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Research on the Promotion of New Quality Productive Forces under the Support of Scientific Research Funding Institutions in the Context of Open Science and Ethics of Science and Technology

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Abstract: This paper explores the mechanisms by which open science and scientific ethics, supported by research funding agencies, drive the enhancement of new productivity. Open science promotes knowledge sharing and collaboration, thereby increasing research efficiency and innovation capacity, while scientific ethics provide behavioral guidelines that ensure integrity and social responsibility in research processes. Research funding agencies play a crucial role in promoting the implementation of open science and scientific ethics through policy-making, funding support and infrastructure, supervision and evaluation mechanisms, promoting interdisciplinary and international cooperation, establishing incentives and reward mechanisms, and providing education and training. The research demonstrates that the implementation of open science policies and scientific ethics standards not only increases research efficiency and innovation capacity but also improves the quality and social acceptance of scientific research, thereby effectively enhancing new productivity. Based on the current practices, the paper forecasts future efforts of research funding agencies in strengthening open science policies, improving scientific ethics standards, promoting interdisciplinary and international cooperation, and advancing research system reforms.

1. Introduction

In the contemporary era of rapid global technological development, open science and the ethics of

science and technology have become two core themes in promoting scientific research progress. Open science emphasizes transparency and accessibility in all stages of research, such as planning, implementation, and communication, so as to facilitate the sharing and collaboration of science. The ethics of science and technology focuses on adhering to ethical principles during the scientific research process, ensuring that research is conducted responsibly, and protecting the rights and well-being of research subjects. Scientific research funding institutions play a crucial role in this framework. They not only provide necessary financial support for scientific research activities but also serve as promoters and regulators of scientific research ethics and open science practices. With the advancement of science and technology and the increase in social needs, new quality productive forces, a type of productive forces based on knowledge and technological innovation, have gradually become a new driving force for economic development. This paper aims to explore how open science and the ethics of science and technology can promote the enhancement of new quality productive forces under the support of scientific research funding institutions. We will analyze how the policies of scientific research funding institutions shape the scientific research environment and how these policies affect the openness and ethics of scientific research activities. The ultimate goal of this paper is to provide strategic suggestions for scientific research funding institutions, policymakers, and scientific researchers to help them more effectively promote the transformation of scientific research achievements and the sustainable socioeconomic development while popularizing open science and the ethics of science and technology.

2. Basic Concepts and Importance of Open Science and Ethics of Science and Technology

2.1. Basic Concept and Importance of Open Science

2.1.1. Basic Concept of Open Science

Open Science refers to promoting the wide dissemination and application of scientific knowledge by enhancing the transparency, accessibility, and collaboration of scientific research. It encompasses all aspects of scientific research, including multiple dimensions such as Open Access, Open Data, Open Methodology, Open Peer Review, Open Educational Resources, and Open Collaboration. Open Access: It means that academic papers, research achievements, and scientific data are freely available to the public, eliminating knowledge barriers and facilitating the sharing and utilization of knowledge. Open Data: It emphasizes the open sharing of scientific research data, enabling other researchers to repeat experiments and verify results, thus promoting the progress of scientific research. Open Methodology: It advocates the transparency of research methods and processes, making it convenient for other researchers to understand, test, and replicate them. Open Peer Review: It promotes the openness and transparency of the review process, improving the fairness of the review and the credibility of scientific research. Open Educational Resources: It promotes the open sharing of educational resources, facilitating the fairness and quality improvement of education. Open Collaboration: It encourages cross-disciplinary, cross-regional cooperation and enhances the collaborative innovation ability of scientific research.

2.1.2. Importance of Open Science

Open Science plays an important role and has significant meaning in modern scientific research. Firstly, by facilitating the sharing and dissemination of scientific knowledge, it breaks the traditional academic barriers and greatly improves the efficiency and innovation ability of scientific research. Open Access and Open Data enable more researchers to utilize existing scientific research resources, avoid repetitive research, and save resources. Open Methodology and Open Peer Review enhance the transparency and credibility of scientific research, contributing to the accumulation and progress of scientific knowledge. Secondly, Open Science promotes cross-disciplinary, cross-institutional, and cross-border scientific research cooperation and enhances the collaborative innovation ability of scientific research. Through Open Collaboration, researchers can share resources and learn from each other, thus promoting the solution of major scientific problems and technological breakthroughs. Finally, Open Science also has important social value. Through open educational resources and open scientific research achievements, the public can obtain scientific knowledge more widely, improve scientific literacy, and promote the democratization of science and public participation.

2.2. Basic Concept and Importance of Ethics of Science and Technology

2.2.1. Basic Concept of Ethics of Science and Technology

Ethics of Science and Technology refers to the ethical and moral issues involved in the process of scientific research and technological application, as well as the corresponding norms and standards. It includes ethical considerations regarding the regulation of research behaviors, the protection of research objects, and the application of research achievements. The main framework of Ethics of Science and Technology includes: Research Integrity: It ensures the authenticity, reliability, and transparency of scientific research, avoiding academic misconduct such as data falsification, plagiarism, and duplicate publication. Informed Consent: In research involving human participants, it ensures that the participants fully understand the purpose, process, risks, and rights and interests of the research and voluntarily participate. Data Privacy Protection: During the process of data collection, storage, and use, it protects the privacy and personal information of research objects, preventing data abuse and leakage. Ethical Review: Through the ethical committee, it reviews scientific research projects to ensure that the research complies with ethical norms and legal requirements.

