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Фіялка С. Б.

*канд. наук із соц. комунікацій, доц. кафедри
видавничої справи та редагування
Навчально-наукового видавничо-
поліграфічного інституту, КПІ ім. Ігоря
Сікорського, м. Київ, Україна, fiyalka@i.ua*

ORCID: 0000-0002-1855-7574

Fiialka S.

*PhD of Social Communications, Associate
Professor at the Department of Publishing
and Editing, Publishing and Printing Institute
of Igor Sikorsky Kyiv Polytechnic Institute,
Kyiv, Ukraine, fiyalka@i.ua*

ORCID: 0000-0002-1855-7574

DIRECTIONS OF THE MODERN SCIENTIST'S COMMUNICATION INTERACTION IN THE SPACE OF FORMAL AND INFORMAL SCIENTIFIC COMMUNICATION**НАПРЯМИ КОМУНІКАЦІЙНОЇ ВЗАЄМОДІЇ СУЧАСНОГО ВЧЕНОГО У ПРОСТОРІ ФОРМАЛЬНОЇ І НЕФОРМАЛЬНОЇ НАУКОВОЇ КОМУНІКАЦІЇ**

The subject of the research is the directions and conditions of interaction of the scientist in the space of scientific communication. The purpose of the article is to characterize the communication interactions of a modern scientist in the space of scientific communication, which is formed by research institutions, research teams, grant donors, the state as one of the subjects of scientific management, scientific journals, social networks, attestation systems. The research methodology is based on a set of general scientific methods (analysis, synthesis, generalization) and approaches (systemic, socio-communicative approaches). A systematic approach to the study has been provided through analysis as a process of dividing the object of study into components and synthesis to understand the object. Socio-communicative approach has been used to identify the impact on scientific communication of social changes occurring in society. The modern scientist must know the international standards for preparing scientific publications; read and publish articles in journals indexed by Web of Science, Scopus and other prestigious scientometric databases; have profiles on social networks for scientists; use English as the language of international scientific communication; join projects with Ukrainian and foreign scientists and write co-authored articles. Currently, the reputation of the scientist and communication standards of academic integrity come to the fore

(correct citation, prevention of plagiarism, self-plagiarism, falsification of research, trade in authorship, etc.). An indicator of a scientist's successful communication is his scientific rating, which includes: 1) the citation rate of publications and their number; 2) the reputation of the journal in which they are published; 3) the number of received grants (domestic and international); 4) participation in international cooperation.

Keywords: scientific journal, communication interactions, scientific communication, formal communication, informal communication, mass audience.

Предметом дослідження стали напрями й умови взаємодії науковця у просторі наукової комунікації. Мета статті — схарактеризувати комунікаційні взаємодії сучасного науковця у просторі наукової комунікації, що формується науково-дослідними установами, науковими колективами, грантодавцями, державою як одним із суб'єктів управління науковою діяльністю, редакціями наукових журналів, соціальними мережами, системами атестації наукових кадрів тощо. Методологія дослідження ґрунтується на комплексі загальнонаукових методів (аналіз, синтез, узагальнення) та підходів (системний, соціокомунікативний підходи). Системний підхід до дослідження напрямів соціально-комунікаційних взаємодій було забезпечено завдяки аналізу як процесу поділу об'єкта дослідження на складники для їх вивчення та синтезу для розуміння об'єкта в цілому. Соціокомунікативний підхід застосовано для виявлення впливу на наукову комунікацію соціальних змін, що відбуваються в суспільстві. Сучасний учений повинен знати міжнародні стандарти оформлення наукових публікацій; читати та публікувати статті у журналах, що індексуються Web of Science, Scopus та іншими престижними наукометричними базами; мати профілі в соціальних мережах для науковців; володіти англійською мовою як мовою міжнародного наукового спілкування; долучатися до спільних проєктів з українськими і зарубіжними науковцями та за результатами досліджень брати участь у підготовці статей у співавторстві. Нині на перший план виходять авторитетність науковця та комунікаційні стандарти академічної доброчесності (коректність цитування, розподіл авторського внеску, запобігання плагіату і самоплагіату, фальсифікаціям досліджень, торгівлі авторством тощо). Показником успішної комунікації науковця стає його науковий рейтинг, який охоплює: 1) показник цитованості публікацій та їх кількість; 2) репутація журналу, в якому вони публікуються; 3) кількість отриманих грантів (вітчизняних та міжнародних); 4) участь у міжнародному співробітництві.

