



RESEARCH AND ENGINEERING INNOVATION PROJECTS OF THE NATIONAL ACADEMY OF SCIENCES OF UKRAINE

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SCIENTOMETRICS AS A TOOL FOR STRATEGIC MARKETING OF A RESEARCH INSTITUTION

Introduction. To ensure the sustainable development of R&D activities, it is advisable for research institutions to implement elements of marketing management, particularly strategic marketing, which enables effective managerial decision-making. Applying marketing principles to R&D management enhances the visibility, competitiveness, and societal relevance of institutional research outcomes.

Problem Statement. This is currently relevant given that, under the conditions of war, funding for the institutes of the National Academy of Sciences of Ukraine has been significantly reduced.

Purpose. This study aims to substantiate the feasibility and effectiveness of using bibliometric and scientometric analysis of global scientific information flows as an instrument of strategic marketing in the management of R&D activities within research institutions.

Materials and Methods. The analysis has been conducted using the Scopus database (Elsevier), whose analytical tools allow the retrieval and examination of publication data on any research topic based on selected keywords. Scientometric indicators have been applied to assess trends, structures, and dynamics in global R&D related to specific scientific domains.

Results. Using ceramic nanocomposites as an example, the study has examined the dynamics of publication activity by researchers from various countries, reflecting the relevance and evolution of this R&D direction. The distribution of publications by document types has provided insight into the maturity and stage of global research. Further analysis of publications by performing organizations identified target audiences for potential R&D products, while the distribution by funding organizations allowed for anticipating sponsor priorities and aligning institutional research plans accordingly. The industry-based distribution of publications has revealed potential users and consumers of R&D results. The findings have demonstrated that scientometric analysis is an effective tool for strategic marketing of R&D. It enables institutions to identify key audiences and partners; to detect trends and opportunities for developing new R&D products

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and services that meet stakeholder needs; to define key topics and concepts in relevant R&D domains to support evidence-based marketing strategies; to establish connections with potential collaborators, co-authors, and grant providers.

Conclusions. Scientometric research provides essential input for defining and adjusting priority R&D areas, as well as for medium- and short-term planning of institutional research activities. Integrating scientometric tools into strategic marketing promotes evidence-based management, strengthens the competitive positioning of research institutions, and ensures better alignment with global R&D development trends.

Keywords: strategic marketing, scientific products, ceramic nanocomposites, bibliography, scientometric analysis, key audience.

To ensure the sustainable development of R&D activities, it is essential to establish a management approach that guarantees an adequate level of funding under any internal or external conditions. This issue has become particularly pressing in recent years, as the funding of the institutes of the National Academy of Sciences of Ukraine (NASU) has been significantly reduced due to the ongoing war. Within the first year after the full-scale invasion began, core funding decreased by 15%, while competitive project-based funding declined by 35%. Consequently, many research projects have been curtailed, and the average employment level of research staff has fallen to 0.6 full-time equivalent or lower.

Industrial enterprises facing similar challenges successfully employ marketing management tools, or strategic marketing, to maintain stability and competitiveness [1]. This term refers to a managerial activity associated with the development and implementation of decisions that guide an organization's operations toward achieving strategic competitive advantages, ensuring rapid adaptation to internal and external changes, long-term sustainability, and alignment of the economic interests of producers and consumers [2–4].

Depending on institutional goals, the strategy type may focus on stabilization, survival, or growth. For the sustainable development of a research institution, the most appropriate choice is a strategy of intensive growth, aimed at increasing income and strengthening market positioning through:

- ◆ the utilization of existing internal capabilities;
- ◆ collaboration with other institutes and universities;
- ◆ active expansion into new markets.

In implementing such a strategy, all institutional resources must be directed toward achieving the defined objectives. The primary means of doing so is the development and enhancement of R&D products — including new technologies, materials, and services — together with the creation of unique innovative solutions and the pursuit of leadership in R&D.

The conceptual framework of the marketing strategy is illustrated in Fig. 1.

The diagram illustrates the key stages of this process.

At the first stage, the organization assesses its R&D potential — available resources such as funding, equipment, personnel, and R&D outputs — and conducts an analysis of both the external and internal environment. Based on this assessment, the institution identifies its strengths and weaknesses.

Next, the competitive advantage is determined — what the organization can accomplish more effectively than its competitors (e.g., higher productivity, unique R&D products, or advanced technologies).

