



Successful practices of open science in the context of globalization challenges

Pavlova Olena Mykolaivna

Doctor of Economics, Professor, Head of the Department of Economics and Trade, Lesya Ukrainka Volyn National University, 13 Voly Avenue, Lutsk, Voly Avenue, 43025, Volyn region, Ukraine, <https://orcid.org/0000-0002-8696-5641>

Lyashenko Oksana Mykolaivna

Doctor of Economics, professor, Professor of the Department of Economics and Trade Lesya Ukrainka Volyn National University, 13 Voly Avenue, Lutsk, Voly Avenue, 43025, Volyn region, Ukraine, <https://orcid.org/0000-0001-5489-815X>

Bereziuk Maksym Ruslanovych

Student of the Department of Economics and Trade, Lesya Ukrainka Volyn National University, 13 Voly Avenue, Lutsk, Voly Avenue, 43025, Volyn region, Ukraine, <https://orcid.org/0009-0002-7367-2521>

Poltorak Oleksandr

Postgraduate student of the Department of Economics and Trade Lesya Ukrainka Volyn National University, 13 Voly ave., Lutsk, Volyn region, 43025, Ukraine, <https://orcid.org/0009-0002-6407-3228>

Holubchuk Ihor Mykolaiovych

Postgraduate student of the Department of Economics and Trade, Lesya Ukrainka Volyn National University, 13 Voly Avenue, Lutsk, Voly Avenue, 43025, Volyn region, Ukraine, <https://orcid.org/0009-0009-2369-5558>



Прийнято: 23.11.2024|Опубліковано: 03.12.2024

Abstract. This article undertakes a crucial analysis of effective open science practices in the context of global challenges that significantly influence research processes. The current trends in the development of open science, particularly its integration into international scientific communities and opportunities for global cooperation, are explored. The authors underscore the vital role of access to scientific data, open publications, and innovative technologies in addressing global issues such as climate change, pandemics, and technological inequality. The authors present examples of successful implementation of open science in different countries and regions, demonstrating the positive impact of openness on the speed and quality of scientific achievements. Particular attention is paid to the challenges and risks associated with open access to scientific data and publications and possible ways to overcome them.

Purpose of the article. To conduct a substantiated analysis of successful practices in implementing open science in the context of various globalization challenges.

Materials and Methods. The methodology of open science has become one of the leading areas of modern scientific research aimed at increasing the accessibility, transparency, and efficiency of scientific activities. Open science provides free knowledge sharing, open-access publication of research results, and close cooperation between scientists from different countries. These principles benefit international research, where language and cultural barriers hinder effective interaction and knowledge sharing.

Results. Successful open science practices are becoming critically important in the face of current globalization challenges, such as climate change, pandemics, and social inequality. Open access to scientific data and publications contributes to the expansion of scientific knowledge, improves collaboration between researchers, and increases the overall effectiveness of scientific research. One of the key benefits of open science is its potential to significantly enhance the quality of scientific



research. By promoting transparency, reproducibility, and collaboration, open science can help identify and correct errors, prevent fraud, and ensure the reliability of research findings. However, to realize this potential, numerous challenges need to be overcome, such as a lack of trust in open questions, different platforms, intellectual property protection, and technological limitations.

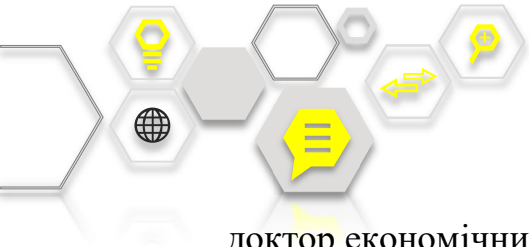
Conclusions. It is important to note that technologies such as blockchain and artificial intelligence can significantly improve the processes of publishing, peer review, and management of scientific information in the future. In addition, the development of an open platform for data and information exchange creates new opportunities for scientists and ensures transparency of their research. The successful implementation of open access in the context of globalization requires the efforts of the scientific community, governments, and the private sector. The private sector, in particular, can play a crucial role in developing and implementing innovative technologies, funding research, and ensuring the commercial viability of open science initiatives. Finding a balance between access to knowledge, quality of publications, and protection of authors' rights is a shared responsibility that can be achieved through effective collaboration and mutual understanding. This collaboration is essential for the sustainable development of open science, which will be a key aspect of solving the most pressing problems of our time.

