CHAPTER «SOCIAL COMMUNICATIONS»

SCIENTIFIC JOURNAL AS SOCIO-COMMUNICATIVE PHENOMENON: FORMATION AND DEVELOPMENT TRENDS

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Abstract. The need to study a scientific journal as socio-communicative phenomenon is caused by a rapid development of communication processes in the scientific sphere and the need for the integration of Ukrainian science into the world scientific and cultural spaces. The number of scientific journals is growing exponentially, globalization in scientific communication is deepening. Thus, the study of the formation and development trends of scientific journals, the generalization of world and Ukrainian experience in scholarly publishing is extremely important. The research was carried out using analysis, synthesis, classification, comparison. The logic of our research develops from the selection of facts, their study, systematization, and generalization to the prediction of the development of a scientific journal as a social-communication phenomenon. To summarize the theory, historical and logical methods were applied. Based on a systematic approach, we reached the conclusions and distinguished the trends of scientific publishing. The world of scientific journals is a structured and hierarchical system. Their functions include verification, storage and dissemination of scientific knowledge. The main characteristics of a scientific journal as a social communication phenomenon are following: 1) to support of scientific communication; 2) to fix communicative roles of participants of the editorial and publishing process; 3) to focus on civilizational challenges; 4) special language and text; dependence on English as the language of international scientific communication. A scientific journal enables theorists and practitioners to obtain new information in the field of fundamental and applied research, to familiarize themselves with new methods of scientific

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studies, helps to understand the trends of scientific discourse, contributes to the design and forecasting of scientific activity, provides a guide about how research results should be presented in terms of content and form. As powerful accumulators of verified scientific knowledge, scientific periodicals create the space of scientific communication, uniting the scientific community and building its interaction with society, business and the state. Authors, editors and reviewers, as well as consumers of scientific content, participate in scientific communication through a scientific journal. Awareness of the laws of scientific journal evolution and the generalization of the best practices in this field can be a methodological basis for the development and implementation of an effective policy in the field of scientific press publishing in Ukraine.

1. Introduction

A scientific journal is an intermediary between the author (authors) of a specific article and other researchers, potential employers, investors. There are outsiders and leaders among scientific journals, just like in any other sector of the publishing industry. The editors of a newly created scientific journal have to put in a lot of efforts to attract authoritative authors and ensure proper review. Meanwhile a world-class English-language journal known in scientific circles is already a platform for the struggle of authors for the right to be published in it.

The need to study the formation and socio-communicative essence of a scientific journal is due to the rapid development of communication processes in the scientific sphere and the need for the most effective integration of Ukrainian science into the world scientific and cultural spaces. The number of scientific journals is growing exponentially in the world, the processes of globalization in scientific communication are deepening, publishers and scientists are developing and improving behavioral norms of the scientific community regarding peer review, the interaction of authors with editors and reviewers, as well as with co-authors. Thus, the study of the formation and development trends of scientific journals, the generalization of world and Ukrainian experience is extremely important and determines the relevance of our research.

The research was carried out using general scientific theoretical methods (analysis, synthesis, classification, comparison). The logic of our research

develops from the selection of facts, their study, systematization, and generalization to the prediction of the development of a scientific journal as a social-communication phenomenon. In order to research the historical stages of the development of the scientific journal, to summarize theoretical developments, historical and logical methods were applied. Thanks to the historical method, we received a detailed retrospective, from the angle of which the current state of scientific periodicals was investigated. Also, the historical method helped to delve into the essence of the research field, to look at the past from the standpoint of the present, and to predict the transformation of the studied phenomenon, taking into account the experience gained through scientific reflection. The logical method made it possible to establish cause-and-effect relationships between the studied phenomena and to notice hidden contradictions in the development of the research object.

A systematic approach made it possible to consider the object of the research in the process of development and has been provided thanks to analysis, the process of dividing the research object into components for their study and, accordingly, synthesis, for understanding the object as a whole. The specificity of the systemic approach here is determined by the fact that it allows to fully reveal the research object in the process of its development and to combine the complex system of its internal and external components into a single theoretical picture. Based on a systematic approach, the research results were transformed into a system of interconnected facts, patterns and conclusions. The synthesis method helped to distinguish the trends of scientific press publishing at the state and international level.

2. Evolution of scientific journals

According to M. Lafollette, a scientific journal is a periodical that is considered by an identified intellectual community as the main channel for the exchange of knowledge and as one of the arbiters of the authenticity or legitimacy of this knowledge [28, p. 69]. A traditional scientific journal is a periodical publication where articles have a standardized format depending on the subject area or specifics of the research itself and undergo expert evaluation in the process of acceptance for publication [12].

Publishers, national states, professional associations, and individual researchers are the driving forces behind the formation of scientific

periodicals [39]. The main role of a scientific journal is, on the one hand, to provide the reader with reliable, up-to-date information, and, on the other hand, to enable the author to reach a large audience [1].

The history of scientific journals begins in the 17th century. "Le Journal des Sçavans", founded by D. de Sallo in France in January 1665, is considered the first scientific journal. The pilot issue of the publication contained ten articles, several letters, and notes, but it had a volume of only 20 pages and at the same time covered information on various topics [46].

According to D. Price [36], the first classic scientific journal is "Philosophical Transactions", a journal of the Royal Society of London. Started in March 1665 as a monthly, the journal became a means for the members of the Royal Society of London to disseminate the results of their scientific experiments and lectures. The first issue of the journal is now available digitally through JSTOR.

The editor of "Philosophical Transactions", H. Oldenburg, attracted correspondents from all over the world, and encouraged disputes between authors, far-sightedly considering discussion as an essential stimulus in scientific work. At the same time, he was distinguished by his radicalism: he usually fundamentally revised articles, establishing certain publishing traditions, which, along with the traditions of scientific research itself, contributed to the effective functioning of the "tandem": "scientific activity + publicizing its results through publication".