At the second stage, the institution evaluates whether its available resources are sufficient to ensure competitive advantage and to achieve its strategic objectives.

Drawing on the analysis of resources and capabilities, a strategy is selected that allows for the most efficient use of available assets to attain the desired level of competitiveness.

Once the strategy is chosen, the institution identifies any resource gaps that could hinder its implementation and plans the necessary actions to secure effective performance in subsequent stages.

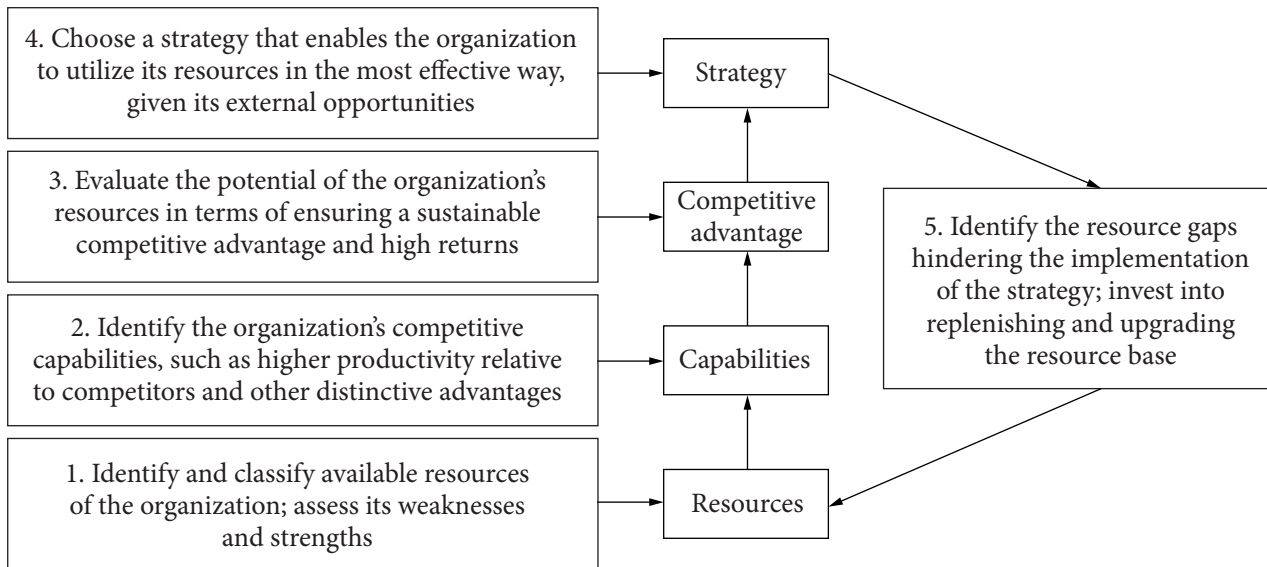


Fig. 1. Schematic representation of the marketing management process in an organization [1]

Given the specific nature of R&D products, the strategic marketing of a research institution requires appropriate and relevant tools, particularly information-based instruments.

The purpose of this study is to demonstrate the feasibility of using bibliographic scientometric analysis of global scientific information flows in implementing strategic marketing within a research institution.

One of the most effective tools for analyzing the R&D marketing environment is scientometric research. Although scientometric methods are widely applied to assess the publication activity of individual researchers and research institutions [5], their use for marketing analysis of R&D activities in Ukraine has not yet been reported. This study explores how scientometric analysis can support: the identification of competitors; the assessment of demand for R&D developments; the discovery of emerging niches; the definition of target audiences through market segmentation — dividing potential clients into groups based on criteria such as industry, size, and geographical location.

As an example, let us consider how the bibliographic scientometric analysis of global scientific information flows can be applied to assess the

competitiveness of one of the priority R&D directions of the Frantsevich Institute for Problems of Materials Science of the National Academy of Sciences of Ukraine (IPMS NASU) — the development of ceramic nanocomposites.

The analysis has been conducted using the Scopus database [6], created by the leading European publisher Elsevier. The choice of this resource is justified by its key advantages, including:

- ◆ coverage of more than 22,000 scholarly research journals published by over 4,000 leading publishers worldwide;
- ◆ inclusion of approximately 13 million patents from four international patent agencies;
- ◆ incorporation of materials from scientific conferences;
- ◆ a data depth of nearly 60 years (since 1966);
- ◆ integration with specialized Elsevier databases (such as *Embase*, *Compendex*, and others) as well as major databases from other publishers.

