A Study on Research Performance Evaluation: A Systematic Literature Review

Shihan Zhang[1,2,*], Aida Hanim A. Hamid[1], Bity Salwana Alias[1]

[1]Faculty of Education, Universiti Kebangsaan Malaysia, Bangi, Selangor, MALAYSIA.
[2]Business School, Hunan Institute of Technology, Changsha, Hunan, CHINA.

ABSTRACT

Under the background of globalization and the knowledge economy, scientific and technological innovation is of vital importance for enhancing a country's scientific and technological innovation capacity, strengthening its comprehensive national strength and international competitiveness. This article aims to comprehensively summarize the existing research on scientific research performance evaluation and explore the methods and influencing factors. For this purpose, this article adopts the PRISMA method to systematically review 76 articles on scientific research performance evaluation published from January 2014 to December 2024. The research finds that, first of all, the quantitative research method is the most often used approach, followed by the qualitative research method, while the mixed research method is the least frequently utilized. Second, research performance evaluation indicators are diversifying, with researchers no longer relying just on publications as a criterion. Instead, they are placing more emphasis on factors such as collaboration between research teams, international cooperation, and multidisciplinary collaboration. Third, the research performance is influenced by researcher's academic proficiency, research interests, academic standing, work ethic, and career stage. Fourth, current academic circles tend to be result-oriented in research performance evaluation while neglecting the importance of process management and dynamic evaluation. This article comprehensively summarizes the research methods and their influencing factors in this field and provides insights for future research. Furthermore, this study also provides a reference for the scientific research achievements of research institutions to achieve sustainable economic growth and development.

Keywords: Scientific research performance, Performance evaluation, Systematic literature review.

INTRODUCTION

In recent years, the competition of scientific research is increasing, and the investment of scientific research institutions is increasing accordingly. How to evaluate scientific research performance scientifically, objectively and fairly has become a hot issue concerned by all circles. As an important subject of scientific research activities, investment in scientific research directly affects the effect and performance of scientific and technological innovation. In 2020, the General Office of the State Council, PRC issued (*the Plan for Deepening the Reform of Educational Evaluation in the New Era*), proposed "Enhancing the assessment of colleges and universities, advocating for categorized evaluation of colleges and universities, directing the strategic positioning of various kinds of colleges and universities, and fostering their

distinct features and standards." As an effective means of public administration management, performance management has long been introduced into the field of education in developed countries.

In 1979, the United States and the Netherlands introduced "performance funding" into the field of higher education as an important means of educational policy formulation, educational resource allocation, and education and teaching management. With the popularization, informatization and internationalization of higher education, research performance evaluation has become an important means to promote the management of higher education institutions and an indispensable part of the quality evaluation system of higher education. In general, the evaluation index system can effectively predict the future research performance of higher institutions.[1]

Performance evaluation promotes the development of scientific research. However, the development of scientific research also puts forward higher requirements for performance evaluation.[2] Carrying out research performance evaluation and improving

incentive and constraint mechanisms linked to quality, contribution, and performance will help stimulate the internal driving force and innovation vitality of research institutions, guiding research institutions to clarify development goals and achieve scientific development, promoting research institutions to contribute to economic and social development.

At present, there is a lack of systematic literature review on research performance evaluation.[3] The existing evaluation system focuses more on short-term results, such as publication and project conclusion, and lacks systematic research on the long-term contributions of researchers.[4] The research performance evaluation system often relies too much on quantitative indicators, such as the number of papers and citations, and ignores the importance of qualitative evaluation. The evaluation system focuses on academic achievements and neglects the contribution of scientific research to teaching and social services. In addition, the existing evaluation system is mostly static evaluation, lacking dynamic evaluation mechanisms, and cannot timely reflect the dynamic changes of researchers and research projects.

Based on this, this study has two research objectives: 1) To systematically review the evaluation methods, evaluation index, influencing factors, and improvement strategies of research performance. 2) To identify the shortcomings of current research and future research directions. According to the research objectives, four research questions were raised:

1. What are the research performance evaluation methods?

2. What are the indicators of research performance evaluation?

3. What are the factors that affect research performance?

4. What are the future research directions for research performance?

This study aims to systematically review the research progress on research performance in recent years, summarizing the main research methods, evaluation indicators, and influencing factors, identifying the main problems and gaps in current research, and proposing strategies for improving research performance and future research directions, to provide references for the practice and theoretical research on research performance evaluation. First, the study introduced literature retrieval and screening methods. Then, the study presented the research results, including the main research topics, influencing factors, and evaluation methods. Finally, the study discussed the research findings, research gaps, and future research directions and summarized the main conclusions.

LITERATURE REVIEW

In the early 19th century in Europe, Robert Owen of Scotland made the first application of performance evaluation in industry. Performance evaluation is a subsystem of the performance management system.[5] To carry out performance management, performance evaluation must be carried out first. Performance evaluation refers to the use of scientific and normative standards, methods, and procedures to evaluate the performance, efficiency, and actual effects of an organization or an individual as accurately as possible.[6] Performance evaluation is the core of performance management.

Research performance evaluation is a cognitive activity that uses scientific methods to judge the value of scientific research activities, and their input and output based on certain scientific research objectives, to manage, supervise, forecast, and regulate scientific research activities and provide the basis for scientific research decision-making.[7] At present, scholars have conducted a lot of effective exploration on the evaluation of research performance. Research output, impact of research results, research visibility, and social relevance are all factors considered in the measurement of institutional and individual research performance.

Research performance evaluation theory

Several researchers have examined the scientific validity and feasibility of implementing research performance evaluation by drawing on theories like new public management theory and knowledge production mode transformation.[8,9] Using the view of principal-agent theory and modern institutional economics, researchers have examined the basic structure, assessment framework, current challenges, and potential solutions for university research performance management.[10,11] From the managerial viewpoint, scholars have examined the extent to which "management" has been integrated into higher education, that is, a sector that requires significant public funding. This integration has been driven by the need for organizational redesigning and the necessity of performance measurement.[12]

Researchers have examined how research institutions and universities evaluate and manage their research performance using stakeholder theory. They have suggested including stakeholders in the evaluation and administration of research institutions and universities at a methodological level.[13] Scholars have conducted theoretical analysis and critical examination of the performance evaluation practice in China. They have demonstrated the logical reasoning behind implementing research performance evaluation based on ontology, politics, and practice. Furthermore, they have provided evidence that a well-designed performance evaluation system can accurately reflect the quality of university management.[14] Thus, it is urgent and essential to assess the reasonableness and feasibility of implementing research performance evaluation at scientific research institutions from a theoretical standpoint.

Research performance evaluation system

Indicators play a significant role in evaluating research performance, and the indicators used in each country's

measurement system are unique.[15] To some degree, the design of the evaluation index system may help to shape the performance of scientific research projects conducted at universities and research institutions.[16] The internationally representative performance evaluation index system of basic research has been put forward and improved by Professor Martin, including first-level indicators such as scientific research activities, scientific research output, and scientific research progress, and second-level indicators such as input resources and economic benefits.[17]

When it comes to the performance of applied research, British scholar R. Coombs discussed the composition, organization, and implementation of research motivation and research strategy. They also discussed the relationship between research mode, technological innovation diffusion, technological progress and output, employment, and trade.[18] Chinese scholars developed an index system to evaluate the performance of applied research. They introduced the dimensions of research resources, investment, output, and benefits[7]. Using the interdisciplinary dynamic perspective as their foundation, Daumiller developed a brief Multidisciplinary Research Performance Questionnaire (SMRPQ).[19] Some researchers have developed research performance evaluation indicators for the fields of humanities and social sciences.[20] Additionally, other researchers have provided "substantive" indicators to establish the "predictive power" of research reputation.[21] The evaluation of scientific research performance is different and not systematic, and more research is required.

Research performance evaluation of the innovation team

The United States was among the pioneers in conducting performance reviews of research teams. Since 1947, the scientific research team at Brookhaven has been doing theoretical and practical research in the fields of physical chemistry, biomedicine, environmental science, and energy technology. Additionally, they are responsible for the dissemination of scientific knowledge and the transfer of technology to different levels. In 2007, Chinese Scholar Zhang Yan developed a four-dimensional index model to evaluate the success of university research and innovation teams. The index model includes the following components: academic value, economic and social advantages, talent effect, and input-output rate.

Within the context of the research performance evaluation and management of the innovative capacity of university research teams, researchers put forward the application of the Internet of Things and cloud computing technology in the management of the innovation ability performance assessment of research teams.[22] The fundamental ideas and specific performance evaluation index system of the teaching team of basic courses were developed.[23] Using the CRITIC methodology, Kumaran investigated important aspects of the dynamics of the project

team as well as the efficacy of the team. He also gave weight to the various domains and generated overall performance metrics for the project.[24] Study into the performance evaluation of scientific research teams is becoming increasingly refined.

