БІБЛІОТЕКОЗНАВСТВО

УДК 001.38

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BIBLIOMETRIC AND SCIENTOMETRIC METHODS OF RESEARCH EVALUATION

The paper discusses bibliometric and scientometric methods for measuring the production and dissemination of scientific knowledge. It aims to answer the questions why qualitative and quantitative methods are important to evaluate scientific products and how to implement these methods into the Ukrainian context. The author concludes that these methods must be used carefully when measuring or comparing the performance of individual scientists and research groups, in combination with other types of research evaluation.

Keywords: *bibliometrics, scientometrics, research evaluation.*

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БІБЛІОМЕТРИЧНІ ТА НАУКОМЕТРИЧНІ МЕТОДИ ОЦІНЮВАННЯ НАУКОВО-ДОСЛІДНИЦЬКОЇ ДІЯЛЬНОСТІ

У статті розглянуто бібліометричні та наукометричні методи для вимірювання показників продуктивності науково-дослідницької діяльності та поширення наукового знання. Мета статті полягає в тому, щоб відповісти на запитання, чому якісні та кількісні методи відіграють важливу роль у процесі оцінювання наукової продукції і як правильно їх використовувати в контексті української науки. Автор доходить висновку, що ці методи треба застосовувати з великою обережністю при вимірюванні або порівнянні показників окремих науковців і дослідницьких груп, а також у поєднанні з іншими видами оцінювання їхньої дослідницької діяльності.

Ключові слова*: бібліометрія, наукометрія, оцінювання дослідницької діяльності.*

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БИБЛИОМЕТРИЧЕСКИЕ И НАУКОМЕТРИЧЕСКИЕ МЕТОДЫ ОЦЕНКИ НАУЧНО-ИССЛЕДОВАТЕЛЬСКОЙ ДЕЯТЕЛЬНОСТИ

В статье рассмотрены библиометрические и наукометрические методы для измерения показателей продуктивности научно-исследовательской деятельности и распространения научного знания. Цель статьи заключается в том, чтобы ответить на вопросы, почему качественные и количественные методы играют важную роль в процессе оценки научной продукции и как правильно их использовать в контексте украинской науки. Автор приходит к выводу, что эти методы нужно применять с большой осторожностью при измерении или сравнении показателей отдельных ученых и исследовательских групп, а также в сочетании с другими видами оценивания их исследовательской деятельности.

Ключевые слова: *библиометрия, наукометрия, оценивание исследовательской деятельности.*

The global number of papers published in different fields of science has increased over the past decades. It is chiefly because scientific productivity is considered in the distribution of financial resources and in admission to participation in research groups and graduate programs as well as it is related to the socio-economic characteristics of a country. The importance of producing papers has led to the obsession with their quantity among researchers. Associated with this increase in scientific productivity, observed is the rapid development of bibliometrics and scientometrics which particular methods are being used in evaluating the progress of science and behaviors of scientists. In Ukraine, scientometric tools were introduced not long ago, thus raising numerous discussions regarding their reliability and validity among the research community. Thus, the present article aims to answer the questions why qualitative and quantitative methods are important to evaluate scientific products and how to implement these methods into the Ukrainian context.

Impact factors of scientific journals have gained significance in scientific work and research management and policy. Nowadays impact factor and other indicators are used in the evaluation of journal's performance as well as in the evaluation of research groups, institutes and even countries. With the advent of «Big Science» these techniques found a new application in the field of science administration though bibliometrics had been the domain of librarians and sociologists.

The terms «bibliometrics» and «scientometrics» themselves were almost simultaneously introduced in 1960s. Bibliometrics and scientometrics are explained as a set of methods for measuring the production and dissemination of scientific knowledge. Bibliometrics is made up of methods for conducting quantitative analysis of science and is based on two assumptions: the goal of researchers is to advance knowledge, and this means disseminating the results of their research and studies through a variety of communication media, including writing, which lies at the core of the academic tradition; scholars have to publish in order to build a reputation and advance their careers. [3, 2] The main types of indicators used in bibliometrics are:

– publication count (number of articles published in learned journals during a specific time frame);

– citations and impact factor (used to evaluate the scientific impact of research);

– co-citation and co-word analysis (used to map research activity: co-citation analysis, co-word analysis, and bibliographic coupling).