2.2.2. Importance of Ethics of Science and Technology

Ethics of Science and Technology plays a crucial role in ensuring the standardization, transparency, and responsibility of scientific research. Firstly, it guarantees the authenticity and credibility of scientific research. The systems of Research Integrity and Ethical Review ensure the standardization of the scientific research process, prevent academic misconduct, and maintain the credibility of the scientific community. Secondly, it protects the rights and interests and privacy of research objects. Through Informed Consent and Data Privacy Protection, it guarantees the right to know and the right to autonomy of research participants and prevents their rights and interests from being infringed. In

addition, Ethics of Science and Technology also contributes to the responsible application of science and technology. It requires researchers to fully consider its social impact and moral responsibility when conducting scientific research and technological development, avoid having a negative impact on society and the environment, and promote the good use of science and technology.

3. The Role of Scientific Research Funding Institutions in Open Science and Ethics of Science and Technology

3.1. Formulation and Implementation of Funding Policies

Scientific research funding institutions directly guide and regulate scientific research behaviors by formulating and implementing funding policies. These policies not only determine which research projects can obtain funding but also clearly define the open science and ethics of science and technology guidelines that need to be followed during the research process.

Open Access Policies: Many funding institutions require that the research results funded must be published in an open access format to ensure that the research results are freely available to the public and the scientific community. For example, the "Horizon 2020" program in Europe and the National Institutes of Health (NIH) in the United States both emphasize the open access of research papers and data.

Ethical Review Requirements: Funding institutions usually require projects to pass the review of the ethical review committee before applying for funding to ensure that the research complies with ethical standards. For example, the National Science Foundation (NSF) in the United States stipulates that all research involving human participants must undergo ethical review.

3.2. Provision of Financial Support and Infrastructure

Scientific research funding institutions not only provide research funds but also invest in the construction of scientific research infrastructure to support the implementation of open science and the ethics of science and technology.

Construction of Open Science Platforms: Funding institutions invest in the construction and maintenance of open science platforms, such as data repositories, open access journals, and collaboration tools. These platforms provide convenient conditions for researchers to share and obtain scientific resources.

Provision of Ethical Resources: Funding institutions fund ethical training programs and formulate ethical guidelines to help researchers understand and comply with the ethics of science and technology norms. For example, the National Institutes of Health in the United States provides multiple online ethical training programs covering aspects such as research integrity and informed consent.

3.3. Supervision and Evaluation Mechanisms

Scientific research funding institutions ensure that funded research projects follow the

requirements of open science and the ethics of science and technology through supervision and evaluation mechanisms.

Project Progress and Outcome Evaluation: Funding institutions regularly evaluate funded projects to check whether they are carried out in accordance with the requirements of open science and the ethics of science and technology. For example, the "Horizon 2020" program of the European Union ensures that project implementation complies with open access and data sharing policies through mid-term evaluations and final evaluations.

Handling of Violations: Funding institutions have mechanisms to handle academic misconduct and ethical violations to ensure the integrity and standardization of scientific research activities. For example, the National Science Foundation in the United States has an office specifically dealing with research misconduct to protect the fairness and credibility of scientific research.

3.4. Promotion of Interdisciplinary and International Cooperation

Scientific research funding institutions promote the globalization and systematization of open science and the ethics of science and technology by promoting interdisciplinary and international cooperation.

Funding for Interdisciplinary Projects: Funding institutions encourage and support interdisciplinary research projects. By integrating the knowledge and methods of different disciplines, they can solve complex scientific problems. For example, many projects supported by the "Horizon 2020" program of the European Union involve interdisciplinary research, promoting collaboration among different fields.

Support for International Cooperation Projects: Funding institutions promote scientific exchanges and cooperation on a global scale through international cooperation projects to jointly address global challenges. For example, organizations such as the International Science Council (ISC) and the Global Research Council (GRC) promote international scientific research cooperation, share resources and research results, and facilitate the implementation of global open science and the ethics of science and technology.

4. Case Studies and Analyses

4.1. National Natural Science Foundation of China (NSFC)

The National Natural Science Foundation of China (NSFC) is the main funding institution for basic research in China. It has taken a series of important measures in promoting open science and the ethics of science and technology[1]. Through policy guidance and the regulation of funded projects, the NSFC actively promotes the implementation of open science and the ethics of science and technology, thereby enhancing new quality productive forces.

4.1.1. Practices in Open Science

The NSFC has adopted several measures in open science, including open access policies and data

sharing requirements. The NSFC requires that all research results of funded projects must be published in designated open access journals to ensure that the research results are freely available to the public and the scientific community. In addition, the NSFC also encourages scientific researchers to share research data and provides data management plans to ensure the reusability of the data.