The emergence of "Le Journal des Sçavans" and "Philosophical Transactions" testified to the growing pace of development of experimental science and the desire of researchers to share ideas and results of scientific activity more effectively than personal letters or scientific books allowed.

D. Kronik singled out four main components of the first scientific journals, which gradually transformed this type of publication into a new means of scientific communication: 1) originality of the publication (presentation of new knowledge, ideas, hypotheses, research results); 2) references to other similar publications; 3) availability of book reviews; 4) publication of news or reports. The scientist also described main forms of the first scientific journals: those published by scientific societies (about 80 %) and substantive (independent) [26].

With the emergence of the first scientific journals, the search for optimal ways of scientific communication with the help of this tool took place.

At first, articles were allowed to be printed in various journals, moreover, without even indicating the sources where they had already been published. Peer review of articles began to develop only in the 19th century, primarily in chemical journals.

According to B. Houghton, by the end of the 17th century there were from 30 to 90 scientific journals all over the world, and by the end of the 18th century a total number increased to 755 titles. By the middle of the 18th century, the journal gradually became the main means of scientific communication, its main functions were outlined: providing scientists with information about research, including reviews of foreign scientific achievements; informing a wide audience and storing new knowledge; encouraging scientists to publish their works; a platform for discussing scientific ideas, hypotheses, or theories, open to criticism [21].

Gradually, journals began to move from broad coverage of various scientific issues to specialization, which was reflected both in the creation of new journals that covered narrower topics, and in changing the names of journals to more specialized ones. Quantitative growth in the publication of specialized journals reflected further dynamism in the development of scientific knowledge [46].

In addition to raising the role of the scientific journal in the progress of science in general, it also played a prominent role in the formation of the prestige and reputation of an individual scientist or scientific team. The creation of specialized journals (along with the emergence of specialized societies) demonstrates the adoption of a new paradigm in science. The specialization of science lasted throughout the 19th and 20th centuries [27].

At the beginning of the 19th century there were about 100 names of scientific journals, which became the fastest and most convenient means of disseminating the results of scientific research [18]. In the 1850s, the number of journals titles was 2,000, and by 1900 it had reached 10,000 [36].

With the increase in the number of periodical scientific publications in the world, there was a need for the development of tools for identifying and searching for articles. In the mid-1800s, the first bibliographic indexes (reference journals) appeared, which in the second half of the 20th century transformed into databases and other search engines.

At the end of the 19th century in the conditions of the dominance of the idea of “national science” a “nationally oriented” model of scientific

communication (country – language – author) had been developed. Economic, political and military competition between states served to spread this model [20].

In 1937, the number of scientific journals reached 33 thousand [3], in 1970 – 50 thousand [14], and in 1991 – 133 thousand [38]. Today, according to Ulrich's Periodicals, there are more than 200,000 scientific journals in the world.

Thus, emerging in an era when the sharing of discoveries was often considered unprofitable, scientific journals began to compete with monographs, theses, letters, etc., eventually becoming the primary means of communication due to the faster dissemination of information.

Over the past 80 years, the roles of participants in the editorial and publishing process in the field of preparation of scientific journals have been significantly deconcreted. Authors become publishers when they publish articles on their own websites. Subscription agencies that provide direct links to e-journal content are now little more than intermediaries and provide a pathway to primary sources. Professional associations that digitize and archive scientific journals play a traditional library role [23].

A certain regional specialization was also formed. For example, scientists from the USA and EU write scientific articles primarily in the fields of astronomy and astrophysics, biological and biomedical sciences, health care, psychology and social sciences, conservation of natural resources, mathematics and statistics. Meanwhile, Chinese scientists prefer agricultural sciences, chemistry, physics, information technology, mechanical engineering, materials science, environmental protection [37].

Back in the early 1970s, D. Price pointed out that in a few generations the number of leading scientists will grow much more slowly than the number of average scientists, and this will increase the cohort of scientists capable of writing good scientific works, but not outstanding ones. He believed that each new discovery stimulates further scientific research and expands its scope, so the number of scientific journals grows proportionally [36].

Since the productivity of the research author remained relatively constant over time, D. Price suggested that the growth in the number of scientific journals and scientific articles is closely related to the number of scientists and increases in tandem. He also estimated that from 1830 to the early 1960s, about one abstract journal was created for every 300 journal

titles. These journals emerged because of a crisis of information overload: when the number of journal articles increases, scientists are unable to read every publication that may be relevant to their field.

The modern interconnected problems of the inverse proportionality of the number and quality of scientific articles are a natural manifestation of what D. Price once predicted. Therefore, we fully agree with the opinion that the quality of the scientific press can be improved only by reducing the scientific efficiency and productivity of researchers [24].

B. Latour in his monograph "Science in Action" notes that most of the scientific papers remain simply unread. No one agrees with them, no one even objects to them. That is, in most cases, the discussion process does not even begin, and the ability to conduct a discussion largely depends on the resources that can be attracted. And these resources are concentrated in the hands of a very few [50, p. 266–267].

According to S. Bradford's law, 80 % of scientific information can be found in 20 % of scientific journals (the so-called Pareto principle inherent in many disciplines: an empirical rule according to which 80 % of the effects are caused by 20 % of the causes) [6].