In many countries, Scopus serves as a primary source of scientometric data for conducting evaluative research at both the national and corporate levels.

The Scopus analytical tools provide users with unique capabilities for generating customized search queries. The platform's functionality enables

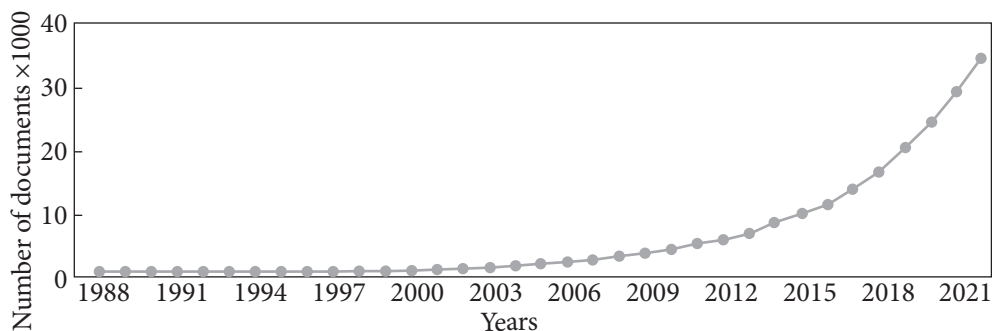


Fig. 2. Distribution of documents on ceramic nanocomposites by year since the appearance of the first publications [6]

the retrieval of all publications on a selected topic, as well as the identification of sources that cite those works. The search engine allows users to instantly obtain and analyze results on any topic expressed through specific keywords, thereby offering a powerful instrument for R&D market analysis and benchmarking.

As an example, let us consider how the bibliographic scientometric analysis of global scientific information flows can be applied to assess the competitiveness of one of the priority R&D directions of the Frantsevich Institute for Problems of Materials Science of the National Academy of Sciences of Ukraine (IPMS NASU) — the development of ceramic nanocomposites.

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Using data from the Scopus database, the publication activity dynamics of researchers from various countries in the field of ceramic nanocomposites have been analyzed. This indicator reflects the relevance and global development of this R&D direction, which, in turn, determines the demand for corresponding R&D products (Fig. 2).

A bibliographic analysis similar to the one presented above makes it possible to trace the emergence of promising subfields branching from the main R&D direction under consideration, thus enabling a timely response to innovation challenges. An illustrative example is the evolution of research in the broader field of nanomaterials, which has developed along the following lines (with the years marking the onset of a significant increase in publication activity): nanoceramics (2005) → nanostructured materials (2010) → nanostructured metals (2010) → nanoalloys (2012) → carbon nanocomposites (2017).

The timely initiation of research in a new and promising area contributes to strengthening the institution's leadership position in the global R&D landscape.

The following section presents scientometric studies of ceramic nanocomposites over a five-year period (2018—2023) (Fig. 3).

As shown in Fig. 3, ceramic nanocomposites have remained a prominent R&D trend during the analyzed five-year period, indicating that further research in this field can be effectively planned. At the same time, it is necessary to specify the composition-related focus by identifying which types of ceramic nanocomposites are in greatest demand through scientometric analyses of boride, hydride, nitride, and other nanocomposites to guide subsequent research and development activities.

To develop an effective marketing strategy for the selected R&D direction, it is essential to understand the current stage of global research in this field. Insight into this can be gained from the distribution of publications by type (Fig. 3). All analyses presented below are made for the time interval 2018—2023.

As a rule, at the initial stage of research, conference papers tend to dominate, followed by journal articles, then review papers, after which book chapters and subsequently books appear. It should be noted, however, that this sequence is not universal: for example, the first publications may be journal articles or patents rather than conference papers. Nevertheless, such deviations do not significantly affect the correlation between the stage of field development and the prevailing type of publications.