Keywords: open access, scientific publications, intellectual property, peer review, blockchain, artificial intelligence, big data, social inequality, collaboration, plagiarism, research ethics, access to knowledge, infrastructure, publication funding, academic community, innovation.

Успішні практики відкритої науки за умов глобалізаційних викликів

Павлова Олена Миколаївна

доктор економічних наук, професор, завідувач кафедри економіки і торгівлі
Волинський національний університет імені Лесі Українки, 43025, Волинська
область, місто Луцьк, просп. Волі, 13, <https://orcid.org/0000-0002-8696-5641>



Ляшенко Оксана Миколаївна

доктор економічних наук, професор, професор кафедри економіки і торгівлі
Волинський національний університет імені Лесі Українки, 43025, Волинська
область, місто Луцьк, просп. Волі, 13, <https://orcid.org/0000-0001-5489-815X>

Березюк Максим Русланович

Студент кафедри економіки і торгівлі, Волинський національний університет
імені Лесі Українки, 43025, Волинська область, місто Луцьк, просп. Волі, 13,
<https://orcid.org/0009-0002-7367-2521>

Полторак Олександр Валерійович

аспірант кафедри економіки і торгівлі, Волинський національний університет
імені Лесі Українки, 43025, Волинська область, місто Луцьк, просп. Волі, 13,
<https://orcid.org/0009-0002-6407-3228>

Голубчук Ігор Миколайович

аспірант кафедри економіки і торгівлі, Волинський національний університет
імені Лесі Українки, 43025, Волинська область, місто Луцьк, просп. Волі, 13,
<https://orcid.org/0009-0009-2369-5558>

Анотація. У статті аналізуються ефективні практики відкритої науки в умовах глобальних викликів, які впливають на дослідницькі процеси. Досліджено сучасні тенденції розвитку відкритої науки, зокрема її інтеграцію в міжнародні наукові співтовариства та можливості для глобальної співпраці. Автори підкреслюють важливість доступу до наукових даних, відкритих публікацій та інноваційних технологій для вирішення таких глобальних проблем, як зміна клімату, пандемії та технологічної нерівності. Представлено приклад успішного впровадження відкритої науки в різних країнах та регіонах, що демонструє позитивний вплив відкритості на швидкість і якість наукових досягнень. Особлива увага приділена викликам і ризикам, пов'язаним з



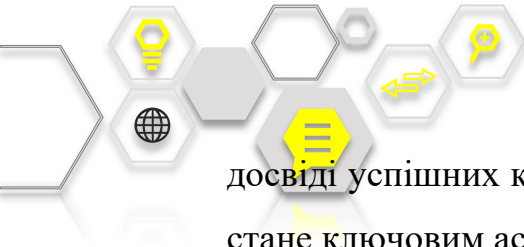
відкритим доступом до наукових даних та публікацій, а також можливим шляхам їх подолання.

Мета Провести обґрунтований аналіз успішних практик реалізації відкритої науки в умовах різних глобалізаційних викликів.

Методи. Методологія відкритої науки стала одним із провідних напрямів сучасних наукових досліджень, спрямованих на підвищення доступності, прозорості та ефективності наукової діяльності. Відкрита наука забезпечує безкоштовний обмін знаннями, публікує результати досліджень у відкритому доступі та тісну співпрацю між науковцями з різних країн. Ці принципи є особливо корисними для міжнародних досліджень, мовні та культурні бар'єри можуть стати перешкодою для ефективної взаємодії та обміну знаннями.

Результати. Успішні практики відкритої науки набувають критичного значення в умовах сучасних глобалізаційних викликів, таких як зміна клімату, пандемії та соціальної нерівності. Відкритий доступ до наукових даних і публікацій сприяє розширенню наукових знань, покращенню співпраці між дослідниками та підвищенню загальної ефективності наукових досліджень. Проте, для реалізації зазначеного потенціалу необхідно подолати численні виклики, такі як недостатня довіра до відкритих питань, різних платформ, захисту інтелектуальної власності та технологічних обмежень.