Indicators are important for the growth of the number of scientific journals, according to which it is possible to classify scientific journals. These criteria-indicators play a fundamental role both from a methodological point of view and from a business point of view. Currently, there are many databases that collect biometric data for ranking scientific journals, such as SCOPUS (https://www.scopus.com/), Web of Science Core Collection (https://webofknowledge.com/), and Google Scholar (https://scholar.google.it/). Among the indicators there are the number of citations of the articles published by the journal, the impact factor (IF), SCImago Journal Rank (SJR), the source of normalized impact of the article (SNIP) and the h-index.

Since the late 1960s, and especially since the mid-1990s, digital versions of journals have been spreading, speeding up readers' access to scientific content and providing enhanced functionality. DOI (Digital Object Identifier) has replaced numbers, volumes, and page numbers for Internet searches. Modern search systems of electronic sorting have largely solved the problem of finding scientific information.

The wide availability of bibliometric data from sources such as Elsevier, Google Scholar and Thomson Reuters ISI make it easy for employers

to obtain data on the productivity of scientists and to compare it with the performance of other researchers. At the same time, the role of the modern journal is very similar to the role of scientific periodicals in the past, despite changes in the format of presentation of material and funding schemes: to disseminate research and provide primacy [19]. Meanwhile, falsification of scientific results and plagiarism become increasingly urgent problems of scientific periodicals, and retraction of scientific articles is a routine practice.

The end of the 20th – the beginning of the 21st century opened a new era of scientific communication associated with the emergence of electronic journals. These are periodical scientific publications that are a complete electronic resource and contain a group of electronic documents (articles) that have undergone editorial and publishing processing (including peer review) and have source information intended for long-term storage, distribution in an unchanged form, all copies of which correspond to the original. Such terms as network-, online-, Internet-, Web-journals are also used.

"Mental Workload" and "Computer Human Factors" are considered as the first electronic scientific journals. "Mental Workload" appeared in the USA as part of the experimental project of the 1970s "Electronic Information Exchange System", "Computer Human Factors" – in Great Britain as part of the project "Development of Electronic Networks" [51].

The advantages of electronic journals for the user include speed of preparation and distribution of publications; round-the-clock access; a wide range of search possibilities; the possibility of establishing an interactive connection between the author and the user; navigation (search for information through citations, access to cited works); including multimedia; system of personal adjustment for convenience in finding the necessary information. In addition, universities can include e-journals in distance education.

Today, electronic journals are more popular among libraries and readers than their printed counterparts, although both forms continue to coexist. The combination of an increasing number of scientific journal titles and their wider availability, especially in electronic format, has sparked discussions in the library, publishing, and scholarly communities about the challenges and prospects of scholarly communication. Accelerated rates of creation and accumulation of information, globalization of knowledge actualized the search for tools to ensure quick and effective access to this knowledge, scattered across different countries and different information repositories.

The main innovation made possible by Internet technologies was the growth of open access – free, immediate, permanent, full-text Internet access to scientific publications, which allows any user to read, download, copy, distribute, print, refer to full texts articles, use them for indexing and for any other legitimate purposes without financial, legal or technical barriers, except those related to access to the World Wide Web. The only restriction on reproduction and distribution is copyright.

The term "open acces" was first used at a meeting held in Budapest in February 2002. P. Suber singled out the following features of open access journals: digital form, online access, free of charge, lack of copyright and licensing restrictions [44]. The number of these journals increases by about 30 % every year. S. Silver suggests that within 10 years access to all journals will become unlimited [41].

Open access models include journals and an open archive or institutional repository. Open access journals are electronic periodicals that and freely available to users. Archives (repositories) are created by scientists depositing and self-archiving their materials in open electronic archives. These can be both non-reviewed unprinted materials (preprints) and peer-reviewed articles, as well as dissertations, reports, etc. [55].

Preprints, for example, help initiate an open discussion, get feedback from readers, comments, remarks that contribute to the improvement of scientific work. And while preprints may contain errors, imprecise conclusions, etc., they can also serve as an early indicator of later academic impact [33].

The open access model benefits all stakeholders: organizations (service to society and return on investment in research); authors (increasing the visibility of their works); readers (access to primary sources); publishers and reviewers (evaluation of their work); libraries (providing the opportunity to satisfy various information requests); research institutions (reputation and prestige).

Scientific periodicals have been significantly influenced by many other innovations made possible by information and communication technologies that have changed the way scientific knowledge is obtained, evaluated, and disseminated. Services such as SSRN, Google Scholar, ResearchGate, Academia.edu, Mendeley have made the search for scientific knowledge more interactive and web-oriented: search methods now focus on topics and author names, rather than searching for journals themselves.

Nowadays, the perception of the very fact of publishing an article is changing. For example, the Crossref API lists several dates associated with a publication: index date, publication date, update date, acceptance date, deposit date, creation date, online publication date, release date. In addition, each publisher interprets the meaning of the corresponding date in own way [32].

In general, authors, readers and commercial publishers have clearly benefited from the digitization of scientific periodicals [29]. Publishers continue to invest in digital publishing infrastructure. For example, Elsevier invested in Mendeley in 2013, SSRN in 2016, and Plum Analytics in early 2017. In 2015, Springer invested in MacMillan to become the second scientific publishing giant. At the same time, such actions of publishing houses lead to an increasing dependence of the entire scientific community on them.

Since the beginning of the XXI century more and more scientific journals use the electronic manuscript submission system. This helps to save the time of all participants in the editorial and publishing process and helps to establish communication between them. Among the most popular programs are ScholarOne (SAGE journals and some Nature Publishing Group journals), Editorial Manager (Springer, Wiley, PLOS), and Evise® (Elsevier). The online publication submission system provides transparency by providing authors of scientific periodicals with access to the manuscript tracking system, which allows checking the status of the manuscript at all stages of the editorial and publishing process.