Research performance evaluation of researchers

Research performance evaluation of researchers was possible to break down into individual research performance and research projects. Hajarolasvadi developed a comprehensive and dynamic model that explored the influence of individual-team compatibility on the execution of a project.[25] To implement research performance evaluation, Hermanu carried out interviews with representatives of research institutions within Indonesia's higher education system through focus groups.[26] The following seven scales were created by Manasia, which are recruitment and selection; research recognition and value; participation in research projects and teams; work motivation; work remuneration and wages; career growth opportunities; and leadership effectiveness.[27]

Furthermore, Alibekova proposed an individual research performance rating scale that was inclusive.[28] The evaluation index system of scientific research performance of most Chinese researchers can be summarized into two categories. The first establishes "moral diligence" as the standard, whereas the second establishes "incentive, output, environment" as the standard. At the micro level, Qi Yong presented a model for a performance evaluation system that would be used by scientific researchers. This model has 5 dimensions: research projects, academic value, economic value, talent effect, and input-output rate.[7] There are various indicators of individual research performance evaluation in the academic community, and no unified standard has been formed.

Research performance evaluation methods

Qualitative evaluation and quantitative evaluation are the two methods that are utilized to evaluate the effectiveness of universities' scientific research. Methods such as the Delphi method, peer review method, and case analysis method are examples of common qualitative evaluation techniques available. The bibliometric method, the fuzzy comprehensive evaluation method, the h-index, the PCA (principal component analysis), the gray correlation analysis method, the optimal weight set, and other assessment techniques are included in the quantitative evaluation. Scholars have utilized these methodologies, and they have been successful in producing the desired outcomes.

However, inappropriate measurements can result in the creation of improper incentives.[29] For instance, a bibliometric approach to performance evaluation criteria in Australia showed that the relative quality of articles decreased as publishing productivity grew.[30] Researchers mentioned that there are a number of performance evaluation models that are not only

more effective but also more commonly recognized, such as the Balanced Scorecard (BSC), Key Performance Indicators (KPI), and Business Advantage Model (BEM).[31] KPIs are utilized extensively in both national and international performance evaluation models, and they also serve as a guide for university divisions.[32] BSC and BEM are also utilized rather regularly.[33] At the same time, the establishment of local quality standards and performance indicators of excellence can serve as a means of motivating researchers to make contributions to the advancement of socioeconomic development and innovation.[34]

In the field of research performance evaluation, quantitative analytic methods are generally considered to be the most prevalent. Quantitative methods not only can guarantee the objectivity of the outcomes of research performance evaluation but also occupy the mainstream. Furthermore, the Data Envelopment Analysis (DEA) method is frequently utilized in the process of performance evaluation for several non-profit organizations. In the process of constructing a university research performance evaluation model from the "input-output" perspective, this research approach is gaining popularity among an increasing number of academics. A performance indicator system for university social science research that is built on BP neural network.[1]

As a result of the fact that a single research method could have some limits throughout the application process, an increasing number of academics are adopting a combination of numerous theories and methodologies to evaluate the performance of scientific research from a variety of perspectives. To get more reasonable assessment results, research approaches such as the Linguistic 2-Tuples model, the adaptive analytic hierarchy Process, the DEMATEL structural hole theory, the media role theory, the global principal component factor analysis method, principal component analysis, the skyline method, and so on are utilized.

To summarize, research performance reflects the input, output, efficiency, and effects of activities related to scientific research. Through the implementation of research performance evaluation, it is possible for research institutions to reinforce the system of incentives and constraints, promote fair competition, and get a timely understanding and grasp of the work that researchers do for the government, institutions, and organizations. At the same time, they are working to improve their own scientific research. Researchers are also contributing to the advancement of local economic and social development, as well as the utilization of resources in a manner that is truly reasonable from the top down.

METHODOLOGY

Method and approaches

Systematic Literature Review (SLR) is a scientific, systematic, and transparent method for identifying, evaluating, and synthesizing all relevant literature within a particular field of study.[35] Its aim is to provide a comprehensive, objective and reliable summary and analysis of the field. It is necessary to comprehensively understand the research status, identify research gaps, evaluate research quality, integrate research results, support evidence-based decision-making, avoid research duplication, improve research transparency and promote academic exchanges. Researchers can improve the scientific and social value of research by conducting systematic literature reviews, which allow them to suggest new research questions and directions based on the research that has already been conducted.[36]

Search criteria

This Systematic Literature Review (SLR) follows the guidelines of the Preferred Reporting Program for Systematic Review and Meta-Analysis (PRISMA). PRISMA is a set of rules that gives complete criteria for doing a systematic literature review. These guidelines include numerous steps of identification, screening, eligibility evaluation, and inclusion.

The articles are derived from the Scopus and Web of Science (WoS) Core Collection databases. They are the two main bibliographic databases for researchers and are generally regarded as the most comprehensive data sources. In the beginning, the phrase "research performance evaluation" was utilized in the search fields of Scopus and Web of Science for the purpose of conducting article searches. To maintain the relevance of articles, SLR restricts the usage of keywords to "research performance evaluation" and other topics that are connected to it (Table 1).

Next, we obtain the eligible research articles in the Scopus and WoS databases respectively in accordance with the PRISMA protocol. This study selects the decade from 2014 to 2024 as the research period. This choice is based on the significant trends and important changes presented in the field of scientific research performance during this period. First of all, around 2014, global scientific research investment and research activities entered a new growth stage. Many countries and regions successively introduced policies to enhance scientific research competitiveness, which provided an important policy background for the improvement

Table 1: Keywords and Searching Information Strategy Example.

Databases	Keywords used
Scopus	TITLE-ABS-KEY (("scientific research performance evaluation" OR "research performance evaluation" OR "research performance assessment" OR "research performance appraisal" OR "research performance measurement")).
Web of Science	TS (("scientific research performance evaluation" OR "research performance evaluation" OR "research performance assessment" OR "research performance appraisal" OR "research performance measurement")).

of scientific research performance. Secondly, this period witnessed the rapid development of emerging technologies such as big data and artificial intelligence. The wide application of these technologies has greatly changed the model and efficiency of scientific research, providing new tools and methods for the evaluation and improvement of scientific research performance.

Furthermore, from January 2014 to December 2024, the frequency and depth of international scientific research cooperation have significantly increased. The increase in cross-border research projects not only promotes the exchange and sharing of knowledge but also poses new challenges and requirements for the evaluation system of scientific research performance. Therefore, choosing this period of time can better capture the dynamic changes in the field of scientific research performance in multiple aspects such as policies, technologies, and cooperation, providing strong support for systematically sorting out and analyzing the development trends of scientific research performance. The data was taken as of December 2024. Since we downloaded the data in January 2025, at that time, the articles had not yet been published in 2025.

This SLR restricted the articles that met the following criteria to acquire relevant articles: a) the articles were published in English; b) the papers were research articles; c); the timeline is between 2014 and 2024 (Table 2).

Search flowcharts

The PRISMA flowchart shows the process of searching for articles in this SLR, as shown in Figure 1.

Search output

Next, each article was read separately. The researchers also examined the research results, research methods, research abstracts and the titles of the research articles, with a focus on the concept, measurement, research samples, evaluation methods and evaluation indicators of research performance. Finally, we retrieved 71 articles from Scopus and 53 articles from WoS. Among them, 48 are overlapped by two databases. Finally, it was determined that the number of articles analyzed under the theme of "Evaluation of Scientific Research Performance" was 76. Figure 2 describes the distribution of articles in these two databases.

Data extraction

From the review of each original article, the following eight pieces of information were recorded: (i) author, (ii) article title, (iii) publication year, (iv) publication name, (v) citation situation, (vi) country, (vii) abstract, (viii) research method, (ix) scientific research indicators. The first six items are directly derived from

Table 2: Instruction and Exclusion Criteria.