Висновки. Важливо відзначити, що технології, такі як блокчейн і штучний інтелект, в перспективі можуть суттєво покращити процеси публікації, рецензування та управління науковою інформацією. Крім того, розвиток відкритої платформи для обміну даними та інформацією створює нові можливості для науковців, а також забезпечує прозорість їх досліджень. Для успішної імплементації відкритого доступу в умовах глобалізації необхідні зусилля наукової спільноти, урядів та приватного сектору, які здатні знайти баланс між доступом до знань, якістю публікацій та захистом прав авторів. Впровадження ефективних механізмів та рекомендацій, заснованих на



досвіді успішних країн, сприятливому стійкому розвитку відкритої науки, що стане ключовим аспектом до вирішення найгостріших проблем сучасності.

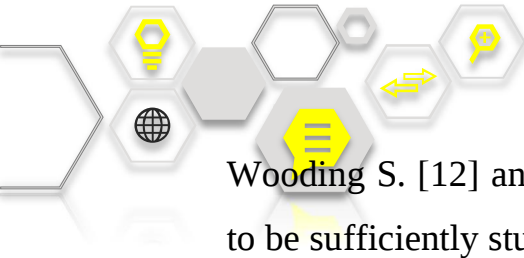
Ключові слова: відкритий доступ, наукові публікації, інтелектуальна власність, рецензування, блокчейн, штучний інтелект, великі дані, соціальна нерівність, колаборація, плагіат, дослідницька етика, доступ до знань, інфраструктура, фінансування публікацій, академічна спільнота, інновації.

Problem statement. In today's world, open access to scientific data and publications is becoming essential in response to globalization challenges such as climate change, pandemics, and social inequality. However, despite its apparent advantages, implementing open science practices faces numerous challenges that must be addressed urgently.

First, the lack of trust in open platforms, in particular, due to possible cases of plagiarism and poor quality peer review, may decrease their popularity among researchers. Second, financial inequality in access to publications and resources between countries with different levels of economic development complicates cooperation between researchers at the international level.

Thus, to successfully implement open science in the context of globalization challenges, it is necessary to find a balance between access to information, quality of publications, protection of intellectual property, and technological innovation. This requires the collective efforts of the scientific community, governments, and the private sector to create effective mechanisms that promote the development of open science in the global context.

Analysis of recent research and publications. A significant contribution to the development of issues related to the problem of open science has been made by leading scholars such as Bazeliuk N. [7], Berezko O. [1], Brownstein J. S. [9], Cooper S. [10], Dashko I. [14], Drach I. [3], Freifeld C. C. [9], Hafner M. [12], Khatib F. [10], Kopanieva V. O. [4], Kroes N. [11], Lichten C. A. [12], Madoff L. C. [9], Mykhailichenko L. [14], Nosenko Yu. H. [5], Pavlov K. V. [8], Regeilo I. [7], Strishenets O. M. [8], Sukhikh A. S. [5], Treuille A. [10], Vasylenko A. Yu. [2],



Wooding S. [12] and others. At the same time, their successful practices still need to be sufficiently studied.

Identification of previously unresolved aspects of the general problem.

Although the concept and implementation of open science have been extensively discussed in academic and policy arenas, several critical aspects remain underexplored. A key priority is identifying and developing effective mechanisms that not only promote the accessibility and dissemination of scientific knowledge but also ensure fair and inclusive participation for all stakeholders: researchers, institutions, and underrepresented regions alike. A deeper investigation into successful international practices is crucial. Learning from the experiences of countries that have made significant strides in open science can offer valuable guidance. These lessons can inform the creation of strategies tailored to address specific local and global challenges, including climate change, public health emergencies, and technological disparities. Bridging these gaps is essential for building a strong foundation that supports the sustainable evolution of open science.

The purpose of the article. To conduct a substantiated analysis of successful practices in implementing open science in the context of various globalization challenges.