Today, the sphere of Ukrainian scientific periodicals is being significantly restructured, integrating into the international space of scientific communication. With this in mind, all participants in the editorial and publishing process – authors, editors, reviewers – have to master international publishing experience and standards. Among the current areas of work related to the development and promotion of Ukrainian journals in the global space of scientific communication, the following can be distinguished:

1. Ensuring international visibility of the publication.
2. Formation of stable and reliable distribution channels of the journal.
3. Increasing the external attractiveness of the journal for authors and readers, in particular thanks to visualization of the content taking into account the best world experience.
4. Bringing the publication into compliance with the requirements set forth by global scientometric bases.

5. Involvement of the best specialists in the field in the selection and examination of manuscripts: strengthening the editorial boards by foreign scientists who have high rates of citation in international databases.

The most important guarantee of the quality of a modern scientific journal is the system of scientific review, which has been slowly developed since 1665 and has been formally implemented since the mid-1800s. However, the process of scientific review has now changed radically: if earlier scientists informally consulted with colleagues and friends about the quality of their manuscript before submitting it for publication, recently double-blind peer review has been practiced, when the reviewers do not know the names or institutions of the authors.

3. Classifications of scientific journals

According to the types of publishers, modern scientific journals are classified into five categories: a) journals edited and published by five large commercial publishers called the Big 5 (Elsevier, Springer, Taylor, Wiley and Sage); b) journals edited by professional associations and published by commercial publishers; c) journals edited and published by the International Journal of Economics, Finance and Management Sciences (International Journal of Economics, Finance and Management Sciences); d) journals edited and published by university publishing houses, such as Oxford University Press; e) journals produced by small or medium-sized publishers, in addition to the four types mentioned above [45].

According to the depth of information processing, there are three types of scientific journals. Primary journals mostly publish new results or new interpretations and discussions of known facts and ideas. Secondary journals mainly give preference to data on primary documents and are a product of informational and bibliographic activities. They cover abstract journals and their indexes, express information bulletins and bibliographic journals. Tertiary journals summarize previously published materials. This group includes journals of survey results, journals devoted to scientific methodology, etc.

In many fields, there is an informal hierarchy of scientific journals; editors of the most prestigious journals tend to be the most selective in selecting articles for publication, and the journals themselves have the highest impact factor [10]. Some journals specialize on publishing the

scientific results of authors from a certain country or region, for example, the European Journal of Social Theory.

C. and T. Bergstrom classify modern scientific journals into two groups: those controlled by "non-profit" professional societies and those subordinated to commercial publishers [2].

The publication in a journal can take place in two models: when the reader pays and when the author pays. The first model is traditional, according to which publishers receive income from publication subscriptions. The second is new and arose due to the possibility of free access to articles via the Internet. Under this model, publishers receive a fee from authors for making their articles available to a wide range of readers [25].

There is also a so-called hybrid model, when the author is offered to pay for publishing an article and thus it becomes publicly available, or not to pay, but in this case the article is available only to subscribers.

J.-C. Guedon divides scientific journals into two categories: mainstream, published mainly in developed countries, and peripheral, published in developing countries [17]. Journals of the first group are also called center, high-ranking, or elite. They rank highly in citation systems and are usually published in English. The second group, regardless of the volume and circulation of the publication, includes both English-language publications and periodicals in other national languages. Many journals of this group are not indexed by international citation databases.

According to the purpose of the publication, the following journals can be distinguished: a) aimed at meeting the needs of authors in publishing material with the aim of including it as a scientific article to fulfill formal requirements (for a report, for obtaining a scientific position, scientific degree, etc.); b) oriented to the spreading of scientific results.

In the Ukrainian segment of the scientific press, Ya. Yatskiv divides scientific journals by purpose: scientific and theoretical, scientific and practical, and scientific and methodical. Scientific and theoretical journals reflect the achievements of fundamental and applied sciences. These are journals of the National Academy of Sciences, branch academies, academic research institutions, scientific societies, and institutions of higher education. They include journals that publish information of a general scientific, fundamental nature, and journals in different thematic fields. Along with the results of research, they highlight the progress and methods of their

implementation, and discuss the problems of sustainable development. Their readers are, first of all, researchers, teachers, specialists of industry enterprises and project institutes.

Scientific and practical journals are intended for specialists whose professional activity is based on the results of scientific research, requires evaluation of practical experience at the theoretical level and is related to the implementation of scientific developments in practice. They are designed to help specialists of various professions in solving practical tasks, to promote the improvement of their qualifications, the ability to reasonably choose promising directions and methods of development of production and technology. Methodological recommendations are published in scientific and methodical journals [56].

In Ukraine, important steps have been taken to improve the content and media visibility of scientific journals. In particular, in accordance with the order of the Ministry of Education and Science of Ukraine dated January 15, 2018 No. 32 "On approval of the procedure for forming the list of scientific specialized publications of Ukraine", the criteria for forming the list of specialized publications of Ukraine were formulated.

The journals were divided into three categories. Category C included journals that met the minimum requirements. This is a state registration certificate; ISSN; DOI; the journal's website with Ukrainian and English interfaces or the journal's web page on the founder's website with information about the journal's policy, a list of editorial board members, information about the review process and compliance with ethics, recommendations for preparing publications and the order of their submission; annotations in English of at least 1,800 characters. Publications of this group were also required to be placed on the "Scientific Periodicals of Ukraine" platform in the V. I. Vernadskyi National Library of Ukraine of the NAS of Ukraine and the National Repository of Scientific Texts.

Category B included journals that met these requirements for publications of group B, as well as such requirements as ensuring high-quality independent review of materials submitted for publication by scientists who conduct research in the relevant field and have at least one publication in journals during the last three years, included in the List, or in foreign journals included to the Web of Science Core Collection and/or Scopus, or monographs or sections of monographs published by

international publishing houses belonging to categories A, B or C according to classification Research School for Socio-Economic and Natural Sciences of the Environment (SENSE).