Criterion	Eligibility	Exclusion
Language	English	Non-English
Literature type	Indexed Journal (research articles)	Non indexed journals, Systematic literature review journals, chapter in book, conference proceeding
Timeline	Between 2014-2024	<2014
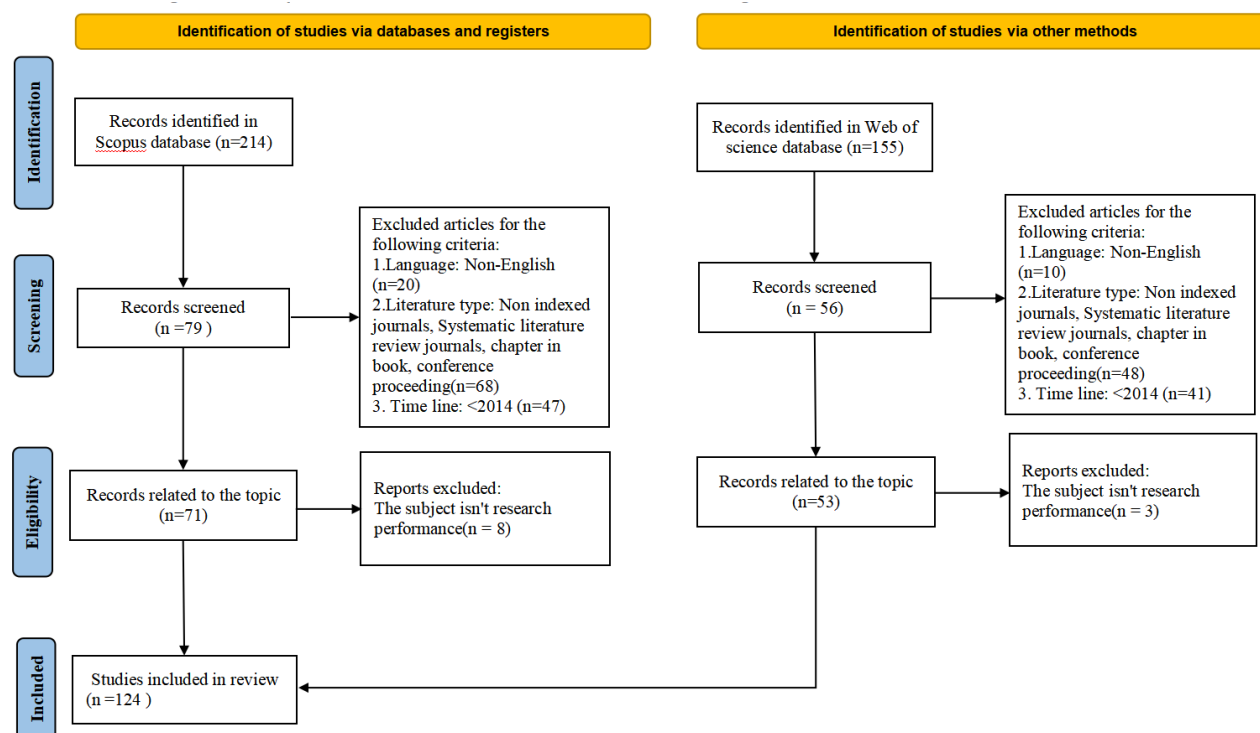
Figure 1: PRISMA Flow Chart Diagram.

two databases, while the last two are obtained by us through reading articles. Based on these data, we present the review results and conclusions.

FINDINGS

Publishing Trend

This systematic literature review included 76 relevant literatures published between 2014 and 2024, and the research subjects covered researchers, research institutions and universities from different countries and regions. The research results indicate that from January 2014 to December 2024, the overall average number of papers on "scientific research performance evaluation" was 8 to 10 per year. The number of published articles in 2019 was the lowest, with only 4. In 2022, the number of published articles was the highest, reaching 14. These results indicate that the topic of scientific research performance evaluation has received increasing attention from scholars, which proves that the research topic of this paper is worthy of study (Figure 3).

Published journals

In terms of the number of published journals, 76 articles were respectively published in 64 journals. Among them, 7 articles (accounting for 9.2%) originated from Scientometrics. and Sustainability, Journal of Informetrics, Proceedings of the Association for Information Science and Technology, Current Two articles were published respectively in the six journals of

Science, Studies in Higher Education and Journal of Scientometric Research (accounting for 2.6% respectively), while only one article was published in the other 57 journals, accounting for 75% in total. Generally speaking, the sources of papers are relatively scattered. Only the number of publications in Scientometrics journals is significantly higher than that in other journals (Figure 4).

In terms of the quality of the published journals, 65.79% of the articles were indexed by SCI or SSCI. Among them, articles published in Q1 journals accounted for 19.73%, those in Q2 journals accounted for 13.15%, those in Q3 journals accounted for 11.84%, and those in Q4 journals accounted for 21.05%. The remaining 34.21% were articles not indexed by SCI or SSCI (Table 3). The results show that most of the published articles on research performance evaluation are of high quality.

Geographical distribution

The scholars mainly come from Asia, Europe and North America. The researchers who contributed the most mainly came from China and India, followed by Malaysia. The number of publications in these countries was 11, 6 and 5 respectively, accounting for 14.47%, 7.89% and 6.58% respectively. Germany, Australia, Korea and the United States each published 4, accounting for 5.26% respectively. Italy, the United Kingdom and Indonesia each published 3. The proportions were 3.95% respectively, and each of the remaining countries had only one
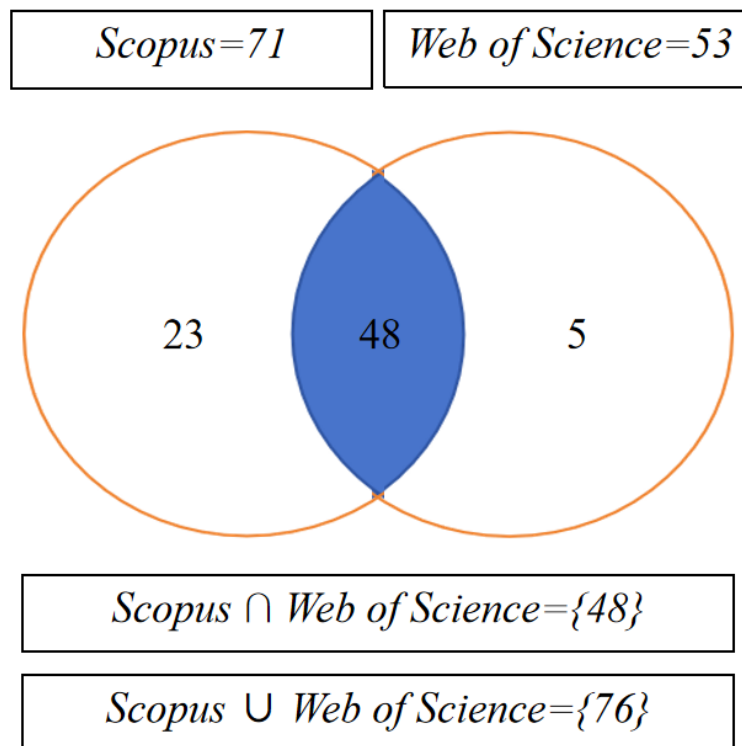
Figure 2: Article allocation based on the "Research Performance Evaluation" database.
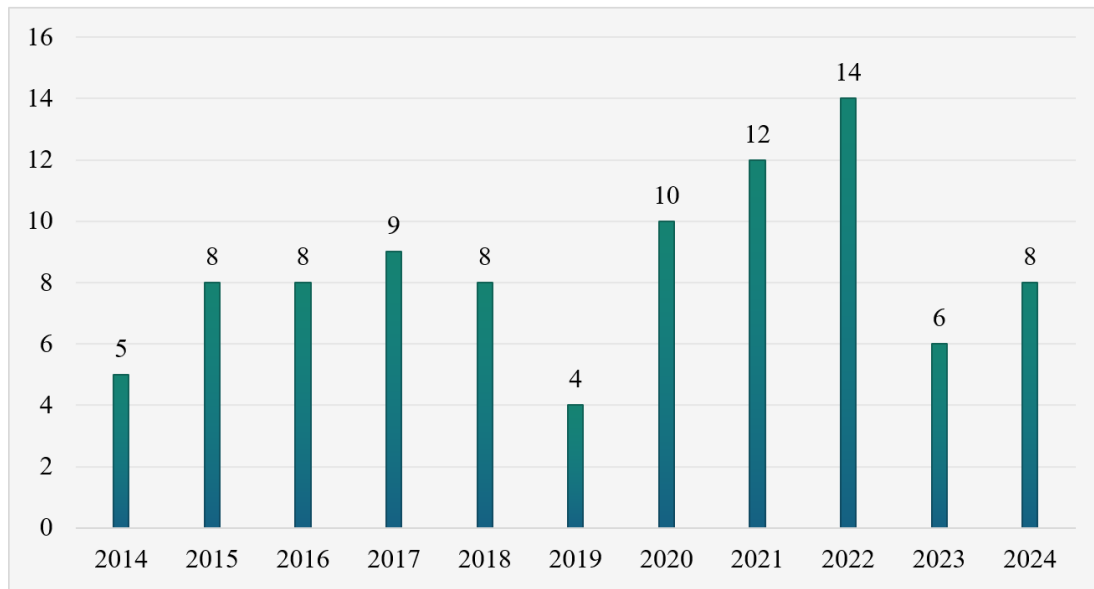
Figure 3: Number of Publishing Research Articles per Year.

or two studies. Furthermore, there are four articles that do not clearly specify specific regions. It can be seen from the graph that East Asia and Europe are the leading regions in this research field.