Among all publications on the topic under consideration, journal articles constitute the largest share, followed by review papers, book chapters, and conference papers (Table 1). This distribu-

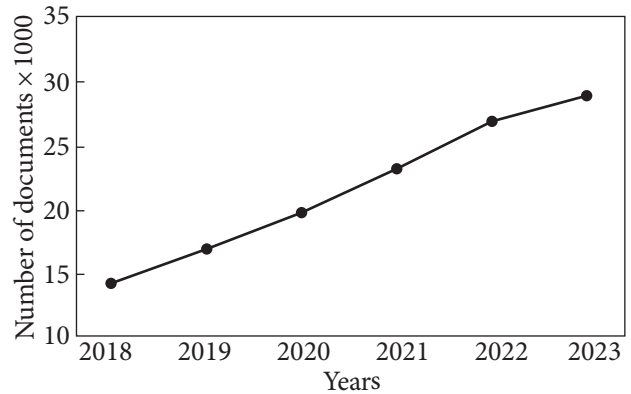


Fig. 3. Distribution of documents on ceramic nanocomposites by year for the period 2018—2023 [6]

tion indicates that R&D on ceramic nanocomposites has moved beyond the initial stage and is currently in a phase of active development, which should be taken into account when planning future research. At this stage, it is advisable to focus efforts and concentrate resources on conducting applied research and on the development of new products and services for end users.

To identify the key topics and concepts within the field and to develop a marketing strategy for further R&D, it is necessary to study the target audience of the scientific output — that is, the group of organizations most interested in the research and capable of deriving the greatest benefit from it. Indirectly, an organization's level of interest in a given scientific product can be inferred from the number of documents on the topic that are affiliated with it.

The geographical distribution of publications on ceramic nanocomposites by country for the period 2018—2023 is shown in Fig. 4.

It should be noted that the largest part of the target audience under consideration is concentrated in Asian countries. The distribution of docu-

Table 1. Distribution of Documents on Ceramic Nanocomposites by Document Type for the Period 2018—2023 [6]

Type of document	Articles	Reviews	Book section	Conference reports	Books	Short communications
% of the total documents	79.5	13.2	4.3	2.3	0.3	0.1

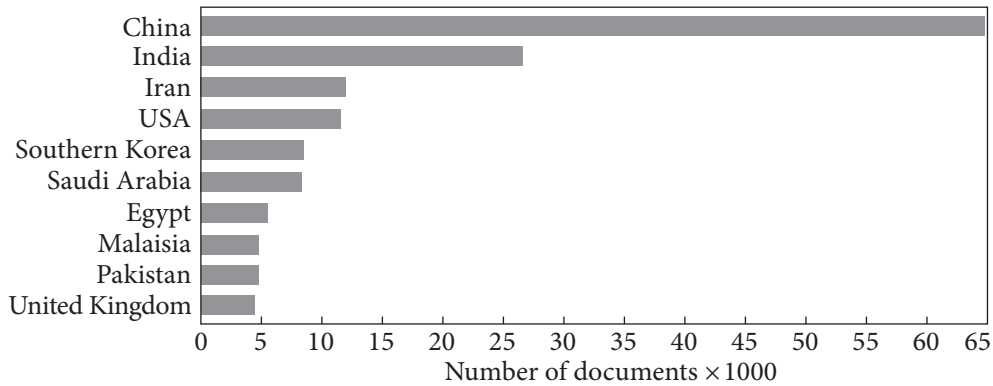


Fig. 4. Distribution of documents on ceramic nanocomposites by country for the period 2018–2023 [6]