The editorial board of the journal must include at least seven scientists with a scientific degree in one of the specialties corresponding to the scientific profile of the journal. Each of these specialists, including the editor-in-chief, must have at least three publications in the last five years or at least seven publications (articles, monographs, sections of monographs that correspond to the scientific profile of the publication) during the last fifteen years, including at least one in the last three years, published in at least two different journals included to the Web of Science Core Collection and/or Scopus, or monographs or sections of monographs published by international publishing houses belonging to categories A, B or C according to the classification of the Research School for Socio-Economic and Natural Sciences of the Environment (SENSE).

In addition, the editorial board must include at least three scientists who work primarily in Ukrainian scientific institutions or institutions of higher education, and at least one scientist who works primarily in a foreign scientific institution or institution of higher education. The scientist can be a member of no more than three editorial boards of publications included to the List.

Category A includes Ukrainian journals that are indexed in Scopus and (or) Web of Science Core Collection. According to the Procedure, category C journals, which by April 2020 had no right to be included in categories A or B, were planned to be excluded from the List without the right to renewal. The reasons for exclusion of a publication from the List by the decision of the Ministry of Education and Science are also: violations of the principles of academic integrity by the editors, authors and reviewers; systematic publication of materials that do not contain new scientific results [52].

4. Mega-journals as a new form of scientific publications

A new form of scientific journals – mega-journals – has gained considerable popularity under modern conditions. In 2006, the first mega-journal PLoS ONE was founded, which introduced a publication fee for authors, and also initiated a new process of peer review of the publication, which was based on ensuring the scientific and methodological soundness of the research, but not its significance and originality. The idea of the PLoS

ONE publishers was that any manuscript that presented scientifically valid results based on experiments was worthy of acceptance [12]. The opinion about the importance of any article in a mega-journal is formed on the basis of the evaluation of the publication by the readership [43].

Due to the popularity of this publication in the system of scientific communication, publishers have begun to issue "Nature" (Scientific Reports), "AIP Advances", "BMJ Open", "F1000" and "PeerJ". Separate initiatives have also emerged in the field of humanities and social sciences, in particular "SAGE Open" and "The Open Library of Humanities".

B.-C. Bjork singled out the features of mega-journals. They are the following: a large volume; expert assessment only regarding scientific validity; broad subject area; full open access; good reputation of the publisher; availability of scientific editing; availability of infographics for better perception by a wide audience; additional influence measurement indicators (altmetrics); availability of a platform for readers' comments on the journal's website [4].

The attitude of scientists to mega-journals varies significantly. R. Wellen determined that they are a positive innovation that can contribute to significant changes in scientific communication [49]. J.-C. Guédon, participating in an online discussion about the future of scientific journals, stated that mega-journals are the best form of communicating the results of scientific research to a wide readership [17]. D. Butler expressed the opinion that mega-journals are the "golden bottom" for open access publishers [8], although there is a danger that they may become a "cesspool" for manuscripts rejected by the more demanding editors of scientific journals [30].

The number of citations and downloads are usually used as indicators of the quality of individual articles, which can be additionally improved by active promotion on the Internet and discussion of publications. With a mega-journal, the publisher and author save time because they do not have to deal with a large number of journal titles with different publishing and ethical standards. The reputation of the publisher here is the most important criterion for attracting articles written by well-known scientists and actively contributes to the development of the journal.

At the same time, mega-journals have also created skepticism among scientists. They are, for example, already considered as "dumping of the scientific press", which reduces the value of the content of publications compared to ordinary journals [11]. Scientists also note that thousands of

articles published in mega-journals are not reviewed professionally, but only superficially reviewed [7].

There are concerns that publishing in mega-journals is "career suicide," especially for early-career researchers [47]. C. Creaser suggested that mega-journals may threaten the existence of highly specialized journals, but this will not happen as long as there is a demand for quality control of research output, which is achieved by peer review [9].

The growing number of mega-journals raises questions about how the reviewer community (practitioner-scientists) will cope under the pressure of peer review requests, as well as how the reader will navigate the excessive volume of journal pages, as the number of individual mega-journal pages increases by more than 1000 % per year. In addition, such a significant amount has no limits. Authors may be tempted by the seeming ease of publishing their work in a mega-journal, and there is a significant risk that their articles will be unnoticed for a long time, or even never.

In any case, mega-journals today have significantly influenced the nature of scientific communication itself: relying only on the scientific and methodological soundness of research during the selection of articles, their editors promote interdisciplinary scientific research and allow the audience to determine the relevance of publications themselves [30].

Mega-journals create broad multidisciplinary repositories in open access, thus reversing the trend toward specialization of scientific journals. They sometimes underestimate the role of editorial board members and reviewers, who traditionally act as arbiters in determining the importance of a publication. In addition, mega-journals enhance interdisciplinary collaboration. Articles contain frequently updated information about citations, bookmarks and tweets, and authors and readers can get a detailed analysis of how the posts were loaded. The ability for readers to comment on articles provides the potential for unlimited peer review, while authors themselves can use these features to communicate with their audience.

Overall, a mega-journal is an attractive idea for authors worldwide. They choose to publish in these journals for various reasons, but, as T. Domnina found out, they value above all the quality of the journal, timely expert review, as well as the speed of publication [12]. With this in mind, mega-journals will continue to gain popularity. Their development will depend on the ability to maintain high scientific standards of publications.