The results show that many authors worldwide are highly concerned about the evaluation of scientific research performance (Figure 5). Descriptive analysis helps us better understand the global attitude towards scientific research performance evaluation and fully demonstrates the importance of scientific research performance evaluation. Furthermore, the number of publications in this field in East Asian and ASEAN countries ranks among the upper-middle levels in the world. This indicates the wide interest and participation in this topic.

The most frequently cited articles

This section analyzes the top 10 most frequently cited articles in the Scopus and WoS databases from January 2014 to December 2024.

Figure 6 shows the 10 most frequently cited articles related to the relationship of "scientific research performance evaluation". Among them, the most remarkable research was conducted by Mingers J *et al.*, 2017, published in *the European Journal of Operational Research* with 124 citations. This study conducts empirical research on a large number of commercial and management journals to evaluate indicators such as the H-index, SJR, SNIP and characteristic factors. The research results show that none of the indicators is superior, but the H-index (including the productivity of journals) and SNIP (aimed at regulating domain effects) may be the most effective at present.

Following closely behind is Martin-Sardesai A *et al.*, 2018, published in *the Journal of Intellectual Capital* with 60 citations. This article examines the impact of ERA on Australian public

universities and finds that studying the design, implementation and use of pms is a tool for measuring and managing the performance of HC research in universities. Ryan J.C. in 2014 received the third-highest number of citations, with a total of 54 citations. The paper examined the work motivation of scientific researchers and the impact of work motivation on scientific research performance. This research also comes from the European region.

Overall, among the top 10 most frequently cited articles, research on Asian countries is significantly lacking, indicating that the international influence of Asian countries in articles on this topic is relatively limited.

Research performance evaluation method

After reviewing all 76 publications, we discovered that bibliometric analysis was the method that was utilized the most frequently for answering research questions and objectives, with 30 articles using bibliometric methods. Due to the increasing amount of public information published on the Internet, bibliometric indicators derived from citation databases such as Scopus have become the target indicators for researchers, organizations and countries to evaluate their academic influence and research output through quantitative indicators. 9 articles employed the cross-sectional quantitative research method, and there were also quite a few articles that used the scientific quantification method, Back-Propagation (BP) neural network, and principal component analysis method. This is slightly different from the results of previous studies, in which regression analysis was one of the most widely used methods.[26]

This study finds that the mixed method, DEA, focus group interviews and peer review are the more commonly used methods for evaluating scientific research performance. A small

Table 3: The distribution of journal quality.

Journal	Quartile	n	Percentage
Scientometrics	Q1	7	19.73%
Studies in Higher Education		2	
Higher Education		1	
SAGE Open		1	
Health Research Policy and Systems		1	
Computers in Human Behavior		1	
Journal of Intellectual Capital		1	
Sustainability Accounting, Management and Policy Journal		1	
Sustainability	Q2	2	13.15%
Research Evaluation		1	
Journal of Management Science and Engineering		1	
Qualitative Research in Accounting and Management		1	
Journal of Business and Psychology		1	
R & D Management		1	
Journal of Intellectual Capital		1	
Journal of Technology Transfer		1	
Library & Information Science Research		1	
Science and Public Policy	Q3	1	11.84%
PLoS One		1	
Transinformacao		1	
Journal of Accounting and Organizational Change		1	
Human Resource Development International		1	
Malaysian Journal of Library and Information Science		1	
KEDI Journal of Educational Policy		1	
Marketing Letters		1	
Serials Review		1	
Current Science	Q4	2	21.05%
Cogent Social Sciences		1	
Journal of Scientometric Research		2	
Energies		1	
Journal of Environmental Health Science and Engineering		1	
Cogent Education		1	
Journal of Advances in Management Research		1	
International Journal of Educational Management		1	
Information Development		1	
Frontiers of Education in China		1	
Collnet Journal of Scientometrics and Information Management		1	
Terra Economicus		1	
Automatic Documentation and Mathematical Linguistics		1	
Accounting History		1	
Other Journals (N=1 (Non-SCI, Non-SSCI included))		26	34.21%

number of studies have also collected subjective evaluations from researchers and managers to understand the influencing factors of scientific research performance and suggestions for improving the evaluation system. Other methods for conducting research performance evaluation include Artificial neural network technology, Chi-square verification, Super Efficiency (SE), and Weighting method. Semi-structured interview, Delphi survey, etc. In a word, it is clear from these research techniques that the quantitative approach is the one that is used the most, followed by the qualitative research method, and the combination of qualitative and quantitative methods is the one that is utilized the least. The distribution of methods used is shown in Figure 7.

## Research performance evaluation index

Academic research activity is a complex system with multiple inputs and outputs. The objectivity of evaluating scientific research performance and the trustworthiness of the assessment outcomes rely on a well-designed system of evaluation indices. According to the attribution of specific indicators, this study divides scientific research performance evaluation index into 8 dimensions (Table 4).

In the first category, output indicators are broken down into 4 distinct indicators. The index that is most widely used is the "number of published papers" index, which contains 22 articles.

This index is followed by the index that measures the number of books and textbooks published, the index that measures the number of scientific research projects, and the index that measures the number of peer-reviewed journals published.

The second category is the influence index, which is broken down into 6 distinct indications. The number of articles that use the index of "citation times" is the highest, with 25 articles included in this category. The number of articles that use the index of "h index" and "impact factor" is 16 and 10, respectively. It is important to note that 4 of the articles exclusively use high-quality journals that are graded Q1 or Q2, which is an indication that the academic community is becoming more demanding of the quality of journal publication. In addition, "number of reads of the publication" is one of the indications that is used in one of the articles, while "academic awards" is one of the indicators that is used in another article.

Indicators of resource access constitute the third category. These indicators are broken down into 5 distinct categories. There are 17 articles that use the "scientific research funding" indicator, and 9 articles use the "number and structure of scientific researchers" indicator. There are 6 articles that discuss the research rate of return, 4 articles concentrate on scientific research equipment and laboratory conditions, and 3 article concentrates on the working environment. The fourth category is composed of cooperation
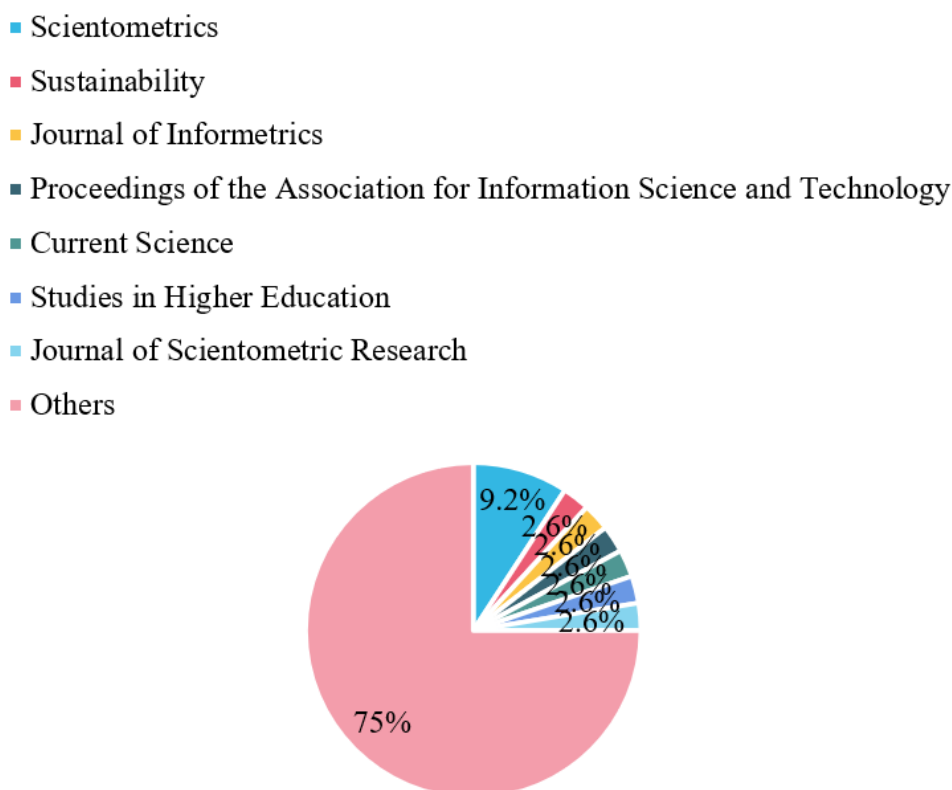
Figure 4: The distribution of articles in journals.
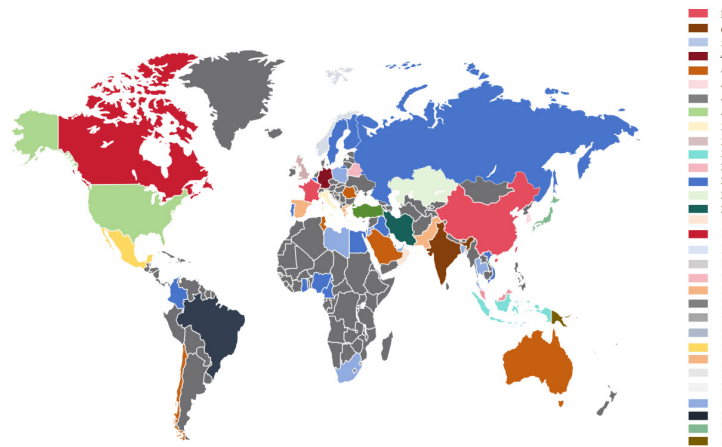
Figure 5: Geographical Distribution of publications.

and exchange indicators, which are further subdivided into 4 specific indicators. There are 8 articles that make use of the indicator of "domestic and international exchange," 5 articles utilize the indicator of "academic exchange," and 4 articles utilize the indicator of "interdisciplinary cooperation."