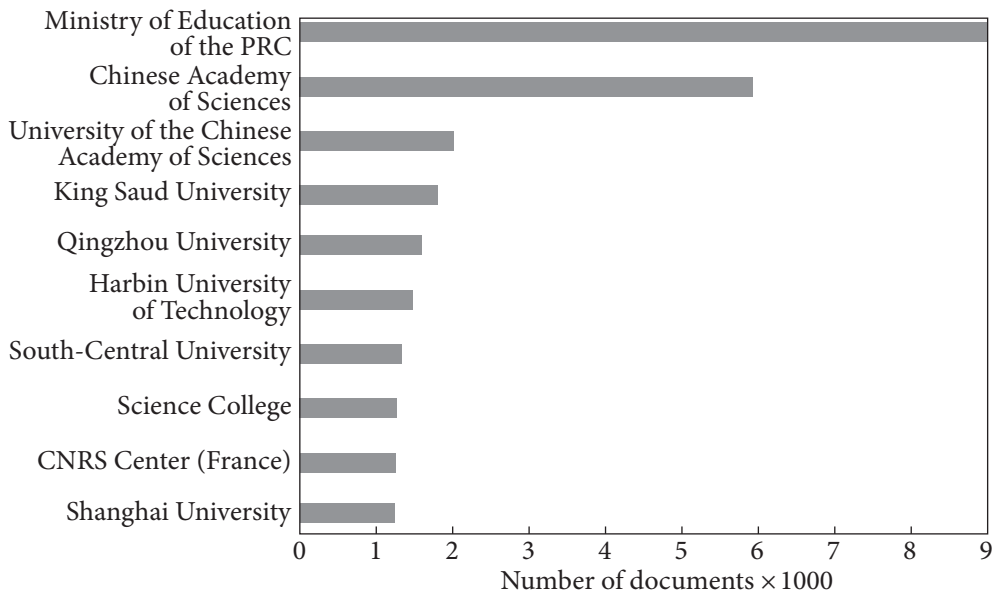


Fig. 5. Distribution of documents on ceramic nanocomposites by organization for the period 2018–2023 [6]

ments by organizations, presented in Fig. 5, allows the target audience to be further specified at the organizational level.

The majority of publications are affiliated with Chinese organizations, including the Ministry of Education of the People’s Republic of China, the Chinese Academy of Sciences, and the Harbin Institute of Technology, as well as King Saud University (Saudi Arabia) and the National Centre for Scientific Research (CNRS, France).

This information is valuable for analyzing the competitiveness of a research institution, that is, identifying what it can do better than its competitors (e.g., higher productivity, unique R&D products), determining competitors, and finding potential partners for collaborative research, including through competitive projects and grant programs. It also helps in strategically directing the institution’s publication and communication policy, such as selecting journals and conferences for dissemination.

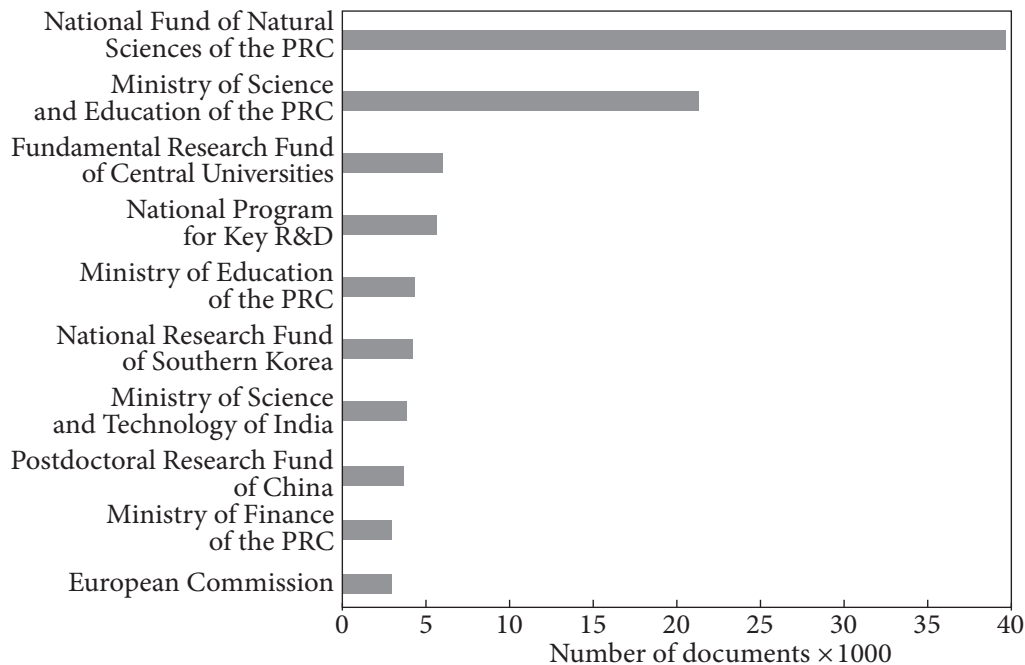


Fig. 6. Distribution of documents on ceramic nanocomposites by sponsoring organizations [6]

Figure 6 presents information on organizations sponsoring research in the field of ceramic nanocomposites. Knowledge of these sponsors allows research plans to be adjusted in advance to meet the needs of specific potential funders. The largest sponsors of work in this field include the National Natural Science Foundation of China, the Ministry of Science and Education of China, the Fund for Fundamental Research of Central Universities in China, the National Key R&D Program of China, the National Research Center of Korea, the Ministry of Science and Technology of India, the China Postdoctoral Science Foundation, the Ministry of Finance of China, and the European Commission.