An integrated approach based on the analysis of scientific literature, empirical research, and practical examples will be used to achieve the research goal. The following methods will be used in the research process:

1. Literature analysis - a systematic review of scientific articles, reports, documents, and policies related to open access, open science, and globalization challenges.
2. Case studies - research of specific examples of successful implementation of open access in different countries and regions.
3. Comparative analysis: Comparing open access practices in different countries and regions to identify differences in approaches, policies, and consequences.



4. Literature analysis - to review theoretical approaches and practical experience in managing innovation projects.

This comprehensive methodology allows us to understand the state of open access to scientific data and publications, identify critical problems, and suggest ways to overcome them in the context of globalization challenges.

Presentation of the primary research material. Modern trends in the development of open science plays a crucial role in transforming the scientific process, in particular through integration into global scientific communities and the promotion of international cooperation. Open science involves the availability of scientific data, publications, and research methods, which allows for transparency, repeatability, and cooperation between scientists from different countries.

One of the main trends is the growing popularity of open data. Scientific institutions and journals are increasingly introducing policies requiring researchers to publish their data in the public domain. This improves the quality of scientific results and facilitates access to information for all participants in scientific activities, including low-budget laboratories and research groups from developing countries.

Another essential component of open science is open access to scientific publications. Platforms supporting the open-access model provide free access to scientific articles, greatly expanding opportunities for scientists and students. This contributes to greater accessibility of knowledge and raises awareness of new achievements in various scientific fields [10].

In addition, open collaboration platforms, such as GitHub for code or Zenodo for data, allow researchers worldwide to collaborate on projects in real time. This is especially important in global challenges such as climate change or pandemics, where interdisciplinary collaboration is critical to developing practical solutions.

Another important aspect is the role of international organizations that actively promote the concept of open science. Initiatives such as the UNESCO Open Science Action Plan aim to support countries in implementing open science standards by providing them with resources and guidance.




Equally important is the culture of openness gradually emerging in the scientific community. Attitudes toward publications and public discussion of scientific results are changing. Scientists are increasingly aware of the importance of sharing knowledge, which leads to increased trust between researchers and society.

Thus, the integration of open science into global scientific communities not only promotes international cooperation but also creates conditions for a more inclusive, transparent, and efficient scientific process that meets society's current challenges and needs (Table 1).

Other essential aspects of the development of open science include:

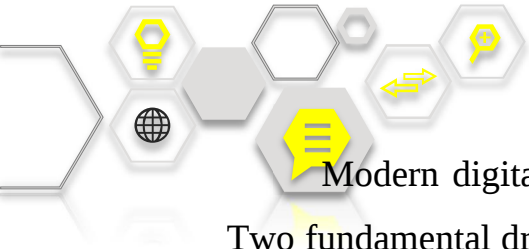
1. Digital infrastructures: The increasing use of data storage and processing platforms, such as the Open Science Framework, which integrates data and methods in an easy-to-use format [9].
2. Open learning: The development of open learning resources that allow students and researchers to access materials and courses for free, contributing to the professional development of scientists from different countries.
3. Citizen science: The general public's involvement in scientific research stimulates interest in science and helps attract new ideas and resources.

Table 1

Open science trends and their impact.

Trend	Feature	Impact on international cooperation
Open data	Researchers publish their data in accessible formats	Facilitates access to information and repeatability of research
Open access	Free access to scientific articles	Increases the availability of knowledge for scientists from different countries
Working together	Platforms for joint projects	Promotes interdisciplinary research and innovation
International initiatives	Support for open science standards	Encourages countries to implement open practices
Open learning	Access to educational resources	Improves the skills of researchers and students
Open learning	Involving the public in scientific research	Promotes new ideas and resources

Recourse: developed by authors using [7]



Modern digital technologies are driving many innovations in open science. Two fundamental driving forces behind these changes are the belief in the value of the free exchange of ideas and the redefinition of the role of scientific data. Researchers are actively seeking new ways to disseminate their research and collaborations, questioning the effectiveness of traditional peer review systems and finding new sources of information.

For example, researchers share their methods on platforms such as OpenWetWare.org and engage participants in crowdsourcing projects in scientific publications. The GalaxyZoo program, for example, involves users in classifying images of galaxies, and Twitter is becoming a source of data for health research, epidemiology, and political trends.