The fifth category is composed of application and transformation indicators, which are further subdivided into 4 distinct indicators. There are 8 articles that utilize the "number of patents applied for and granted" indicator, and 5 articles utilize the "technology transfer" indicator, and 3 articles utilize the "combination of industry, university, and research" and "application project" indicators. The sixth category is management and organization indicators, which are divided into 3 specific indicators. There are 9 articles that use the indicator of "team organization and cooperation," and 4 articles use the indicator of "scientific research project management," and 2 article uses the indicator of "scientific research training."

The seventh category is the academic reputation indicator, which is further subdivided into 2 specific indicators. A total of 9 articles make use of the "academic reputation and international ranking of research institutions or universities," while 4 articles utilize the "reputation and influence of researchers in the academic community." There are 4 specific indicators that fall under the eighth category, which is referred to as "other categories of indicators." These indicators include "geographical proximity," "reference review," "research frontier" and "information analysis", all of which are less frequently mentioned in the article and are difficult to categorize.

Although many scholars have used publications and citation indicators, there are also many scholars who believe that citation indicators should be used cautiously. For example, research showed that, on a global and sectoral scale, the contribution

and impact of scientific publications on world science is almost negligible.[37] Also, the impact of published papers on research performance was not significant.[38] Similarly, citation analysis, as a tool for research performance evaluation, must be constructed and applied with caution due to its limitations in techniques and methods.[39] Hence, impact factors used in research performance evaluations should be used more carefully, especially when variables such as journal size, publication language, publisher country, and subject area are correlated with self-citation rates.[40]

Influencing factors of research performance

In this paper, the influencing factors of scientific research performance are divided into 5 categories, namely, individual factors, team factors, organizational and institutional factors, external environment factors and resource factors (Figure 8).

When looking at research performance from the perspective of individual factors, scholars believe that the results of individual research performance will be influenced by factors such as productivity, academic contribution, influence, and research ability of scholars. Additionally, the amount of work pressure that researchers are under is also considered one of the factors that affect research performance. Many academics maintain that the performance will also be influenced by the number of authors and the scale efficiency of the research. Furthermore, they considered that papers that are cited more frequently will be accepted in a shorter amount of time. Papers with authors from central and high-income countries have the advantage of being published in a shorter period.[41]

From the perspective of team factors, an increasing number of academics have come to realize that cooperation is significant. There are 10 articles that hold the belief that research performance is influenced by collaboration, which includes cooperation among research innovation contests. Additionally, there are 6

articles that hold the belief that multidisciplinary cooperation and international cooperation are vital for research performance. The administration of the university ought to emphasize the academic contributions and influence of the faculty to encourage the enthusiasm and innovation of the faculty members.[42] Universities should make full use of the benefits and features of the many fields of study, increase the number of professionals and exceptionally young teachers, and broaden the autonomy of the management of finances for scientific research. Through the utilization of multidisciplinary collaboration to provide high-quality outcomes from scientific research, with the goal of fostering the integration and collaboration of scientific research resources.

From the perspective of organizational and institutional factors, scholars believe that the allocation, use and self-management of scientific research funds are essential. In a similar vein, research management methods, management processes, and regulatory agencies are all regarded as being among the elements that influence the performance of research. There are academics who believe that the criteria used to evaluate the performance of scientific research vary depending on the type of university.[43] Additionally, academic preparation and the ambiance of the academic environment are crucial elements.

From the external environmental factors, there are 8 articles that hold the belief that the ranking of the institution, the ranking of the country, or the ranking of the university will affect the research performance of the institution. Additionally, there are some academics who have acknowledged the significance of policies such as administrative regulations and educational regulations. Furthermore, the level of economic development in the region as well as the demand in the market will have an impact on the research performance of institutions.

From the perspective of resource factors, scholars believe that data resources, technical support, financial support and scientific research resources all have an important impact on researchers' scientific research. It was shown that activities related to "supervision" and "professional progress" were of greater significance across all criteria groups.[28]

DISCUSSION

Research performance evaluation is the product of higher education development to a certain stage. Research performance evaluation is the key to evaluating the quality, impact and productivity of research. This literature review finds that there is a diversity of evaluation methods and indicators of scientific research performance, complex and diverse influencing factors, and each evaluation method has its advantages and disadvantages.

The indices of research performance that are being evaluated indicate a diverse tendency. It is no longer the case that researchers rely solely on publications as a criterion; rather, they are increasingly focusing their attention on collaborations between research teams, collaborations between countries, and collaborations between disciplines, in addition to the growth and advancement of researchers themselves. In addition, academics are paying greater attention to the quality of publications rather than the quantity of publications, which implies that research performance evaluation is paying an increasing amount of attention to the dynamic process and the quality of research, which provides a favorable path for future research.

Regarding the selection of assessment indicators, it is possible to choose from the dimensions of higher education function, which may include talent training, scientific research, and social service. From the dimensions of university operation, which may include input indicators and output indicators. Regarding the various evaluation purposes, additional research is required to investigate how to appropriately determine the number of indicators that are chosen, as well as the reliability and validity of the indicators that are produced. Particular attention should be paid to the performance indicators that are associated with the distribution of funds.
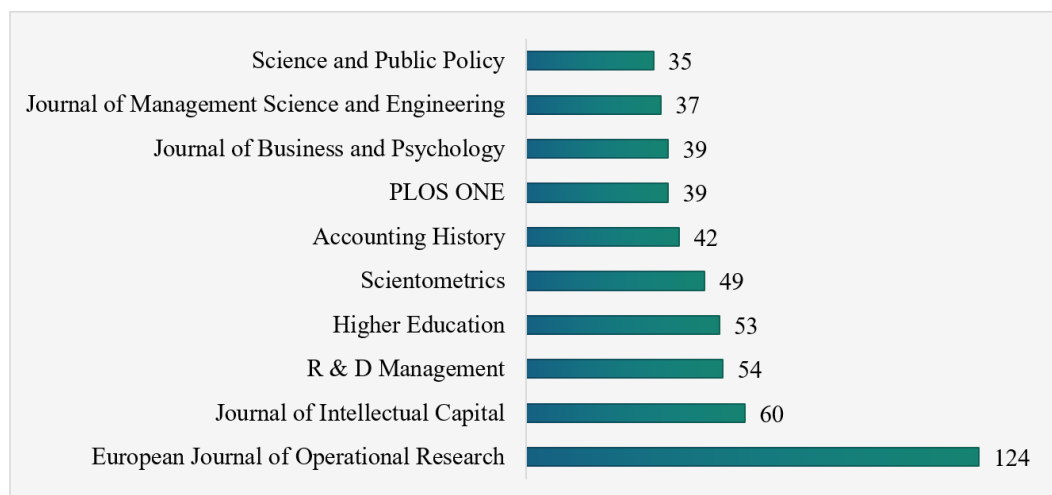
Figure 6: Shows the top 10 most frequently cited journal sources.