The largest sponsors of research in the field under consideration are the National Natural Science Foundation of China and the Ministry of Science and Education of China. Other significant sponsors include the National Research Center of Korea, the Ministry of Science and Technology of India, and the European Commission.

Additional information on potential clients and end users of R&D outputs can be obtained through bibliographic analyses of the distribution of publications by industry (Table 2).

The most interested parties in the results of research in this field — that is, the key target audience — include several industries, with the main ones being materials science, engineering, physics and

Table 2. Distribution of Documents on Ceramic Nanocomposites by Fields of Knowledge for the Period 2018—2023 [6]

Field of knowledge	Materials science	Engineering	Physics and astronomy	Chemistry	Chemical engineering	Ecology	Power engineering	Biochemistry	Computer engineering	Medical science
% of the total	31.6	18.6	13.9	13.1	9.7	2.8	2.8	2.3	1.2	0.9

astronomy, chemistry, and chemical engineering. When planning research, it is important to consider the needs of specific potential end users within these sectors.

It should also be noted that for each search (Figs. 2—6), Scopus provides corresponding lists of publications, enabling a range of additional analytical studies with any desired level of detail.

CONCLUSIONS

The formulation of conclusions in this study has been assisted by Artificial Intelligence [8].

Scientometric analyses are therefore an effective tool for the strategic marketing of R&D outputs, enabling researchers and institutions to:

- ◆ Identify the key audience: understanding who publishes and reads research in a given field,

thereby allowing efforts to be directed appropriately.

- ◆ Detect trends and opportunities: develop new products and services that meet the specific needs of the audience.

The results of scientometric analyses can be applied to:

- ◆ Topic mapping [7] that helps to identify key themes and concepts in a research field and develop a marketing strategy for R&D development that is relevant to the target audience.
- ◆ Collaboration analysis, facilitating connections with researchers in the field and establishing relationships with potential co-authors and grant agencies.

Additionally, scientometric results can support the identification and adjustment of priority R&D directions, as well as medium- and short-term research planning within a research institution.

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НАУКОМЕТРИЯ ЯК ІНСТРУМЕНТ СТРАТЕГІЧНОГО МАРКЕТИНГУ НАУКОВОЇ УСТАНОВИ

Вступ. Для підтримки сталого розвитку наукових досліджень доцільним є запровадження науковою установою засобу маркетингового управління або стратегічного маркетингу, який дозволяє приймати ефективні управлінські рішення.

Проблематика. Актуальним це є наразі, коли за умов війни значно скоротилося фінансування інститутів НАН України.

Мета. Довести доцільність застосування бібліографічного наукометричного аналізу світових потоків наукової інформації при реалізації стратегічного маркетингу.

Матеріали й методи. Для аналізу було використано пошуковий апарат бази даних *Scopus* видавництва «Elsevier», який дозволяє отримати та проаналізувати результати за будь-якою тематикою, вираженою ключовими словами.

Результати. На прикладі наукового напрямку «керамічні нанокompозити» вивчено динаміку публікаційної активності науковців різних країн, що характеризує рівень актуальності напряму досліджень. Розподіл публікацій за видами демонструє, на якій стадії знаходяться відповідні світові дослідження, а розподіл публікацій за організаціями-виконавцями дозволяє оцінити цільову аудиторію наукової продукції. Аналізування організацій-спонсорів дає можливість заздалегідь зкоригувати плани досліджень з метою задоволення потреб конкретних потенційних замовників, а розподіл публікацій за галузями показує потенційних замовників та користувачів наукової продукції. Показано, що наукометричні дослідження є ефективним інструментом для маркетингу наукової продукції, оскільки дозволяють визначити ключову аудиторію, ідентифікувати тренди та можливості розробити нові продукти і послуги, які задовольняють потреби цільової аудиторії, визначити ключові теми та концепції у своїй галузі й розробити маркетингову стратегію, релевантну для користувачів, налагодити зв'язки з потенційними співавторами та грантодавцями.

Висновки. Результати наукометричних досліджень можуть бути корисними при визначенні та коригуванні пріоритетних напрямів розвитку наукових та науково-дослідних робіт, а також при середньо- та короткостроковому плануванні досліджень наукової установи.

Ключові слова: стратегічний маркетинг, наукова продукція, керамічні нанокompозити, бібліографія, наукометричний аналіз, ключова аудиторія.