Open Science as a Component of Transparent Information Space for Scientists: Domestic And Foreign Context

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The use of open science in the scientific activities of institutions allows to increase the level of information access and transparency of information about the results of scientific research and its promotion in the world. In turn, we need leverage and effective mechanisms to increase the level of transparency in the dissemination of science and the ability to obtain input from research. This article analyzes the work of representatives of national and international scientific schools on the study of open science and its impact on the scientific activity of organizations. The conceptual category of «open science» is considered. The main components of open science in the system of scientific activity of organizations are studied, which include: easy access to scientific products, transparent review of research results, open methodological complex, accessible educational process and the possibility of using software products without limited access.

The scientific principles of openness, which characterize the formation of open science, which include the principles of quality and integrity, benefits for society, equality and justice, diversity and inclusiveness. The practical mechanisms of the influence of open science on the scientific activity of institutions are studied. A comparative analysis of the practical implementation of open science in the European Union, the United States and the African continent. Author's proposals on the ways of development of open science and its impact on the scientific activity of institutions are formed, which include: increasing the transparency of information about the scientific results of institutions and scientific results of scientists; formation in society of positive views on the academic integrity of scientific products and services; raising the level of European integration processes of the domestic scientific space. The main conclusions of scientific research and outlined further ways of scientific research are formed.

Keywords: science, work, information, principle, analysis.

УДК 339.338.1:339.4 *JEL код:* F14, M11, O12

Introduction. It is necessary to define the concept of open science, which means cascading processes, the main purpose of which is to form the availability of research results, scientific papers, scientific information for all stakeholders and includes such areas of information as publishing activities, open access, transparency, access to publications and the formation of incentive mechanisms for open access research. It is necessary to develop practical tools for disseminating research results and avoiding limited access to information, unfortunately, observed in some countries worldwide. One should note the importance of the quality of the scientific research, so the formation of a large amount of data can worsen the

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https://doi.org/10.21272/mer.2021.94.01

quality of scientific results verification. The more society receives a large amount of information, the more complex its processing and the formation of high reliability of conclusions, which in turn deteriorate the information quality [1].

Analysis of recent research and publications. Researchers of open science in the scientific activity of universities, research institutions, other companies and their integration into the world information space were studied by L.V. Beetle, O.A. Komarova, L.Yu. Melnyk, V.V. Proshkin, A.V. Cherep. Zhuk L.V. [2] analyzed features and prospects of research in universities. Komarova O.A. [3] identified an increase in the level of informatization and knowledge in post-industrial society. Proshkin V.V. [4] observed the role of science integration of higher education institutions and formed effective mechanisms of scientific information dissemination in scientific institutions and free educational institutions. Melnyk L.Yu. formed an integration model of production potential, education, science in the knowledge economy of the agro-industrial complex [5]. Cherep A.V. [6] studied the problematic aspects of integration processes in educational processes, research and business structures affected by globalization processes and the formation of social and economic growth.

Some foreign scholars, particularly Fecher B., Pacheco R., Fernandez R., have considered the organizational support of digital change, e-science, and e-infrastructures. Thus, Fecher B. [7] formed the vision and main goals of the main open science schools: pragmatic, infrastructural, public, democratic, school of measurement. Pacheko R. [8] analyzed the impact of digital science on productivity and its relationship with traditional scientific processes. Fernandez R. [9] studied open research in terms of social, cultural and technological transformations.

The issues regarding effective mechanisms of open science in the scientific activity of institutions where there are limitations in the informatization of scientific results and the search for ways to increase the transparency of scientific results for society have not been solved yet. These aspects have not lost the need to be studied in Ukraine and the world.

The aim of the article is to investigate the role of open science in the scientific activity of scientific organizations as a component of the information space transparency.

Research methods. Methodical provisions are used in the scientific research: methods of synthesis, method of system analysis, method of scientific result generalization, method of comparative analysis.

Research results. As mentioned in [10], the national scientific community forms directions of European integration significance. It increases compliance with European standards of scientific policy, one of which is Open Science.

In the conditions of Ukrainian realities, open science is a new way to form and manage scientific research. It creates a philosophical ground based on high accessibility, collaboration, interconnectedness, developing a comprehensive worldview, a high level of access and exchange of scientific results through digital technologies. Open science develops consulting factors and open access of society to scientific knowledge for their practical use in the information space. In a short period, the open science principles are formed, the implementation of which can affect the high level of informatization and complexity of science results, and in the long term, can create a high quality of research and educational products.

The Organization for Economic Co-operation and Development (OECD) [11] notes open science as a high transparency of access to scientific information, without certain limits of its use in electronic format and in the classical way of obtaining data, which in turn is financially supported by public authorities.

The work [12] defines the following parts of open science: easy access to scientific products, transparent review of research results, open methodological complex, accessible educational process and the possibility of using software products without limited access (Fig. 1).