The main problems that affect the validity of bibliometric evaluation include limited coverage and exclusion of certain types of documents in the databases, classification of journals by discipline, changes in journal titles, names spelled the same way, number of authors (and distribution of work), excessive, selective, secondary, negative and erroneous citations, self-citation and personal strategies. Since bibliometrics is generally based on bibliographic databases, all the above mentioned reduce the validity of bibliometric research evaluation. [3, 9]

Bibliometric and scientometric indicators are considered to be more powerful at higher levels of aggregation and are more suitable for research evaluation in a large set (a faculty or large research team) and less suitable for the evaluation of individuals or small research groups.

According to Yunwei Chen, «scientometrics is a distinct discipline that performs quantitative studies of science and technology using mathematical, statistical, and data-analytical methods and techniques for gathering, handling, interpreting, and predicting a variety of features of the science and technology enterprise, including scholarly communication, performance, development, and dynamics.» [5] It originates from the quantitative study of science policy research, or the science of science, which focuses on a wide variety of quantitativer indicators of science. As L. Ivancheva assumes, scientometrics relates to the following subjects of research: science by itself; the process of scientific knowledge production; macro-environment of scientific research. [6, 2] An important feature of scientometrics is the possibility to be carried out synchronously as well as diachronously. It enables the tracing of the dynamic changes of the objects of study, becoming a powerful instrument of science policy.

The issues of bibliometrics and scientometrics have been much discussed by reserchers both in our country and abroad. Thus, Katy Borner et

al discuss the challenges of computational scientometrics research in terms of data access, algorithms calability, repeatability introducing two infrastructures: the Scholarly Database and Scientometrics relevant plug-ins of the open-source Network Workbench Tool. [4] In their study, the researchers mention that «while diverse tools exist to crawl, pre-process, analyze, or visualize scholarly data, most of the tools used in science of science studies today are proprietary or 'closed source', making it difficult or impossible to replicate results, to compare new and old approaches, or to agree upon standards» [4, 864]. Yu. Chaikovsky et al argue whether it is possible to apply and benefit from scientometric systems in the context of Ukrainian science. [2] According to Yu. Poliak, scientometric methods could be applied to evaluate scientific products but their capacity is limited. Being used for evaluation of scientific activities, they must be supplemented by expert estimation, and also the number of patents, awards and such hard-formalizable concept as a scientific reputation. [1, 106]

No denying the fact, integration of Ukraine into the global academic and scientific community is one of the most urgent issues of our time. Aimed at enhancing the credibility of science communication, international collaboration and unbiased scientific dialogue, the orders by the Cabinet of Ministers of Ukraine dated 05.04.2012, No. 318 and 08.10.2012, No. 780-R attempted to introduce the international criteria and mechanisms for evaluation of research activities of Ukrainian scientists. Moreover, in the procedure of attestation of the HEI, among other parameters, the criteria of quality and efficiency of scientific activities of the staff are also of great importance. The order of Ministry of Education and Science of 03.04.2012 No. 399 also promotes the dissemination of scientific achievements and the increase of credibility of the Ukrainian science in the world that is becoming increasingly important for our country. These documents highlight the crucial role metrics plays for research performance evaluation. The present tendency is for institutions to be graded more on the visibility of their products then on their long-term reputation or resources. In evaluative scientometric studies, these parameters are measured by activity indicator (measures the quantity of the productivity core), observed impact indicator (stands for impact of productivity core), journal related indices, and other newly introduced global indices (h and h-type indices). These indicators stand for the quantity, impact, influence, and quality of the scholarly communication.

It seems to be important to say that bibliometrics and scientometrics must be used carefully for research evaluation in Ukraine since implementing their methods in our country ruins the current system of scientific hierarchy. Furthermore, each discipline should have its own specific characteristics, so metrics is to be applied differently in each case. It is believed that simultaneous use of many techniques is a preferred approach to capture the different dimensions of a research. Therefore, the use both of quantitative and qualitative research techniques provides broadly consistent data combining depth with breadth. Scientometric studies, in combination with other types of evaluation, will give a better and more complete picture of the Ukrainian research scenario.

Conclusion

The development of bibliometric and scientometric methods has been influenced by the increased number of academic journals on the internet, as well as by the new facilities available for computing information. The ability of bibliometric and scientometric analysis to encompass different levels of aggregation makes it suitable to national and institutional studies.

Scientists and research managers should be in charge of the planning, execution and analysis of the research activities. What should be kept in mind is that research evaluation is an aid not the real goal. The validity of different indicators and indices should be applied cautiously when measuring or comparing the performance of individual scientists and research groups. Besides, some indicators established globally for the evaluation of scientific performance might not be suitable for a realistic assessment of research activity since in some countries like Ukraine publications in national journals in the native language is the norm. Therefore, research evaluation should be considered as only a partial indicator of overall scientific performance of an individual scientist or a research group, faculty, institution.

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