Ключові слова: науковий журнал, комунікаційні взаємодії, наукова комунікація, формальна комунікація, неформальна комунікація, масова аудиторія.

Introduction. Exponential growth of scientific knowledge, commercialization of science and its integration into the field of international scientific communication requires a modern scientist's ability to communicate effectively. The leading role of communications in the activities of the scientist is due to both the internal specifics of science and the peculiarities of the interaction of science with the social environment (economics, politics, law, morality). The results and effectiveness of scientists depend on the level of information support and interaction with other scientists [14]. Participation in international scientific projects, conferences, co-authored scientific research, publications in international peer-reviewed scientific journals — all this is the result of successful communication.

On the one hand, researchers interact with each other within the scientific community, and on the other — disseminate scientific knowledge in society among audiences not directly related to scientific activities [10]. In their communications, some scientists are guided primarily by the principles of scientific credibility and academic integrity, for the other part, only reporting on the fact of publication becomes a priority. However, modern experts in the field of social communications and science studies usually consider the communication of scientists one-sidedly, without focusing on its complexity and contradictions. The relevance of our study is that it summarizes the multifaceted and sometimes contradictory social interactions of scientists with colleagues, investors, editors of scientific journals, mass audiences and more.

Scientific communication includes, first, the publication of scientific works, explanation, and popularization of science by non-scientists (journalists), as well as the promotion of scientific research results [11]. I. Bogdanova listed the components of scientific communication: direct connections (personal conversations, face-to-face scientific discussions, oral reports); connections mediated by technical means of information reproduction (publications, preprints, unpublished materials); mixed relations (scientific seminars, conferences, symposia, scientific and technical exhibitions, etc.) [4].

Formal scientific communication takes place through scientific journals, and informal through seminars, webinars, conferences, correspondence, personal websites of researchers, scientific blogs, social networks [5; 7; 15; 17]. Formal communication is monologue, standardized, unified, while informal is spontaneous, dialogical, casual, irrational, unsystematized and less reliable.

The role of social networks for communication between scientists has been studied in detail by H. Donelan, D. El-Berry, A. Elsayed, D. Lupton, S. Manca, M. Ranieri [6; 8; 9; 16; 18; 19]. They studied their importance for disseminating research results and establishing new relationships with colleagues, tracking indicators related to interest in research. Meanwhile, S. Medvedev, V. Sadivnychy and G. Koryavko, and T. Yakhontova paid attention to the directions of communication between scientists and the mass audience [22; 28; 34].

The purpose of the article is to generalize the directions of communication interaction of a modern scientist in the space of scientific communication, which is formed by research institutions, research teams, donors, the state as one of the subjects of scientific activity management, scientific journals, social networks, attestation systems.

Research methods. The research methodology is based on a set of general scientific methods (analysis, synthesis, generalization) and approaches (systemic, socio-communicative). A systematic approach to research has been provided through analysis as a process of dividing the object into components and synthesis for understanding the object. This made it possible to reveal the integrity of the object of the study in the process of its development and to combine the complex system of its internal and external components into a holistic picture. The method of synthesis made it possible to identify trends in scientific communication.

Socio-communicative approach has been used to identify the impact on scientific communication of social changes occurring in society. In particular, the dependence of scientific communications on the state policy in the scientific sphere is outlined.