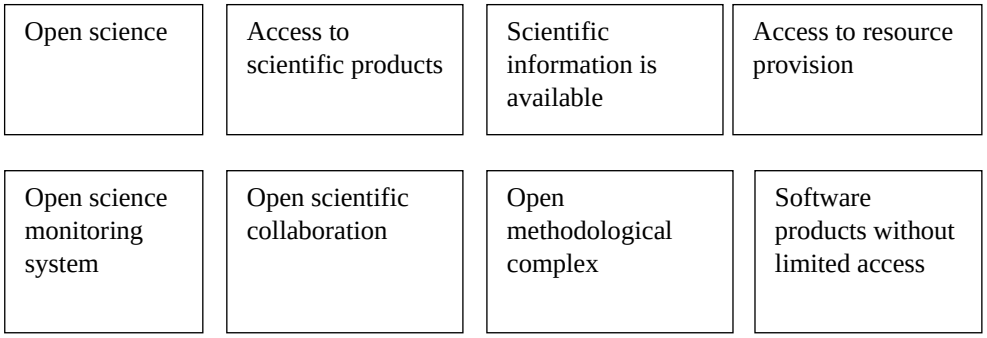

Fig. 1. Open science elements in the scientific activity of organizations and institutions of higher education (compiled by the authors based on [12])

In general, all the elements shown in the figure are included in the open science system and can be used separately.

We study the terminology "open science", actively used in the scientific work of world institutions. According to the Draft Recommendation on Open Science of the 41st session of the UNESCO General Conference held in Paris on 8 September 2021, for this recommendation, the term "open science" means a framework concept that combines different movements and activities aimed at making scientific knowledge of different languages open, accessible and suitable for general reusability, expanding scientific cooperation, leadership and exchange of information for the benefit of science and society and open processes for creating, evaluating and disseminating scientific knowledge to social actors outside the traditional scientific community. It covers all scientific disciplines and aspects of scientific practice, including basic, applied, natural, social and human sciences, and is based on the following key principles: open scientific knowledge, open scientific infrastructure, scientific communication, open training of social actors and open dialogue with other knowledge systems [13].

The main values of open science are based on human rights, ethical, epistemological, economic, legal, political, social, integrative and technological consequences of the discovery of science for society and the dissemination of the openness principles throughout the research cycle. They include:

1. *Quality and honesty.* Open science must respect academic freedoms and human rights, as well as ensure the high quality of research by combining multiple sources of knowledge and providing wide access to research methods and results for their thorough analysis and verification using transparent procedures.

2. *Benefits for society*. As a global public good, open science must belong to and benefit all humanity. To this end, scientific knowledge should be publicly available and its fruits should be part of the common good.

3. *Equality and justice.* Open science must play an important role in ensuring the equality of researchers from developing countries, enabling them to share scientific resources and results on a fair and mutually beneficial basis and ensuring equal access to scientific knowledge for their owners and consumers, regardless of their location, nationality, race, age, sex, income level, socio-economic status, career stage, discipline, language, religion, disability, ethnic origin and migration status, or for any other reason.

4. *Diversity and inclusiveness.* Open science should cover many fields of knowledge, methods and procedures, languages, results and research topics that meet the needs and reflect the epistemological pluralism of the scientific community as a whole, different research teams and scientists, as well as the general public and knowledge carriers beyond traditional science, communities, including indigenous peoples and local communities, relevant social actors from different countries and regions [13].

One should note that the Draft Recommendation on open science [13] indicates the practical mechanisms regarding the impact made by open science on the scientific activities of institutions, which includes:

- encouraging the use of open science methods, starting from the first stages of the research;
- proper encouragement of open peer review procedures;
- encouraging and recognizing the value of publication and dissemination of negative scientific results and those that do not meet the researchers' expectations;
- development of new, inclusive methods and verification mechanisms to consider and recognize the value of the social actors' views who are beyond the traditional scientific community;
- development of strategies that facilitate the placement of data in archives to support their regulaltion and preservation;
- promoting the development of common infrastructure facilities for the collection and storage of open source software;
- providing support to scientists and other members of society in the creation and use of resources based on open data in an interdisciplinary manner;
- encouraging joint use, promoting interoperability of large-scale research infrastructure;
- encouraging open innovative practice, which combines the open science methods with the possibility of accelerated translation into other languages and the development of innovative solutions [13].

In general, these mechanisms can be actively implemented in the national scientific world and the activity of scientific institutions and universities to promote open science and to implement European integration policy in the scientific sphere of Ukraine.

We will conduct a comparative analysis regarding the practical implementation of open science in the European Union, the United States and the African continent, considering previous research on technical, financial and legal aspects of the feasibility to adopt the UNESCO Recommendation on Open Science.