When it comes to the selection of evaluation methods, the educational circle uses various methods to evaluate the performance of colleges and universities. These methods include input-output analysis, data envelopment analysis, the analytic hierarchy process, fuzzy evaluation method, and gray relational degree method, among others. The challenge of how to select the proper method from among the many methods of evaluation and how to convey the results of the evaluation in a manner that is both objective and reasonable is another issue that needs to be studied and resolved. Since the study performance evaluation has not been carried out for a considerable amount of time, the evaluation subject still has deficiencies in the evaluation procedures, theories, and practical experience.
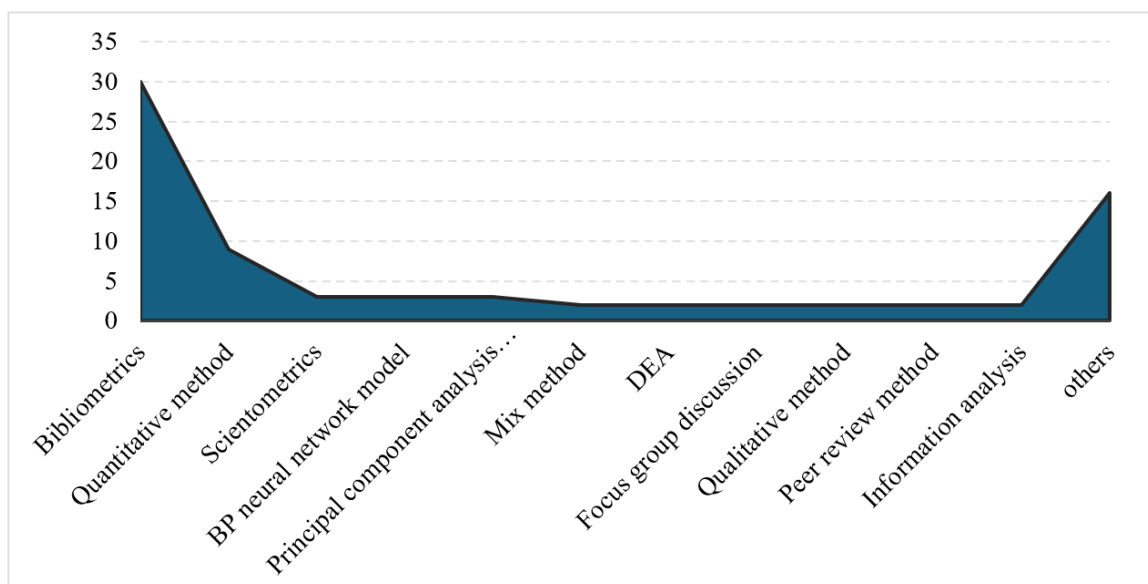
Additionally, the capability to evaluate and apply data information needs to be further investigated and developed. Hysteresis of performance evaluation reward is still a problem that must be addressed when it comes to the application of evaluation results. In the process of evaluating research performance, historical data is considered. Additionally, there is the issue of not providing timely rewards and remuneration, which makes it challenging to guarantee the desired effect of incentives.

At present, nations all over the world have established various criteria, models, and approaches in the process of investigating university performance evaluation. Some examples of these are the UK Times University Ranking, the UK QS University Ranking, and a few local university rankings.[44] It is not possible for these rankings to accurately reflect the performance goals of institutions because they are based on quantitative metrics such as publication and citations, research money, and well-known scholars.[45] Therefore, the establishment of research performance objectives by educational institutions of higher learning should also include output, effect, social satisfaction, and other
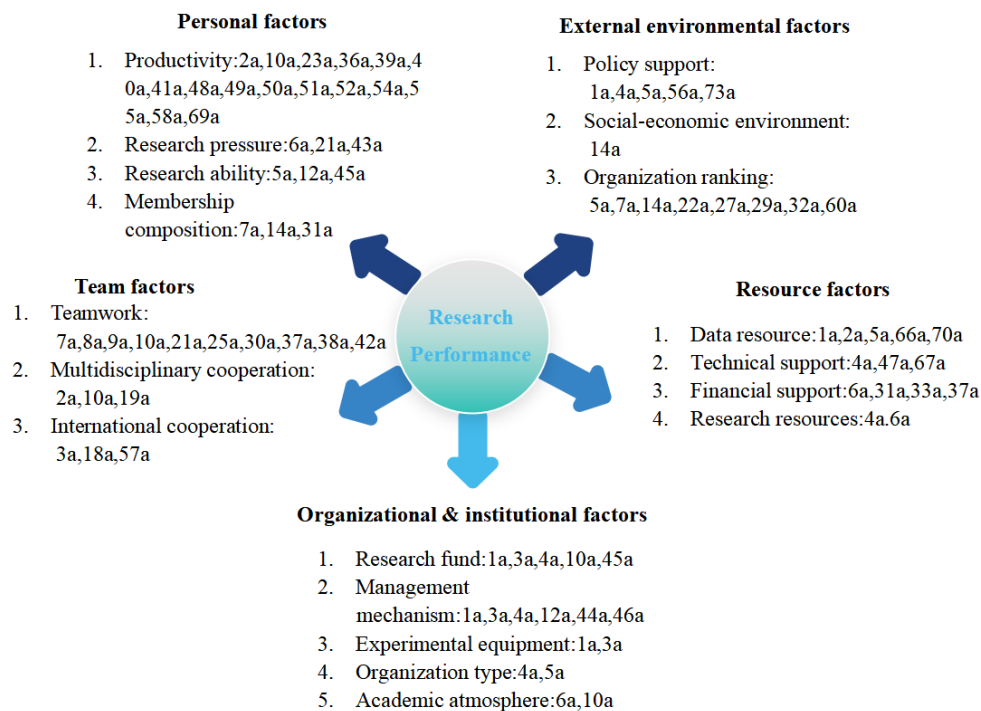
aspects. These aspects include the quality of talent training, the promotion of scientific research results, the level of scientific and technological innovation, the building of talent teams, the innovation of management mechanisms, and so on.

Currently, the practice of performance evaluation in China institutions is mostly found in the exploration of academic circles and regional local governments; however, there is not yet a unified standard paradigm in place.[46] To carry out scientific research on performance evaluation, we should not only sum up the experience of performance evaluation at home and abroad, learn and absorb advanced foreign theories, but also independently explore the standards and norms of performance evaluation of colleges and universities based on domestic and regional practices, and put forward our own theories and standards. Research performance evaluation is an effective lever that can be used to improve the quality of higher education.[47] It is necessary to continuously promote the standardization and construction of standardization in the design, management, implementation, and control of university performance evaluation to assist in the development of higher education's connotation.

The evaluation ranking and the society's unified cognition of the ranking of scientific research institutions conflict with one another regarding the ranking of these organizations. The evaluation of the performance of scientific research is carried out, and universities are classified into various types based on the differences in the primary functions of personnel training and the types of scientific research that are conducted. This is done to encourage the growth of universities from "one column" to "multiple columns" and to break the trend of higher education becoming more homogenized.[42] These various classifications and levels of evaluation, on the other hand, are in direct opposition to the coherent understanding that society has regarding the

Figure 7: Distribution of research methods.

Personal factors

1. Productivity:2a,10a,23a,36a,39a,40a,41a,48a,49a,50a,51a,52a,54a,55a,58a,69a
2. Research pressure:6a,21a,43a
3. Research ability:5a,12a,45a
4. Membership composition:7a,14a,31a

External environmental factors

1. Policy support: 1a,4a,5a,56a,73a
2. Social-economic environment: 14a
3. Organization ranking: 5a,7a,14a,22a,27a,29a,32a,60a

Team factors

1. Teamwork: 7a,8a,9a,10a,21a,25a,30a,37a,38a,42a
2. Multidisciplinary cooperation: 2a,10a,19a
3. International cooperation: 3a,18a,57a

Research Performance

Resource factors

1. Data resource:1a,2a,5a,66a,70a
2. Technical support:4a,47a,67a
3. Financial support:6a,31a,33a,37a
4. Research resources:4a.6a

Organizational & institutional factors

1. Research fund:1a,3a,4a,10a,45a
2. Management mechanism:1a,3a,4a,12a,44a,46a
3. Experimental equipment:1a,3a
4. Organization type:4a,5a
5. Academic atmosphere:6a,10a

Figure 8: Influencing factors of Research Performance.

rankings of universities. Both the students' choice of schools and their decision to enroll in universities will be influenced, to a certain extent, by the feedback of the findings of the university performance review.

There is a problem that requires more attention, and that is the question of how to meet the demands of the public, particularly employers and parents, through the implementation of research performance evaluation. Second, there is still the issue of research institutions being ranked in a strict manner.[48] Based on the findings of the research performance evaluation, the consolidation of institution ranking will further exacerbate the imbalance of higher education resources and the consolidation of interests. This will ultimately lead to the trend of homogenization of colleges and universities, the imbalance of internal and external relations, and the loss of the cultural significance of universities.

In general, the academic skill of researchers, their passion for research, their academic reputation, their work attitude, and the stage of their career development will all have a direct impact on their research performance. In general, higher levels of research production relate to higher levels of academic skill as well as a good attitude towards research. Researchers have the potential to considerably improve their research performance if they are provided with a favorable atmosphere for scientific study and adequate support from resources. It is possible for scientific research activities to be promoted through the provision of policy

advice and support, and international cooperation can bring about additional resources and perspectives.