Results. By communication interactions of scientists, we mean a system of social interactions, networking, dialogue between scientists, as well as communication with other stakeholders (government institutions, business representatives, the public) on issues related to science, search, accumulation and dissemination of scientific knowledge. They include the publication of scientific papers, the explanation and promotion of science by non-scientists (primarily journalists), as well as the promotion of research results [11]. Let`s describe the main areas of communication interactions of the modern scientist.

Interaction with donors. The system of funding science is increasingly moving from a model of targeted funding to grant funding with competition between researchers for funding [32]. This actualizes the ability of

scientists to find grant programs, draw attention to their projects, prepare project applications, provide understanding of scientific information, convince of the uniqueness of the project, and thus encourage a positive decision on funding.

A modern Ukrainian scientist can take part in grant programs from the European Science Foundation; European Research Council; European Association for the Advancement of Science and Technology; European Research Area; European Endowment for Democracy, etc. When applying for a grant, scientists need to explain the social usefulness of the idea, innovation, describe the impact of results on science. The projects in the field of human rights protection, health care, innovation in the field of education; research in the field of inclusive and gender-sensitive services; ensuring peace; environmental protection are especially relevant.

Interaction with colleagues through joint projects and scientific journals. Within the framework of professional activity, the researcher usually performs the following operations: 1) search for information on the subject of scientific research in scientific publications; 2) studying of new sources of scientific information; 3) setting a hypothesis and conducting a new scientific study based on the information obtained; 4) hypothesis testing; 5) analysis of the obtained results; 6) publication of new scientific information in the form of scientific articles, monographs, dissertations [3].

That is, scientific activity is a symbiosis of knowledge production and scientific communication. In fact, scientific activity is a closed communication cycle that begins and ends with scientific communication through scientific publications. The basic unit of scientific communication is a scientific text in a set of communicative factors: connections with other texts, the relationship between author and addressee, place and time of scientific communication, style of scientific thinking, etc. [21].

Communication with colleagues usually includes the following main components: registration of a new idea; certification of its quality; informing about the research and its results (primarily through publication in a scientific journal); archiving of scientific results for further access. The implementation of the first three components is provided by scientific journals under the condition of independent expert evaluation of each article. Archiving of scientific results, their storage is the prerogative of libraries and electronic archives, including open access [33].

In today's world, the need for international scientific cooperation is becoming more acute, the result of which is the design of collective scientific

results in the form of co-authored articles. Global research projects cannot be carried out by single enthusiasts or closed research teams — to produce knowledge, scientists need to share human capital [26]. The very specifics of the development of modern science and coverage of scientific results is to overcome interstate borders, transnationalization and deepening of interdisciplinary ties that contribute to the mutual enrichment of science at both theoretical and methodological levels.

That is, the collective component of science becomes obvious. Cognition does not appear as an intellectual process of a particular individual, but as a cultural and social activity. There is a wide exchange of ideas, resources, technologies, solutions, etc. These processes describe the term “distributed” (“dispersed”) knowledge, when large groups of people create a single global intellectual array of knowledge, impossible without their collective efforts. Team members are responsible for the implementation of various cognitive and practical tasks that are important in the context of a common goal. That is, the research environment requires from scientists a wide range of knowledge and skills in the main specialty, as well as engineering, statistics, information systems, psychology, law, etc. [2].

The interaction of the scientists from different research areas is manifested in the formation of networks of scientific co-authorship, which allow to understand and predict the dissemination of scientific information, the evolution of scientific schools, help to choose areas of research. Among the advantages provided by co-authorship, there are intensification of research, improvement of the quality of the obtained results, better design, etc.

Due to these trends, the modern scientific journal can be considered as a club for scientific communication, which is voluntary; controlled in terms of membership, global and standardized [25]. For the editor of a scientific journal, the main task is to interest the readers of the journal, providing a selection for publication of the most relevant and useful for the audience publications. For the authors, the main goal is to publish the results of scientific research as soon as possible to be read and quoted by other scientists. In fact, only peer-reviewed journals can be considered scientific. Peer reviewing regulates the flow of communication from authors to potential readers, and the process of communication in the scientific community.