These changes have significant implications for science. Open science makes science more accessible, inclusive, and relevant to society. It helps eliminate barriers between different scientific disciplines and between science and the public and accelerates scientific progress by engaging a wider audience in developing ideas and testing theories.

While open science develops independently, policymakers can help coordinate it nationally and internationally. The European Commission, for example, supports open science monitoring initiatives to encourage transparency and collaboration. One of the most developed trends is open access to scientific publications, accelerating scientific progress by providing free access to research results for scientists and the public.

The benefits of open science are closely intertwined with global research priorities, including the free exchange of knowledge and inclusiveness. Although the movement has emerged from the efforts of researchers, publishers, and the public, it is gaining increasing attention from governments and international organizations.

For example, the European Commission has made open science one of its key priorities in science policy, and the United States has an initiative to expand public access to federal research results. The European Research Area (ERA) also supports



these efforts by providing open access to scientific knowledge to strengthen competitiveness and address global challenges.

Thus, given the benefits of open science, Ukrainian scientists' adherence to specific standards will facilitate their integration into the global scientific community, allowing them to participate in actively creating and implementing new trends. As open science is still in its infancy, the information collected on its practices and trends can help identify where policy intervention is needed and where participants have already developed practical approaches.

At the same time, possible negative consequences for the scientific system, which require a separate study, must also be considered. The systems for evaluating scientific results and activities in Ukraine, especially in the (post)war period, must be revised to bring them in line with the principles of open science [6].

Access to scientific data, open publications, and innovative technologies is critical to addressing global challenges such as climate change, pandemics, and technological inequality. These challenges require joint efforts by scientists, governments, and society, and openness in scientific research can be the key to an effective response.

First, in the context of climate change, access to open data on climate change, ecosystems, and the impact of human activities on the environment is vital.

Open publications containing research results allow scientists from different countries to share knowledge and methods. This, in turn, contributes to developing effective adaptation and mitigation strategies. Innovative technologies, such as climate system modeling or big data analytics, can also analyze large amounts of information and predict possible scenarios.

Secondly, in the case of pandemics, access to scientific data and open publications is critical to responding quickly to new threats. Sharing information about viruses, their genetics, and transmission mechanisms helps scientists develop vaccines and treatments quickly.

For example, in the case of COVID-19, open access to the virus's genomic data allowed researchers to quickly identify its structure and develop vaccines that



saved millions of lives. Cooperation between countries and organizations is also essential, as we can only effectively respond to global threats by joining forces.

Technological inequality is another major challenge the world faces. Access to knowledge and technology is often limited for low—and middle-income countries. Open scientific data and publications can help remove these barriers by enabling scientists from different regions to access the latest research and innovations. This, in turn, contributes to the development of local technologies adapted to these countries' specific needs and challenges [9].

In general, access to scientific data, open publications, and the latest technologies is a matter of transparency and a critical element in solving global problems. Collaboration, knowledge sharing, and innovative approaches can significantly increase the effectiveness of scientific research and its impact on society, creating conditions for sustainable development and prosperity for all.

The implementation of open science in different countries and regions illustrates its importance in improving research quality and information access and promoting international cooperation. Open science is receiving considerable attention in the European Union through the European Research Data Area initiative.

This program requires member states to provide access to scientific data through open platforms. The Horizon Europe program funds research projects and actively supports initiatives integrating open data and publications. This significantly increases available open materials, which facilitates international cooperation and knowledge sharing between scientists.

Open science is also prioritized in the United States through initiatives such as Open Government Data and NIH Public Access Policy. For example, the National Institutes of Health (NIH) requires researchers to publish the results of their funded research in the online database PubMed Central. This provides free access to necessary medical and biological research, which increases awareness and innovation in medicine, especially during global crises such as pandemics.

Australia has implemented the National Open Science Strategy, which includes creating a national platform for open data. Researchers are supported to



publish their data in open access and to use open platforms for collaboration. The Australian Research Data Commons (ARDC) program helps create an infrastructure for access to scientific data, promoting interdisciplinary research. This is especially important for the development of new approaches to solving environmental and social problems [12].