An evaluation system that is reasonable has the potential to invigorate the enthusiasm of researchers, whereas an evaluation system that is unreasonable may result in research that is utilitarian and academic dishonesty. These aspects contribute to the overall performance of scientific research by interacting with one another and having a collective impact on the outcome. The establishment of a scientific and reasonable evaluation system for the performance of scientific research, which considers the criteria mentioned above, has the potential to more fully reflect the quality and contribution of scientific research activity than was previously possible.[49]

For this reason, it is recommended that future research should focus on improving qualitative research on research performance and investigating the influence that factors such as the work motivation of researchers, the research environment, and organizational culture have on research performance. While this is going on, a complete evaluation model should be further created. This model should include qualitative and quantitative methodologies to improve the accuracy and comprehensiveness of research performance evaluation. For instance, the establishment of standardized standards for the measurement of research performance to guarantee that the outcomes of the study are similar.

Table 4: Evaluation Index used in Research Performance.

Dimensions	Specific index	Code
Output index	Paper publication	2a,3a,4a,5a,9a,10a,12a,15a,17a,19a, 20a,22a,23a,24a,27a,30a,34a,40a,55a,58a,65a,72a
	Monographs and books	4a,19a,23a,24a,40a
	Peer-reviewed journal	30a,34a,35a,39a,44a,53a,64a
	Number of research projects	23a,24a,30a,34a,40a
Influence index	High quality journal	3a,16a,18a,33a
	citations	3a,7a,13a,15a,20a,22a,23a,24a,25a, 27a,29a,33a,35a,39a,50a,51a,53a,58a,62a,63a,64a,65a,68a,69a,72a
	h-index	18a,20a,22a,24a,28a,41a,49a,50a,54a,58a,62a,66a,71a,72a,75a,76a
	Impact factor	3a,18a,20a,22a,50a,51a,53a,69a,71a,72a
	The number of times a publication is read	3a
	Academic award	4a
Resource acquisition index	Research fund	1a,4a,5a,10a,17a,18a,19a,22a,23a,26a,30a,33a,34a,37a,45a,58a,59a
	Research rate of return	6a,7a,19a,21a,30a,40a
	Working environment	6a,43a,67a
	Equipment and facilities	1a,4a,5a,47a
	Researcher	4a,5a,7a,10a,17a,19a,22a,27a,45a
Cooperation and exchange index	Domestic cooperation	2a,11a
	International cooperation	2a,3a,8a,11a,18a,57a
	Interdisciplinary cooperation	2a,15a,27a,61a
	Academic exchange	12a,23a,30a,31a,34a
Application and transformation index	Technology transfer	4a,17a,19a,22a,53a
	Patents and intellectual property	4a,5a,10a,17a,22a,23a,24a,34a
	Application item	24a,30a
Management and organization index	Research project management	1a,6a,12a,30a
	Team organization	1a,2a,14a,21a,27a,30a,34a,37a,38a
	Research training	12a,38a
Academic reputation index	Personal reputation	12a,30a,34a,48a
	Institutional reputation	4a,11a,19a,31a,32a,33a,48a,52a,60a
Others index	Geographical proximity	8a
	Total references	29a
	Research frontier	2a
	Information analysis	46a,56a,70a,73a,74a

Secondly, with both quantitative and qualitative research methodologies, a detailed examination of the elements that influence the performance of scientific research. The third step is to conduct an in-depth study on the elements that influence the performance of scientific research over the long term and to investigate improvement techniques to investigate the sustainable development of scientific research models. In conclusion, it is of the utmost importance to reinforce the logical allocation of resources for scientific research, improve the system for evaluating the performance of scientific research, stimulate the innovation and cooperation of researchers, and increase the level of scientific research management and policy support.

CONCLUSION AND LIMITATION

In this study, a complete summary of the articles on research performance evaluation is presented, along with an analysis of the evaluation techniques, evaluation indicators, influencing variables, and improvement strategies of research performance. Additionally, the report identifies the diversification of research performance evaluation indicators. When evaluating the success of research, the number of publications is no longer the sole criterion that is considered. Instead, the evaluation places a greater emphasis on aspects such as collaboration within research teams, collaboration between countries, and the quality of research outcomes. It is recommended that the feedback mechanism of the implementation of team research outcomes receive a more considerable amount of attention in the direction that the future research will take. In addition, the findings of the research demonstrate the deficiencies of the methods and indicators that are currently being used to evaluate the performance of research institutions.

First, the criteria for evaluation are inconsistent with one another. There is a lack of uniformity surrounding the definition and measurement methodologies of scientific research performance. Additionally, the indicators and criteria that are utilized in various studies are distinct from one another. Even though there is still a significant amount of room for inquiry within the evaluation model, the academic community has not yet established a research performance evaluation index model that is authoritative.

Second, the evaluation methods are not flawless, and the evaluation methods for qualitative indicators, such as the quality, novelty, and application value of the outcomes of scientific research, are inadequate, lacking in scientific and an inability to be implemented. Even though the number of publications may increase, this does not necessarily suggest that the publication is of higher quality.

Third, there are several flaws in the mechanism that handles feedback and improvement. Most studies concentrate on short-term performance and do not conduct systematic analyses of the elements that influence the performance of research over the long run. In the process of evaluation, there is no mechanism that provides appropriate feedback, and the results of the evaluation are difficult to use as a guide and to improve the work that is being done in scientific research.

Furthermore, the academic community primarily examines the overall research performance of institutions or universities, but it does not evaluate the individual research performance of researchers, which is also essential for the researchers' own development and progression. In the future, research institutions should develop differentiated management policies, construct a research performance evaluation system that is focused on quality, alter the concept of research managers, enhance the capabilities of researchers, and enhance the effectiveness of university research.[50]

CONTRIBUTION AND IMPLICATION

This study serves as an important reference for anyone conducting research and practicing in domains that are related to it. It serves as a reference for educational institutions and research organizations, assisting them in the development of efficient strategies for enhancing the performance of research. Additionally, this study makes sure that policymakers have a scientific foundation to assist the optimization and implementation of research policies while they are being developed. However, this study only includes the most recent 10 years of research, which may have resulted in the omission of some significant findings from earlier decades of research. In addition, there is a possibility of selection bias occurring throughout the process of screening the literature.

In conclusion, the evaluation of research performance is a complicated and multifaceted problem that requires full consideration of individual, organizational, and external environmental elements. Enhancing the performance of research calls for the collaborative efforts of individuals, organizations, and administrative policies. As it moves into a new phase, research performance assessment should have the ability to simultaneously address the requirements of various stakeholders, including the government, universities, and the public. Additionally, it should consider and resolve the practical uncertainty that exists regarding research performance evaluation.

ACKNOWLEDGEMENT

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

REFERENCES

1. Chen C, Zhe C, Zheng Y, Xiong X, Xiao T, Lu X. Evaluation of scientific research in universities based on the theories for sustainable competitive advantage. Sage Open. 2023; 13(2).

2. Sani'ee N, Nemati-Anaraki L, Sedghi S, Noroozi Chakoli A, Goharinezhad S. The effective trends and driving forces in the future of research performance evaluation: A qualitative study. Med J Islam Repub Iran. 2022; 36: 55. doi: 10.47176/mjiri.36.55, PMID 36128266.

3. Silva S, Nuzum AK, Schaltegger S. Stakeholder expectations on sustainability performance measurement and assessment. A systematic literature review. J Cleaner Prod. 2019; 217: 204-15. doi: 10.1016/j.jclepro.2019.01.203.

4. Braithwaite J, Herkes J, Churruca K, Long JC, Pomare C, Boyling C, *et al.* Comprehensive Researcher Achievement Model (CRAM): A framework for measuring researcher achievement, impact and influence derived from a systematic literature review of metrics and models. BMJ Open. 2019; 9(3): e025320. doi: 10.1136/bmjopen-2018-025320, PMID 30928941.

5. Bititci US, Carrie AS, McDevitt L. Integrated performance measurement systems: A development guide. Int J Oper Prod Manag. 1997; 17(5): 522-34. doi: 10.1108/01443579710167230.

6. McDavid J, Huse I, Hawthorn L. Program evaluation and performance measurement: an introduction to practice. 3rd ed. Program Evaluation and Performance Measurement: An Introduction to Practice; 2022.

7. Qi Y, Li QM. The theory and method of the scientific research performance appraisal. Science Press; 2009.

8. Kao SC, Wu C, Su PC. Which mode is better for knowledge creation? Manag Decis. 2011; 49(7): 1037-60. doi: 10.1108/00251741111151136.