5. Piracy of scientific publications

Currently, piracy has become an extremely negative trend related to the publication and distribution of scientific articles. A symptom of the imbalance of the scientific communication system due to the pressure of scientometrics and the lack of concerted efforts to find a viable legal publishing model is, for example, the resource Sci-Hub [31]. This web service offers free access to about 62 million publications. An analysis of article downloads from the resource shows that 35 % of all downloaded articles were published after 2013. A comparison of article usage at the publisher level shows that 80 % of all downloads come from articles from the journals of only nine publishers [16]. The main publisher whose articles were illegally downloaded is Elsevier.

To gain illegal access to an article, users only need to know the title, URL, or DOI number of the article. After entering a search query, Sci-Hub accesses the Library Genesis database. This is a separate database that complements Sci-Hub [22]. If Library Genesis has a copy of the article, then Sci-Hub sends a copy to the user, but if the Genesis Library database does not have such a copy, Sci-Hub uses other proxies until it accesses the requested article. Sci-Hub uses proxies to obtain a copy of the article it sends to the user, and uploads the copy to Library Genesis for later use [42].

Obviously, the main reason for the popularity of the Sci-Hub resource is the economic troubles of certain countries and their educational and scientific institutions. For example, Amir Kabir University of Technology in Tehran is one of Iran's leading research universities, but international sanctions and economic turmoil keep it out of reach of journals. This is what makes researchers illegally access articles [5].

According to J. Peters, articles from Sci-Hub were downloaded primarily (in order of decreasing number of downloads) in Iran, China, India, Russia and the USA [34]. However, a large number of Sci-Hub users already have legal access to the articles they illegally download. For example, leading academic centers in the US and Europe are among the "hot spots" of pirated content downloads via Sci-Hub [13]. At the same time, experts estimate the costs of, for example, German universities on journals subscriptions in the range of 200 million euros per year. For the UK, these estimates range from £160m (according to Jisc collections) to £192m per year (according to Research Libraries UK) [40].

As a result of illegal access to documents via Sci Hub, information about the use of the article is lost. For example, authors do not get information about statistics of its downloads, which is increasingly used as a criterion for evaluating their work. Libraries are unable to adequately monitor the use of the journals they subscribe to, and this results in subscriptions to the publications being discontinued. Thus, the opportunities for non-profit scientific societies to publish journals are limited, because today digital press publishing is as expensive as print publishing. So piracy destroys the viability of the system that supports the quality and integrity of science.

6. Journal as a means of formal scientific communication

Communication is an integral part of the process of scientific research and at the same time it is its result. This is an ordered system of social connections, establishing contacts between scientists, as well as interaction with the readership, state institutions, business on issues related to science, initiated and managed by representatives of the scientific community and which takes place using formal and (or) informal channels.

Scientific communication is multilateral, standardized and ritualized; it activates feedback and can take various forms: communication between members of the same team, co-authorship, transfer of information to specialists in other fields, popularization, formulation of instructions for the practical use of scientific results, etc. That is, this phenomenon covers a wide range of issues: from the actual dissemination of scientific research to new models of public involvement in scientific discussions and decision-making regarding research funding.

The overall goal of scientific communication is to improve the relationship between science and society and to promote science in the public sphere through a variety of means, including increasing scientific literacy and cultivating a positive perception of science as a civilizational value. As one of the main mechanisms of obtaining and transmitting scientific information, scientific communication is an important means of connecting science and society, as well as a condition for the formation scientists' reputation.

The space of scientific communication is formed by universities, scientific research institutions, scientific collectives, scientific activity management structures, scientific journal editors, social networks, libraries, international

scientific organizations and associations, scientific staff attestation systems and covers the system of scientific knowledge, material and technical base, as well as the social conditions in which scientists work.

Currently, significant transformations are taking place in the "author-publisher-library-reader" chain, i.e. informal scientific communication begins to play an increasingly important role. However, the main functions of publicizing new achievements in various fields of science, maintaining a remote dialogue between individual scientists, ensuring the continuity of scientific research are still performed by scientific journals, which provide a forum for communication among scientists, bring valuable scientific information to the general public, business representatives and state authorities, establish the agenda for discussion in specific scientific fields, archive scientific knowledge, ensure compliance with the publication standards of scientific periodicals, and fix the priority of authors.

The institutionalization of scientific communication takes place through peer-reviewed journals. They make it possible to quickly report on the latest results of scientific research, to unite geographically distant researchers based on common scientific and professional interests, and to receive feedback. The revitalization of information exchange in the field of science makes it possible to consider a scientific journal not only as a platform for exchanging the results of scientific activity, but also as an exchange of activity itself, the result of the scientists' interaction as the members of the scientific community.

Scientific journals summarize the results of theoretical or experimental research conducted by individual scientists or scientific groups; initiate further scientific developments and cooperation; generate debates on current scientific problems; provide scientists around the world with access to cutting-edge achievements.

Scientific journals are the markers of the transformation of modern society. Activities related to the preparation, review, editing of scientific publications, exchange of scientific information is a criterion of the degree of social development and the level of maturity of the scientific community, involved in these processes. At the same time, each scientific journal should not be considered in isolation, but in the context of the existence of similar journals and their relationships. Under such conditions, it becomes possible to obtain holistic knowledge instead of a chaotic collection of data, as well as to ensure a dynamic exchange of verified information.

Currently, the number of titles of scientific journals is growing rapidly, as well as new trends are spreading, related, in particular, to the influence of information and communication technologies, internationalization of science. Under these conditions, the role and professional responsibility of the editor, who must realize and implement the ethical norms of scientific communication in publishing practice, as well as understand the motives of authors and readers, the diversity of the publication's audience, the level of readers' knowledge, are actualized.

