Order, 2021) have not been as extensively investigated. For instance, assessing ARS performance based on project activities and the preparation of winners of student research paper competitions and All-Ukrainian Olympiads, which are also considered in constructing domestic rankings (Top 200 Ukraine, Consolidated Ranking of Ukrainian HEIs), is discussed in (Vakaliuk et al., 2022).

Currently, few works directly investigate the participation of ARS in editorial boards and roles as reviewers, experts, or other functional positions in scientific journals. However, some studies touch on this topic and provide partial recommendations. Salinas et al. (2020) tackled reviewer selection issues and introduced the ReviewerNet system, an online interactive visualization tool designed to enhance the reviewer selection process in the academic sphere. Although not directly focused on ARS involvement in editorial boards, it could serve as a valuable instrument for improving reviewer selection and evaluation processes. Yu et al. (2021) examined the link between organizational support and job burnout among academic journal editors, providing insights into factors impacting effectiveness and satisfaction among editors in their roles. Additionally, Xu et al. (2021) identified challenges faced by academic journal editors and their underlying reasons. This information can be valuable for understanding the context in which ARS engage in editorial boards and provide a contextual foundation for future studies on this topic.

Despite some existing research highlighting approaches to assessing ARS performance, criteria and indicators for such evaluations remain underdeveloped.

3 RESULTS

The analysis of the scientific activities of ARS at higher education institutions and research institutions allowed us to identify the relevant criteria and indicators for evaluating the performance of pedagogical research. Building upon previous research experience, each criterion includes from 3 to 7 indicators (Spirin and Vakaliuk, 2017):

- *Project-Competition Criterion*: preparation for project competitions; participation in projects; preparation of students for participation in student research competitions;
- *Scientific-Publication Criterion*: publications in journals indexed in bibliographic databases such as Web of Science, Scopus; publications in conference proceedings indexed in Web of Science, Scopus; publications in specialized scientific journals in Ukraine; publications in international periodicals and conference proceedings; publications in Ukrainian scientific journals not included in the list of specialized publications and publications in domestic conference materials; publication of monographs in Ukraine / international publications; publication of educational manuals or textbooks; supervision of students publishing research results in various publications;
- *Scientometric Criterion*: indexing in Scopus / Web of Science / Google Scholar; citations in Scopus / Web of Science / Google Scholar;
- *Altmetric Criterion*: electronic libraries, repositories; electronic portfolio; number of downloads; number of views; social media dissemination;
- *Expert Criterion*: participation as a reviewer / expert / opponent in PhD thesis; participation in various commissions, expert councils under the Ministry of Education and Science (including project selection), National Academy of Pedagogical Sciences of Ukraine (NAPN), The National Research Foundation of Ukraine (NRFU); editor-in-chief / deputy editor-in-chief / editorial board member of a professional journal; involvement in conference organization;
- *Representative-Scientific Criterion*: PhD thesis defense; academic title attainment; honorary title attainment; awards / distinctions / prizes / scholarships; supervision of a graduate student who defended a PhD thesis; participation in international internships; foreign language proficiency at the B2 level.

We will describe each criterion and explore all the indicators in more detail.

Project-Competition Criterion involves evaluating the performance of pedagogical research within participation in contests and projects, including:

1. The "Preparation for project competitions" indicator assesses the researcher (whether ARS or research staff) based on the number of projects prepared for participation in competitions. The assessment period can range from 1 to 5 years. This is related to the fact that clause 38 of the Licensing Conditions for Educational Activities requires consideration of different types of activities over 5 years, while the contract between the institution and the employee may be signed for only 1 year or 2 years, and so on. This clarification applies to all indicators and criteria described in this paper.
2. The "Participation in projects" indicator accounts for the researcher's participation in projects as a simple performer, principal performer, or project leader. If the researcher participates in multiple projects simultaneously, this is also considered. This indicator can be taken into account if the researcher participates not only in ministerial projects but also in international ones.
3. The "Preparation of students for participation in student research competitions" indicator stipulates that ARS prepare students to participate in nationwide and international competitions of various levels, including private competitions (e.g., Zavtra.Ua).