Canada actively promotes open science through the Canadian Open Science Strategy initiative. The government provides funding for projects promoting access to open data and publications. The Portage project helps researchers store and share data, which allows them to integrate open science into scientific practice. This contributes to developing infrastructure that supports everyone's openness and accessibility to scientific materials.

New Zealand has implemented the concept of open science through the Open Data program, in which the government actively supports open data in various fields, including the environment and social sciences. Research related to environmental protection is published in the public domain, which encourages the public to participate in scientific research and raises awareness of environmental issues.

In Africa, open science initiatives, such as the African Open Science Platform, promote the development of infrastructure for open data. This project creates a network of researchers working in open science and encourages knowledge sharing between countries. In the context of limited access to scientific resources, this initiative is significant for developing countries, as it opens up new opportunities for research and collaboration.

Thus, these examples demonstrate how different countries are implementing the concept of open science, using its potential to improve the quality of scientific research and provide access to critical information. Open science raises awareness and stimulates international cooperation, a crucial factor in effectively addressing the global challenges the modern world faces [6].

Despite its many advantages, open access to scientific data and publications also carries numerous challenges and risks that require careful analysis and resolution. First, one of the most discussed risks is the threat to intellectual property.



Open access can cause authors to fear that their work may be misused, as without proper protection mechanisms, research results can be freely available for plagiarism or commercial use without the author's consent.

Second, the need for more sufficient peer review is another serious challenge. Although many open-access journals adhere to peer-review standards, some publications do not provide adequate quality control of publications. This can lead to the publication of low-quality or even false research, which, in turn, will negatively affect the reputation of science and trust in scientific information.

In addition, open access can create inequality in access to resources. Although the idea of free access should remove barriers, not all researchers have the same opportunities to publish their work in open-access journals, especially in developing countries. This can lead to a gap between countries with advanced science and those with limited research funding.

Another important aspect is the financial model of open access. The cost of publishing can be significant; the authors or their institutions often cover it. This can lead to situations where researchers need help to afford to publish in specific journals, increasing the risk of social and scientific inequality.

Open access can also cause problems with archiving and data durability. Many open repositories do not have the proper infrastructure to store and archive data for the long term, which can lead to the loss of important scientific information due to technical failures or platform closures.

Finally, open access requires new skills and knowledge from researchers. Scientists must be knowledgeable about licensing, copyright, and publication ethics to effectively use open-access opportunities and avoid pitfalls.

Thus, while open access has the potential to transform scholarly communication and increase access to knowledge, it is essential to consider and address these challenges and risks to ensure its effectiveness and safety in the future.

**Table 2**

Challenges and risks of open access to scientific data

Risk	Feature
Plagiarism	The threat of misuse of research.
Quality of publications	The possibility of publishing low-quality materials.
Social inequality	Limited access to publications for researchers from developing countries.
Publication costs	High costs can make it difficult to publish.
Data Preservation	Problems with long-term archiving of scientific materials.

Recourse: developed by authors using [7]

Despite its many benefits, open access to scientific data and publications faces several significant challenges and risks worth considering. One of the most serious is the threat of plagiarism. As research becomes available to a broader audience, there is a risk of misusing ideas and results without adequately acknowledging the authors. This can undermine trust in the scientific community and reduce the value of original work.

Another challenge is publication quality. Although many open-access journals adhere to high standards of peer review, some may not provide adequate control, leading to the publication of low-quality or even false research. This can create information noise and make it difficult for researchers to select reliable sources.

An example of the problem is that some journals operate on a pay-for-publication model without adequate peer review. This has led to the publication of papers containing false data, which can then be used by other scientists, worsening the overall level of scientific communication.

Social inequality is also significant, as researchers from developing countries often face difficulties publishing in prestigious journals due to high costs. This creates barriers to access to knowledge and opportunities for scientific collaboration.

Finally, there is the problem of data preservation. Many open repositories may need more resources for long-term storage of materials, jeopardizing future access to critical scientific data.