Scientific journals are an element of formal scientific communication. Papers are evaluated and distributed in the scientific community and stored for further use. Publication of scientific journals is a self-regulated publishing practice of the scientific community. Among the features inherent in a scientific journal, the main ones are replication, orderliness, and standardization. Scientific journal of the first quarter of the 21st century has unique business models and brings together publishers, founders, libraries, and scholars who create, improve, and consume scientific content.

The authors of scientific journals represent social communities, scientific schools, institutions, disciplinary associations, and the scientific journal itself is a means of communication within them and with other communities. Scientists not only communicate the results of their research to colleagues through articles, electronic preprints, etc., but also rely on previously published articles when planning their research methodology. That is why the author of a specific article is not an individual "I", but a collective "we" [15].

The "collaboration of science" takes place when an individual scientist as a member of the scientific community becomes only a part of the subject of knowledge, to whom only a fragment of the object of knowledge is available within the scope of the research project. In addition, the members of this community may be spatially separated, but the work is performed by "collectives united by common tasks and cooperation agreements, which for various reasons continuously add new members and leave former members" [53].

Individual members of the scientific community learn the properties of the object of research as a collective subject, which affects both the authorship and the conceptual understanding of the object of knowledge. In this problematic context, the scientists' awareness of their involvement in

a certain scientific tradition is of fundamental importance for ensuring the integrity of the research.

Turning to tradition becomes a superstructure on the work of scientists, providing the possibility of their conversation, interdisciplinary communication. And in this context, tradition appears as an existentially colored understanding of the continuity of scientific activity, as its cultural-historical dimension, which gives expediency to specific scientific activity. An appeal to tradition is the coordinates that define the contours of the researched object, creating the possibility of understanding it as a whole in the context of the collaboration of researchers. The traditions of scientific knowledge, methodologically understood as an expression of the historical continuity of science, are the basis of a holistic vision of the object of research by scientific collectives, that is, the tradition is correlated with the collective organization of knowledge, which, appearing in the form of a collective subject, implements large-scale cognitive projects, realizing the progressivity of scientific activity [54]. One of the distinctive features of collaboration is that, despite the division of labor, its members are united by the "we-intention", which gives reason to consider their activities as joint.

Interacting in the space of scientific communication, researchers are guided by communicative strategies of search, presentation, self-affirmation, struggle for recognition, strategies of attraction, etc. At the same time, there are significant differences in communication within a small professional group, a micro-community, and outside it. For example, new ideas are discussed in a narrow circle of colleagues. This happens not only due to trust, but also due to a common socio-cultural context: a common paradigm and conceptual system; unity of goals, as well as everyday research and communication practice.

Playing the role of a means of communication for scientific communities, journals are formed by them and contribute to the formation of new scientific communities [48].

Communication between all participants in the editorial preparation of scientific articles usually takes place in writing. For the editor of a scientific journal, the main task is to interest the journal's readers, ensuring the selection for publication the most relevant and useful articles. For the author, the main goal is to publish the results of scientific research as soon as possible in order to be read, perceived and cited by other scientists.

We agree with the reasoning of J. Potts and J. Hartley that a journal can be seen as a club for scholarly communication that is voluntary, controlled, limited, global and standardized. Voluntariness means that members of a particular academic group join a club for rational reasons: if the benefits of joining exceed the costs. The benefits are mainly the ability to be read, perceived, and cited, while the costs are associated with paying for reading or publishing articles and aligning goals with the club's requirements.

The controllability means that it is important for the club community who exactly and why its members are. The more authoritative are the members of the club, the more valuable is the membership in it.

Limited means that the club gives benefits only to those who are active members of it. Scientific communities use scientific language, which narrows the circle of the audience that can perceive scientific texts. In addition, even the most motivated and active scientists cannot simultaneously be authors in all journals in their field of expertise.

Globality means that scientific journal clubs are connected to other similar clubs: there is competition between scientific journals, for citations. Standardization means that there are established requirements for the content, design of publications, etc. [35].

Only those journals whose editors rely on expert assessment of the quality of the texts published there can be considered truly scientific. Examining manuscripts in the process of expert evaluation is a way of verifying and legitimizing knowledge. Expert evaluation becomes the first communicative response to the authors' proposals.

The journal as a scientific communication club unites the academic community, which has six defining characteristics:

1) a set of common goals;

2) supporting the scientific journal as a forum for communication between community members;

3) constant communication through the active participation of community members in the editorial and publishing process in the role of editors, reviewers with feedback;

4) use of established genres of publications and forms of communication;

5) use of specialized vocabulary;

6) the tendency to rational expansion of the community, when its "survival" depends on a reasonable ratio between "experts" and "newbies".

The main characteristics of a scientific journal as a social communication phenomenon are: 1) maintenance of an institutionally specified type of communication – scientific communication; 2) fixed communicative roles of participants in the editorial and publishing process of creating a periodical scientific publication; 3) the specificity of the circumstances of scientific communication, which occurs through the electronic system of submission of manuscripts; 4) dynamism and adaptability to global changes and modern civilizational challenges; 5) special language and text; dependence on English as the language of international scientific communication; 6) special approaches to content monetization.

A scientific journal plays a prominent role in scientific communication for several reasons: it enables theorists and practitioners to obtain new information in the field of fundamental and applied research, to familiarize themselves with new methods of scientific studies, helps to understand the trends of scientific discourse, contributes to the design and forecasting of scientific activity, provides a guide about how research results should be presented in terms of content and form.

As powerful accumulators of verified scientific knowledge, scientific journals unite the scientific community and build its interaction with society, business and the state. Moreover, the results of scientific research, published in scientific journals and implemented in practical solutions, become a factor of the modernization of society itself.