9. Zhi M. Performance evaluation of public management in view of fuzzy DEA model. J Math. 2022; 2022(1). doi: 10.1155/2022/9822339.

10. Panagopoulos A. Principal-agent model in universities: problems and solutions. In: Carayannis EG, editor. Encyclopedia of creativity, invention, innovation and entrepreneurship. Cham: Springer International Publishing; 2020. p. 1880-3. doi: 10.1007/978-3-319-15347-6_507.

11. Wang S, Jones GA. Competing institutional logics of academic personnel system reforms in leading Chinese Universities. J High Educ Policy Manag. 2021; 43(1): 49-66. doi: 10.1080/1360080X.2020.1747958.

12. Kalfa S, Taksa L. Employability, managerialism, and performativity in higher education: a relational perspective. High Educ. 2017; 74(4): 687-99. doi: 10.1007/s10734-016-0072-2.

13. Mainardes EW, Alves H, Raposo M. Stakeholder theory: issues to resolve. Manag Decis. 2011; 49.

14. Hu Y, Liang W, Tang Y. Evaluating research efficiency of Chinese universities; 2017. Available from: https://link.springer.com/content/pdf/10.1007/978-981-10-4030-6.pdf.

15. Çakır MP, Acartürk C, Alaşehir O, Çilingir C. A comparative analysis of global and national university ranking systems. Scientometrics. 2015; 103(3): 813-48. doi: 10.1007/s11192-015-1586-6.

16. Cheng Z, Xiao T, Chen C, Xiong X. Evaluation of scientific research in universities based on the idea of education for sustainable development. Sustainability. 2022; 14(4). doi: 10.3390/su14042474.

17. Martin BR. The use of multiple indicators in the assessment of basic research. Scientometrics. 1996; 36(3): 343-62. doi: 10.1007/BF02129599.

18. Coombs R, Narandren P, Richards A. A literature-based innovation output indicator. Resour Policy. 1996; 25(3): 403-13. doi: 10.1016/0048-7333(95)00842-X.

19. Daumiller M, Siegel S, Dresel M. Construction and validation of a short multidisciplinary research performance questionnaire (SMRPQ). Res Eval. 2019; 28(3): 241-52. doi: 10.1093/reseval/rvz009.

20. Yongxia M, Jiaxi Q, Yuzhuang G. Research on the achievement evaluation of humanities and social sciences in colleges and universities from the perspective of meta-evaluation – taking the achievement evaluation of NSSFC as an example. Vol. 37(6); 2021 November 15. Educ Sci [Internet]. p. 68 [cited May 20 2024]. Available from: https://jykx.lnnu.edu.cn/EN/.

21. Shirabe M, Koizumi A. Substantiality: A construct indicating research excellence to measure university research performance. J Data Inf Sci. 2021; 6(4): 76-89. doi: 10.2478/jdis-2021-0029.

22. Meng S, Zhang X. The use of Internet of things and cloud computing technology in the performance appraisal management of innovation capability of university scientific research team. Comput Intell Neurosci. 2022; 2022: 9423718. doi: 10.1155/2022/9423718, PMID 35440942.

23. Hong F. Discussion on the performance evaluation index system of basic course teaching team in colleges and universities. Asian Agric Res. 2020; 12.

24. Kumaran S. Performance evaluation of team dynamics and team effectiveness in projects using CRITIC approach. Int J Proj Organ Manag. 2022; 14(2).

25. Hajarolasvadi H, Shahhosseini V. A system-dynamic model for evaluating the effect of person–team fit on project performance. J Constr Eng Manage. 2022; 148(11). doi: 10.1061/(ASCE)CO.1943-7862.0002403.

26. Hermanu AI, Sari D, Sondari MC, Dimyati M. Is it necessary to evaluate university research performance instrument? Evidence from Indonesia. Cogent Soc Sci. 2022; 8(1). doi: 10.1080/23311886.2022.2069210.

27. Manasia L, Popa D, Ianos G. Anatomy of research performance from a bottom-up approach: examination of researchers' perspective. Sustainability. 2022; 14(4). doi: 10.3390/su14042254.

28. Alibekova G, Özçelik S, Satybaldin A, Bapiyeva M, Medeni T. Research performance assessment issues: the case of Kazakhstan. Sch assess reports. Vol. 3(1); 2021.

29. Wilsdon J. The metric tide. J Chem Inf Model. 2015; 53.

30. Butler L. Explaining Australia's increased share of ISI publications – the effects of a funding formula based on publication counts. Resour Policy. 2003; 32(1): 143-55. doi: 10.1016/S0048-7333(02)00007-0.

31. Meng X, Minogue M. Performance measurement models in facility management: A comparative study. Facilities. 2011; 29 (11/12): 472-84. doi: 10.1108/02632771111157141.

32. Azma F. Qualitative Indicators for the evaluation of universities performance. Procedia Soc Behav Sci. 2010; 2(2): 5408-11. doi: 10.1016/j.sbspro.2010.03.882.

33. Mahjoory K, Nikulin VV, Botrel L, Linkenkaer-Hansen K, Fato MM, Haufe S. Consistency of EEG source localization and connectivity estimates. Neuroimage. 2017; 152: 590-601. doi: 10.1016/j.neuroimage.2017.02.076, PMID 28300640.

34. Tijssen R, Winnink J. Global and local research excellence in Africa: new perspectives on performance assessment and funding. Sci Technol Soc. 2022; 27(3): 368-87. doi: 10.1177/09717218221078236.

35. Pati D, Lorusso LN. How to write a systematic review of the literature. Heal Environ Res Des J. 2018; 11(1): 15-30. doi: 10.1177/1937586717747384, PMID 29283007.

36. Sauer PC, Seuring S. How to conduct systematic literature reviews in management research: a guide in 6 steps and 14 decisions. Rev Manag Sci. 2023; 17(5): 1899-933. doi: 10.1007/s11846-023-00668-3.

37. Zhidebekkyzy A, Minazheva G, Temerbulatova Z, Kalmakova D. Evaluation of research performance at universities: A comprehensive methodological approach. Int J Emerg Technol Learn. 2023; 18(6): 110-29. doi: 10.3991/ijet.v18i06.36733.

38. Feng GC. Research performance evaluation in China: A big data analysis. Sage Open. 2020; 10(1). doi: 10.1177/2158244019901257.

39. Zhang L. The impact of data source on the ranking of computer scientists based on citation indicators: A comparison of web of science and Scopus. Issues sci Technol Librariansh. Vol. 75; 2014.

40. Taşkın Z, Doğan G, Kulczycki E, Zuccala AA. Self-citation patterns of journals indexed in the journal citation reports. J Inf. 2021; 15(4). doi: 10.1016/j.joi.2021.101221.

41. Taşkın Z, Taşkın A, Doğan G, Kulczycki E. Factors affecting time to publication in information science. Scientometrics. 2022; 127(12): 7499-515. doi: 10.1007/s11192-022-04296-8, PMID 35250119.

42. Ding T, Yang J, Wu H, Wen Y, Tan C, Liang L. Research performance evaluation of Chinese university: A non-homogeneous network DEA approach. J Manag Sci Eng. 2021; 6(4): 467-81. doi: 10.1016/j.jmse.2020.10.003.

43. Chen Y, Jiang Y, Zheng A, Yue Y, Hu ZH. What research should vocational education colleges conduct? An empirical study using data envelopment analysis. Sustainability. 2023; 15(12). doi: 10.3390/su15129220.

44. Lim MA. The business of university rankings: the case of Times Higher Education. In: Research handbook on university rankings: theory, methodology, influence and impact; 2021.

45. Fauzi MA, Tan CN, Daud M, Awalludin MM. University rankings: a review of methodological flaws. Issues Educ Res. 2020; 30(1).

46. Xu C. Towards a framework for evaluating the research performance of Chinese double first-class universities. Front Educ China. 2020; 15(3): 369-402. doi: 10.1007/s11516-020-0016-6.

47. Ansmann M, Seyfried M. Isomorphism and organizational performance: evidence from quality management in higher education. Qual Assur Educ. 2022; 30(1): 135-49. doi: 10.1108/QAE-07-2021-0114.

48. Cardoso L, Araújo AF, Lima Santos LL, Schegg R, Breda Z, Costa C. Country performance analysis of swiss tourism, leisure and hospitality management research. Sustainability. 2021; 13(4): 1-24. doi: 10.3390/su13042378.

49. Qiao L, Mu R, Chen K. Scientific effects of large research infrastructures in China. Technol Forecast Soc Change. 2016; 112: 102-12. doi: 10.1016/j.techfore.2016.07.029.

50. Wang L, Wang T. Research on the scientific research efficiency of provincial universities based on the DEA model. Mob Inf Syst. 2021; 2021: 1-12. doi: 10.1155/2021/7929084.