In each scientific publication, along with information about the research, there is data about other scientists, in connection with the views

of which formed their own vision of the scientific problem and its solution. The manifestation of such a relationship is citation — the points of interaction of authors with the environment of scientific experience: the collision, the convergence of different ideas. Through citation interaction, scientists continuously influence each other and at the same time are influenced, so over time, conventional ideas about the scientific picture of the world — clusters of knowledge, as well as sets of agreed (conventional) and debatable scientific positions are formed. The reputation of the scientific journals themselves is determined by the quality of the articles. At the same time, publication in a journal with a high impact factor is an indicator of the scientist's reputation.

Interaction with colleagues through channels of informal communication. Formal communication, expressing subject-object relations, corresponds to a mechanistic approach and is expressed mainly in writing. The undeniable advantages of formal communication include invariance, constancy, the ability to record and transmit in space and time to any number of recipients, predictability, order, and so on. Disadvantages include the growing number of publications, their dispersion, outdated information etc. [7].

In contrast to formal scientific communication, which takes place mainly through scientific journals, informal scientific communication may contain unpublished details of scientific discoveries, data on errors, doubts in the process of scientific research. It is organized through seminars, webinars, conferences, correspondence, personal websites of researchers, scientific blogs, social networks and provides immediate interaction. Traditional roles assigned to the producer of information and the user are undergoing significant changes. For example, we cannot clearly define the communicative role of scholars who publish their work on the Internet, because they are both producers of information and its editors and publishers, establishing links between their publication and its potential recipients [27].

In the case of informal communication, the author can communicate directly with the audience. At the same time, the author loses the guarantees for the protection of intellectual property rights provided by the scientific publication, and the reader cannot be convinced of the accuracy of the data, because in this case the materials do not always pass the expert assessment. We are talking, for example, about preprints, posts on social networks. Informal communication expresses subject-subject relations and

presupposes equality of participants of communication. It is spontaneous, dialogical, unforced, irrational, unsystematized, creative, but less reliable than formal.

As informal communication often manifests itself in oral form and in the form of personal correspondence, memories of scientists, survey results, its content as a scientific phenomenon may remain unrecorded, and therefore inaccessible to the public, or be completely lost. However, despite the temporality, spontaneity, fragmentation and subjectivity, the tools of informal scientific communication allow researchers to expand their professional networks [15]. The advantages of informal scientific communication include equality of partners, efficiency, selectivity, feedback [7].

To disseminate research results and establish new links with colleagues to increase the visibility of scientific results, scientists use academic social networks [18; 19]. Among them the most popular are Academia.edu and ResearchGate [9]. Social networks are also used to track indicators of interest to research papers [8]. Facebook, Twitter, and Google+ are also popular channels of informal scientific communication [1]. These platforms are used for public relations by academic organizations, scientific associations, and individual scientists [23].

Several studies have found that age is an important factor influencing the use of social media: early-career researchers show higher rates of use than their senior counterparts [12; 13; 18; 19]. Younger scientists tend to use social media to communicate, and seniors are more interested in conference systems, illustrations, and videos [18]. Women are more likely to use microblogging tools, and men prefer wikis [36].

Informal communication can become formal through the testing of new scientific information in informal communication networks and informal discussions, that become a stimulus for scientific creativity and publications in scientific journals.

Interaction with the state. The state is primarily responsible for funding basic science and creating its attractive image in society. Funding of research projects by the state is aimed primarily at innovative developments in the field of defense, biotechnology, medicine, information technology and more.

According to the Law of Ukraine “On scientific and scientific-technical activities” from 26.11.2015 № 848-VIII, the scientist has the right to: choose the types, directions and means of scientific and scientific-technical

activities in accordance with interests and creative abilities; to unite with colleagues in scientific collectives; to participate in competitions for scientific research, which are financed from the state budget; to publish the results of research; to receive, transmit and disseminate open scientific and technical information; to receive incentives for scientific and scientific-technical activities; to gain state and public recognition, etc. Instead, the law obliges the scientist to adhere to the ethical norms of the scientific community and to strictly adhere to the norms of intellectual property law [35]. However, despite significant improvements in the regulatory framework of scientific and scientific-technical activities, we have the problems of evaluation of scientific articles, conferences papers, monographs, and, of course, low level of funding for science in the country, outflow of scientific personnel abroad, violation of academic integrity by the scientific community (plagiarism, falsification of research, trade in authorship of scientific works, etc.).