Overall, while open access has enormous potential to improve the accessibility of scientific information, it is essential to recognize and address these challenges to ensure the effectiveness and reliability of scientific communication.

Overcoming the challenges and risks associated with open access to scientific data and publications requires a comprehensive approach by all stakeholders in science communication. The first important step is to create and implement clear peer-review standards for open-access journals. This will help ensure the quality of publications and increase trust in open platforms. Scientific organizations and associations can initiate the development of guidelines and codes of ethics that will regulate review and publication procedures.

The second way is to introduce effective mechanisms for protecting intellectual property. Creative Commons licenses, for example, can clearly regulate authors' rights to their work. Such licenses allow authors to control how their materials can be used, reducing the risk of misuse. In addition, training researchers in the basics of legal protection and publication ethics can be an important element in overcoming these risks [10].

It is essential to support researchers from developing countries in addressing the problem of social inequality in access to scientific publications. This can be achieved through financial assistance programs to cover publication costs or by creating special initiatives that offer free access to journals for such authors.

On the issue of data preservation, it is essential to invest in the development of open repository infrastructure. Governments, universities, and research institutions can join forces to create reliable platforms that ensure long-term storage of scientific materials. These platforms should have archiving and backup mechanisms to ensure that the data is available in the future.

In addition, research training programs should be organized to improve the quality of publications and preserve scientific communication. This may include seminars and training on the effective use of open access, peer review methods, and skills in searching for and evaluating scientific information.



Thus, to successfully overcome the challenges and risks associated with open access, an integrated approach that combines the efforts of researchers, publishers, libraries, and government agencies is necessary. Only through joint activities can high-quality, accessible, and reliable scientific information be provided to all scientific community members.

One important aspect of open access is the role of technology in providing access to scientific data and publications. Modern information technologies, such as blockchain, artificial intelligence (AI), and big data, can significantly improve the processes of publishing, reviewing, and preserving scientific information.

For example, blockchain technology can create transparent peer review systems where all process stages are recorded in an immutable register. This allows the authorship of publications to be confirmed, and the full transparency of peer review is ensured, which increases the credibility of open journals. Introducing such technologies can reduce the likelihood of fraud and improve the quality of scientific materials [5].

Artificial intelligence can help automate many processes related to peer review and publication editing. For example, AI-based systems can quickly assess the quality of articles, check them for plagiarism, and even provide recommendations for improving the text. This will allow reviewers to focus on the substantive aspects of the work rather than formal errors.

In addition, using big data in the analysis of scientific publications can help identify new trends in research and the most cited and influential articles. This can help researchers and institutions better target their research and identify potential collaborations.

It is also important to develop open data-sharing platforms that allow researchers to share their work's results. This can be realized through specialized repositories where researchers can post their data, which increases research transparency and promotes reproducibility. Platforms like Zenodo or Figshare have implemented these principles, providing free access to scientific data and related materials.



Thus, integrating the latest technologies into open-access practices can not only improve the quality of scientific communication but also ensure greater efficiency in research, creating new opportunities for collaboration and innovation.

Conclusions and prospects for further research. Successful open science practices are becoming critically important in the context of modern globalization challenges such as climate change, pandemics, and social inequality. Open access to scientific data and publications contributes to the expansion of scientific knowledge, improves collaboration between researchers, and increases the overall effectiveness of scientific research.

However, numerous challenges need to be overcome to realize this potential, such as a need for more trust in open platforms, intellectual property protection issues, and technological limitations.

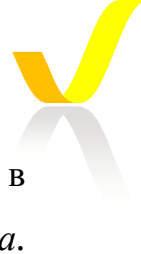
It is important to note that technologies, such as blockchain and artificial intelligence, can significantly improve the processes of publishing, peer review, and management of scientific information. In addition, developing open platforms for data and information exchange creates new opportunities for scientists and contributes to research transparency.

Successful implementation of open access in globalization requires efforts by the scientific community, governments, and the private sector to balance access to knowledge, quality of publications, and protection of authors' rights.

The introduction of effective mechanisms and recommendations based on the experience of prosperous countries will ensure the sustainable development of open science, which will be the key to progress in solving the most pressing problems of our time.

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