In the European Union, the goal of open science is achieved within the framework of the European Open Science Policy Platform and by developing the European Cloud Data Warehouse, introducing new requirements for EU-funded research, and providing open access to scientific data from Horizon 2020 projects, in particular in terms of the O-FAIR Guidelines.

Open access to scientific literature is encouraged, for example, through the Plan S initiative. It has joined movements in other parts of the world supporting open access, namely La Reference in Latin America, Asia OA (Open Access), the Confederation of Open Access Repositories, etc. Some of the world's most developed innovative economies demonstrate a return on investment, so open science can be at the forefront of global change if the broadest scientific community supports its principles. It can also help strengthen scientific and civilian approaches to responsible research and innovation to ensure the transparency of the whole system of science, technology and innovation. In the United States, the Federal Law on Collective Funding and Civil Science entered into force in January 2018. Open science awards are introduced to encourage open research in various fields, including health and the environment. The African Open Science Platform has recently been established in Africa, demonstrating the importance of open science for Africa and countries needing to strengthen their science systems and the global science platforms. The platform is expected to raise awareness regarding the importance of open science and open data for Africa [14].

As for the national aspects of the open science development in Ukraine, it is necessary to explore the directions of this development.

Nosenko Yu.G., in his work [12], points out that "for more effective development of open science in Ukraine it is reasonable to:

- promote the scientific publications with open access;
- develop mechanisms to stimulate the transforming of publications into open access publications;
- promote the creation of open access repositories containing scientific sources;
- encourage researchers to publish research results following the principles of FAIR (Findable, Accessible, Interoperable, Reusable);
- promote the effective accession of Ukraine to the European Open Science Cloud, in particular, to ensure reliable operation and development of national grid and cloud infrastructure, as well as their integration with similar foreign and international infrastructures, to train specialists capable of working in the field of Data Science".

It is also necessary to add the author's proposals on the ways of open science development and its impact on the scientific activity of institutions, which should include:

- increasing the transparency in information about the scientific results of institutions and scientists' scientific results;
- formation of positive views in society on the academic integrity of scientific products and services;
- raising the level of European integration processes of the national scientific space through the publication of research results in high-ranking scientific journals around the world, thus promoting Ukrainian science and forming transparent mechanisms for its provision to users.

Conclusions and prospects for further research. The use of open science in the scientific activity of organizations can increase the access to information and transparency of information about the scientific results. In turn, we need leverage to influence the dissemination of open science and the ability to obtain initial data on the scientific activity results of institutions, which in turn can increase the popularization of scientific activities of national scientific organizations worldwide.

Authors propose to develop economic tools to assess the quality of scientific activity and their openness to the national and global information space for future research.

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JEL Code: F14, M11, O12 Figures: *1*; References: *14*

Language of the article: English

Received 10.10.2021 p.

Mechanism of Economic Regulation, 2021, No 4, 7–13
ISSN 1726–8699 (print)

Відкрита наука як складова прозорого інформаційного простору для вчених: вітчизняний та зарубіжний контекст

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Використання відкритої науки у науковій діяльності закладів дозволяє підвищити рівень інформаційного доступу та прозорості інформації про результати наукових досліджень та її популяризацію у світі. У свою чергу потрібні важелі впливу та дієві механізми підвищення рівня прозорості поширення науки та можливості отримання вхідних даних з наукових досліджень. У данній статті проаналізовано роботи представників національних та міжнародних наукових шкіл щодо досліджень відкритої науки та її впливу на наукову активність організацій. Розглянуто понятійну категорію «відкрита наука». Досліджено основні складові відкритої науки у системі наукової діяльності організацій, до яких віднесено: легкий доступ до наукової продукції, прозорий огляд результатів досліджень, відкритий методичний комплекс, доступний навчальний процес та можливість використання програмних продуктів без обмеженого доступу.

Відзначено наукові принципи відкритості, що характеризують формування відкритої науки, до яких віднесено принципи якості та доброчесності, користі для суспільства, рівності та справедливості, різноманітності та інклюзивності. Досліджено практичні механізми впливу відкритої науки на наукову діяльність установ. Проведено порівняльний аналіз практичного впровадження відкритої науки у країнах Євросоюзу, США та країнах Африканського континенту. Сформовано авторські пропозиції щодо шляхів розвитку відкритої науки та її впливу на наукову діяльність установ, до яких віднесено: підвищення прозорості інформації про наукові результати установ та наукові результати вчених; формування в суспільстві позитивних поглядів на академічну доброчесність наукових продуктів і послуг; підвищення рівня євроінтеграційних процесів вітчизняного наукового простору. Сформовано основні висновки наукового дослідження та окреселнні подальші шляхи наукових пошуків.

Ключові слова: наука, робота, інформація, принцип, аналіз.