Interaction with the mass audience. Science is value that scientists pass on to the public. Today, more and more scientists seek not only to communicate the results of their research to the public, but also to do so in an innovative and exciting way [13]. However, in the interaction of scientists with the mass audience, the advantage is still on the side of simple information strategies with almost no feedback [29]. This problem is partially solved by such scientific events as scientific picnics, when scientists bring their microscopes, reagents, equipment and invite everyone to participate in experiments and observations, and lectures.

The modern mass audience forms certain requests for scientific information, including:

- entertainment: dynamic multimedia series, high-quality web modeling technologies, etc.;
- simplicity, accuracy and clarity [20; 24];
- emotionality: unexpected comparisons, metaphors and examples, humor, spontaneous and even eccentric remarks;
- emphasis on personalities: in the focus of their life stories and successes;
- interactivity: active interaction between the translator and the user of information;
- the presence of author`s deviations from purely scientific topics; links of scientific phenomena to life situations, etc. [30].

The modern scientist who interprets science for a mass audience has the following characteristics:

- media sociality, when he or she is in the system of mass communications, and the main measure of his or her sociality is the number of likes, reposts, subscribers;
- the need to maintain a stable audience, and hence own rating and level of consumption of own media content;
- the format of the content is determined by the typical consumer of this content;
- thematic framing — a framework that determines the thematic nature of the information covered, depending on the scope of scientific interests of the scientist;
- dependance on the most active users and their impressions;
- the possibility of media self-presentation. It is an opportunity to accumulate social media resource in the form of professional growth, social influence, self-expression, self-development, etc.;
- the presence of a communication network — interaction with resources that are a source of information in the field of scientific interests;
- the ability to influence the mass consciousness.

Among the features of high-quality scientific content for mass audience, we can highlight:

- links to authoritative sources of information;
- references to international research centers, academies of sciences, scientific institutes and laboratories;
- comments of scientists recognized by the scientific community, employees of well-known scientific and innovation centers;
- data on approbation of results of scientific activity (publications in peer-reviewed scientific journals, etc.).

The mass consumer of scientific information receives an interpretation of scientific facts, which consists of the professional experience of the scientist and the social context in which the scientist operates and according to which he or she places emphasis, interacting with the audience [20; 24].

Conclusions. Today, a powerful system of scientific communication and channels of communication between scientists, government agencies, science promoters and the public has been formed. Thanks to scientific journals, the scientific community has provided an open text space that allows to report on the latest scientific results and receive feedback

from colleagues. However, with the development of information and communication technologies, scientific communication is becoming more and more informal.

The authority of the scientist and communication standards of academic integrity come to the fore (correct citation, prevention of plagiarism and self-plagiarism, falsification of research, trade in authorship, etc.). An indicator of a scientist's successful communication is his scientific rating, which includes: 1) the citation rate of publications and their number; 2) the rating of the journal in which they are published; 3) the number of received grants (domestic and international); 4) participation in international cooperation. To ensure this rating, a modern scientist must know the international standards for the design of scientific publications; read and publish articles in journals indexed by Web of Science, Scopus and other prestigious scientometric databases; to have profiles in social networks for scientists, to use English as the language of international scientific communication; to join projects with Ukrainian and foreign scientists and participate in the preparation of co-authored articles. At the same time, the researcher needs skills that are already established among the communication competencies of a modern manager: not only professional skills and abilities, but also a set of competencies that allow a scientist to promote a scientific product, implement it in social and industrial practice, directly interact with people on whom the implementation of a particular research project depends.

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