In scientific communication, which takes place through the mediation of a scientific journal, participate a lot of people: authors or author teams; editors and reviewers, as well as consumers of scientific content. The scientific text is built according to a model that meets the communicative needs of both the communicator and the communicated, as well as the conditions of communication. All communicators are guided by motives, knowledge, experience, time and material resources. Readers of a scientific journal are active subjects of influence. Reading the journal for professional, educational or any other purpose, they are able to raise the consumption of scientific information from a purely consumer level to the level of co-creation.

Each researcher, in accordance with the standards of scientific activity, relies on the scientific works of other scientists. Scientific journals themselves are generally characterized by the same parameters that regulate

the requirements for published scientific results. These parameters are prescribed in the Guidelines for Authors, and their compliance is monitored through a review system.

In each scientific publication, along with information about the research, there are data about other scientists, in connection with whose views the scientist's own vision of the scientific problem and its solution was formed. A manifestation of such a relationship is citation, the point of interaction of authors with the environment of scientific experience: collision, convergence of different ideas. Through citational interaction, scientists continuously influence each other and at the same time they are themselves influenced, therefore, over time, conventional ideas about the scientific picture of the world are developed – clusters of knowledge, and sets of agreed (conventional) and debatable scientific views are also formed.

The main element of the system of communication between scientists and the basis for evaluating the results of their activities is a scientific article. It determines the researcher's rating and creates a source base for further research activities. This is a genre of academic literature that quickly records the way of research, reveals the technology and methodology of scientific research, its stages, and allows the communication process to be carried out not only in the interests of a closed group of scientists, but also for the sake of improving the information culture of the entire society. A scientific article requires a special approach to its creation, a submission form determined by the editors, editorial processing with mandatory peer review, and must also contain elements that allow readers to identify it.

The uniqueness of a scientific article is due to the personality of the scientist, as well as the author's manner of presenting the results of scientific research. Having complex structural and content characteristics, a scientific article reveals essential features of the personality of the author and all other people involved in writing and evaluation of the article. In fact a scientific article is a product of co-creation.

The editor of a scientific journal controls the entire editorial and publishing process, communicates with all participants and identifies promising directions of research in the relevant field of science. The editor directs the efforts of all participants of the editorial and publishing process and each of its members, in particular, to the performance of common tasks, which is actualized and at the same time complicated by the

internationalization of research and the growing demands for the quality of published scientific results.

The professional competence of the editor of a scientific journal is embodied in constructive acts of interpersonal communication interaction, in constant self-development, the ability to model and transform the communication situation, one's own communication activity and the behavior of other participants of the editorial and publishing process, to establish and maintain professional contacts, to adhere the principles of academic integrity.

The editor supports interactions between other participants of scientific communication, ensuring the balance of their interests and motivating them to constructive changes in the nature of communicative interactions in order to achieve both individual and collective goals and positive social effects.

The modern scientific journal can be evaluated according to the following indicators:

1. The number of downloads of articles from the journal's website is an indicator that characterizes the publication's popularity among readers.

2. The percentage of accepted or rejected manuscripts is an indicator characterizing the journal's popularity among authors.

3. The average duration of reviewing one article is an indicator that characterizes the efficiency of manuscript evaluation.

4. Average time spent on publishing an article from manuscript submission to journal publication.

5. Feedback from the scientific community and society on the article.

At the same time, the modern system of scientific periodicals cannot equally satisfy the needs of all communicators involved in scientific communication. This is the result of a variety of factors, including high subscription prices, copyright concerns, and the delay between obtaining results and publishing them. Therefore, there is a global discussion on how to correct the shortcomings of the system, and this discussion prompts initiatives aimed at reforming the editorial and publishing process.

7. Conclusions

The need of scientific communication contributed to the development of a scientific journal, a source of scientific information and a place for storing new scientific ideas and fixing research priorities. The formation of

this means of scientific communication takes place under the influence of numerous socio-economic, normative, cultural and technical factors. The main trends at the current stage of the evolution of scientific journals have become the growth of open access and the spread of mega-journals.

The world of scientific journals is a structured and hierarchical system. Their functions include verification, storage and dissemination of scientific knowledge. At the same time, the functioning of each journal directly depends on the social realities within which the authors and editors and reviewers work.

A scientific journal is a form of multilateral social interaction and a center of formal scientific communication between authors (co-authors) and readers, between authors (co-authors) and reviewers, between editors and reviewers, between co-authors, between co-authors and editors, between editors and readers, between editors and the publisher, between the editors and subjects of authority (ministries and departments), etc. At the same time, world-class journals are platforms for the struggle of authors and author groups for the right to be published in them.

The peer-reviewed scientific journal combined several functions. They are following:

– obtaining scientific knowledge;

– dissemination of scientific knowledge;

– accumulation of scientific knowledge;

– impact on society through the implementation of scientific achievements;

– formation and support of activities of scientific communities;

– formation the image of the author and the organization represented by the author (coauthors);

– formation of the image of the state represented by the author (coauthors).

There are some important indicators of the authority of a scientific journal: foreign members of editorial boards and articles wtitten by foreign authors, support of communications with experts in the thematic areas of the journal, cooperation of author teams, belonging to international scientometric bases, as well as the significance of scientific problems raised in articles for the international scientific community.

The representation of scientific journals in the communication space is different and is expressed in citation rates, which determine the social recognition of published articles. Important factors of the importance of publication are its social significance, commercialization of scientific results.

The growth in the number of scientific journals worldwide increases the competition both among authors and in the publishing environment. Therefore, the editors of Ukrainian scientific journals face new challenges that force them to radically revise their editorial policy: how to reach a level that allows access to international scientometric databases, how to strengthen their own positions involving the best authors and reviewers in cooperation, where to find funds to support scholarly publishing, not violating ethical principles, how to prevent conflicts of interest, etc.

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