Scientific-Publication Criterion encompasses the evaluation of performance within the realm of publication activity, which includes the following indicators:

1. Publications in journals indexed in bibliographic databases such as Web of Science, Scopus – this indicator entails having a certain number of publications in the specified journals.
2. Publications in conference proceedings indexed in bibliographic databases such as Web of Science, Scopus – this indicator differs from the previous one in that it refers to articles published in books or conference journals (Proceeding Journals), which are also indexed in the mentioned databases. Such articles in the Scopus database are referred to as proceeding papers, although they don't significantly differ from full-fledged articles.
3. Publications in specialized scientific journals in Ukraine – this indicator entails having articles published in journals listed as specialized publications approved by the Ministry of Education and Science of Ukraine.
4. Publications in international periodicals and conference proceedings – although this indicator may not hold considerable value, in some HEIs, it is a mandatory clause in contracts. This indicator includes publications not covered by the first two indicators. While this point may seem less valuable, the number of publications in the international community also contributes to a researcher's status, even if not in bibliographic databases like Scopus or Web of Science, at least in Google Scholar. Not all educational institutions and research establishments have subscribed access to the mentioned databases to explore the research output of a specific researcher, thus making these indicators relevant.
5. Publications in Ukrainian scientific journals not included in the list of specialized publications and publications in domestic conference materials – this indicator also combines two aspects, encompassing publications in sources not covered by the previous indicators.
6. Publication of monographs in Ukraine / international publications – publishing a monograph serves as a culmination of work on a specific topic, hence its publication is one of the indicators.
7. Publication of educational manuals or textbooks – this indicator is particularly important for ARS, as the presence of such publications is significant both for teaching activities and for meeting licensing requirements.
8. Supervision of students publishing research results in various publications – this indicator is designed for ARS who guide student research work, resulting in publications by students in various sources.

Scientometric Criterion involves evaluating the performance of ARS and researchers in institutions of higher education and research establishments based on indexing and citation in various scientometric databases, including:

1. "Indexing in Scopus / Web of Science / Google Scholar" indicators involves considering the researcher's h-index according to the corresponding bibliographic database.
2. "Citations in Scopus / Web of Science / Google Scholar" – these indicators entails determining the total number of citations in the corresponding bibliographic database.

Altmetric Criterion involves evaluating the performance of HEI's research and academic staff (RAS) based on other equally important indicators:

1. "Electronic Libraries, Repositories" indicator entails assessing the completeness of electronic libraries of research establishments and HEIs with all published works.
2. "Electronic Portfolio" indicator entails having a well-maintained personal electronic portfolio (Vakaliuk et al., 2021a).
3. "Number of Downloads" indicator takes into account the number of downloads of research works from repositories and electronic libraries. This indicator should be considered cumulatively for all of the author's publications simultaneously.
4. "Number of Views" indicator similarly to the previous one involves considering the total number of views of all of the author's publications in a repository or electronic library.
5. "Social Media Outreach" indicator involves having a presence on social media platforms and disseminating one's research activity through them. This indicator is evaluated for specific social media platforms like Facebook, LinkedIn, etc.

Expert Criterion is no less important than the previous ones, as it considers the researcher's involvement in various expert roles, including:

1. Involvement as a reviewer / expert / opponent for PhD thesis – this indicator entails the participation of RAS or researchers in these roles during the defense a PhD thesis.
2. Participation in various committees, expert councils under the Ministry of Education (including project selection) – this indicator involves participating in different expert councils or Accreditation Commissions:
   - Expert Council for Dissertation Examination of the Ministry of Education and Science;
   - Branch Expert Council as an expert of the National Agency for Quality Assurance in Higher Education;
   - Expert commissions of the Ministry of Education and Science or the National Agency for Quality Assurance in Higher Education;
   - Interbranch Expert Council on Higher Education of the Accreditation Commission;
   - Accreditation Commission;
   - Scientific and Methodological Council;
   - Scientific and Methodological Commissions (subcommissions) on higher or specialized postgraduate education of the Ministry of Education and Science;
   - Scientific or scientific-methodical or expert councils of state authorities and local self-government bodies;
   - State Service for Quality of Education for conducting planned (unscheduled) measures of state supervision (control), etc.
3. Editor-in-Chief / Deputy Editor-in-Chief / Editorial Board Member of a specialized journal – this indicator involves actual participation in one of these roles for specialized journals in Ukraine;
4. Participation in conference organization – this indicator involves participating in the organization of conferences of various levels as a program committee member or reviewer, which enhances the researcher's professional level.

Representational-Scientific Criterion is a criterion that involves assessing the performance of HEI researchers and scientific personnel based on specific achievements:

1. "PhD Thesis Defense" involves the presence of a defended PhD thesis (for obtaining a doctoral or candidate of science degree) within the reporting period.
2. "Attainment of Academic Title" involves the acquisition of a diploma confirming an academic title (again, within the period specified by the institution or educational establishment).
3. "Attainment of Honorary Title" involves the conferment of an honorary title on a researcher as provided by the Ministry of Education and Science of Ukraine.
4. "Receipt of Awards / Honors / Prizes / Scholarships" entails researchers receiving various awards, prizes, etc., as stipulated by the Ministry of Education and Science of Ukraine, the Cabinet of Ministers of Ukraine, the Verkhovna Rada of Ukraine, etc.
5. "Supervision of a Defended PhD thesis" pertains to the presence of a defended PhD thesis under the guidance of the researcher. Additionally, this indicator can also encompass the supervision of a doctoral candidate's defense under the guidance of this personnel.
6. "Participation in International Internships" involves possessing a certificate of participation in international scientific or scientific-pedagogical internships once every 5 years.
7. "Proficiency in a Foreign Language at B2 Level" involves passing an examination to demonstrate proficiency in a foreign language (such as English, Polish, etc.) and obtaining the corresponding certificate.

All the identified criteria can be tentatively classified into criteria related to **publication and dissemi-**

nation (altmetric, scientific publication-related), **utilization** (scientometric, project competition-related), and **impact on the academic community** (expert-related, representational-scientific).

4 CONCLUSIONS AND PROSPECTS

The article substantiates the necessity of identifying criteria and indicators for assessing the effectiveness of pedagogical research conducted by academic and research staff.

The following criteria and corresponding indicators have been identified and described: project competition-related (preparation for project competitions; participation in projects; preparing students for participating in student research competitions); scientific publication-related (publications in journals indexed in Web of Science, Scopus; publications in conference proceedings indexed in Web of Science, Scopus; publications in domestic scientific journals; publications in international periodicals and conference materials; publications in domestic non-listed journals and conference materials; publication of monographs in domestic/international publications; publication of educational guides or textbooks; supervision of students publishing research outcomes in various publications); scientometric (indexing in Scopus; indexing in Web of Science; indexing in Google Scholar; citations in Scopus; citations in Web of Science; citations in Google Scholar); altmetric (electronic libraries, repositories; electronic portfolio; download count; view count; social media dissemination); expert-related (participation as a thesis reviewer/expert/opponent; involvement in different committees, expert councils under the Ministry of Education (including project selection); chief editor/deputy chief editor/editorial board member of a professional journal; participation in conference organization); representational-scientific (dissertation defense; attainment of academic titles; attainment of honorary titles; receipt of awards/honors/prizes/scholarships; supervision of a defending doctoral candidate; participation in international internships; proficiency in a foreign language at B2 level).

The identified criteria can be tentatively divided into those pertaining to publication and dissemination, utilization, and impact on the academic community.

The prospects for further research involve determining weight coefficients for the established criteria and indicators within HEIs and research institution personnel. Additionally, a methodology for employing information and digital technologies to assess the effectiveness of pedagogical research could be developed.

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