4.1.2. Supervision of Ethics of Science and Technology

The NSFC has a specialized ethics committee that conducts strict ethical reviews on all projects applying for funding to ensure that the research process complies with ethical standards. Through strict supervision of research integrity, informed consent, and data privacy protection, the NSFC guarantees the standardization and fairness of scientific research activities.

4.1.3. Enhancement of New Quality Productive Forces

The open science and ethics of science and technology policies of the NSFC have significantly improved the efficiency and innovation ability of scientific research. The open access and data sharing policies have promoted the dissemination and utilization of knowledge, reduced repetitive research, and improved the output efficiency of research. The strict supervision of the ethics of science and technology ensures the integrity and quality of research, providing a reliable guarantee for the continuous enhancement of new quality productive forces.

4.2. National Institutes of Health (NIH)

4.2.1. Promotion of Open Science

The NIH mandates that all research results of funded projects must be published in open access journals and encourages researchers to store and share data on open platforms such as PubMed Central. The NIH also provides a large number of open science tools and resources to support researchers in data sharing and open collaboration.

4.2.2. Protection of Ethics of Science and Technology

The NIH implements a strict ethical review system for research projects involving human participants to ensure that all research projects comply with ethical standards and regulatory requirements. In addition, the NIH provides multiple ethical training programs to help researchers understand and comply with the ethics of science and technology norms[2,5].

4.2.3. Impact on New Quality Productive Forces

The open science policies of the NIH have greatly promoted the dissemination and application of scientific research results and driven the rapid development of the biomedical field. The strict ethical supervision and training ensure the integrity and quality of research, providing a guarantee for the sustainable development of biomedical research. Through these measures, the NIH effectively enhances new quality productive forces and promotes innovation and progress in the biomedical field.

4.3. European Research Council (ERC)

The European Research Council (ERC) is an important funding institution for promoting basic research within the European Union, and its policies and practices in open science and the ethics of science and technology are worthy of in-depth analysis[3].

4.3.1. Open Science Policies

The ERC actively promotes open science. Through the "Horizon 2020" program, it requires that all funded research results must be published in an open access format and encourages data sharing. The ERC provides support for open access publishing fees and requires funded recipients to submit detailed data management plans.

4.3.2. Ethics of Science and Technology Norms

The ERC has established a strict ethical review system to ensure that all funded projects follow high-standard ethics of science and technology requirements during the implementation process. The ERC also funds multiple ethical training programs to enhance the ethical awareness and ability of researchers.

4.3.3. Enhancement of New Quality Productive Forces

The open science policies of the ERC promote the wide dissemination and utilization of scientific knowledge and drive collaborative innovation in scientific research. The strict ethical supervision ensures the standardization and fairness of the research process and improves the credibility and social acceptance of scientific research results. Collectively, these measures effectively enhance new quality productive forces and provide a powerful driving force for scientific research innovation in Europe.

4.4. UK Research and Innovation (UKRI)

The UK Research and Innovation (UKRI) is the main scientific research funding institution in the UK and is of typical significance in promoting open science and the ethics of science and technology[4].

4.4.1. Promotion of Open Science

The UKRI requires that all research results of funded projects must be publicly released and provides support for open access publishing fees. In addition, the UKRI has also established an open data policy, requiring researchers to share research data and provide detailed data management plans.

4.4.2. Ensuring Ethics of Science and Technology

The UKRI conducts strict ethical reviews on all funded projects and provides ethical training to help researchers comply with the ethics of science and technology norms. The UKRI also formulates

detailed ethical guidelines to guide researchers to follow high-standard ethical requirements during the research process.

4.4.3. Contribution to New Quality Productive Forces

The open science and ethics of science and technology policies of the UKRI have significantly improved the efficiency and innovation ability of scientific research. The open access and data sharing policies have promoted the wide dissemination and utilization of knowledge, reduced repetitive research, and improved the output efficiency of research. The strict supervision of the ethics of science and technology ensures the integrity and quality of research, providing a guarantee for the enhancement of new quality productive forces.

5. Conclusions

Against the backdrop of the rapid development of modern science and technology, the importance of open science and the ethics of science and technology has become increasingly prominent. As important supporters and promoters of scientific research activities, scientific research funding institutions play a crucial role in enhancing new quality productive forces. Through in-depth discussions on open science, the ethics of science and technology, and the role of scientific research funding institutions, this paper has revealed their importance and mutual relationships in the process of enhancing new quality productive forces.

5.1. Core Values of Open Science

Open science has greatly improved the efficiency and innovation ability of scientific research by facilitating the open access, sharing, and reuse of knowledge. It not only breaks down the information barriers in academia, promotes cross-disciplinary and cross-border scientific research cooperation but also enables scientific research results to be quickly transformed into practical applications, driving technological progress and economic development. The core values of open science lie in its transparency and collaboration, which make scientific research more efficient, inclusive, and sustainable.

5.2. Guaranteeing Role of Ethics of Science and Technology

The ethics of science and technology provides behavioral norms and standards for scientific research, ensuring the integrity and social responsibility of research activities. Measures such as ethical review, informed consent, and data privacy protection not only protect the rights and interests of research objects but also improve the credibility and social acceptance of research. By following the norms of the ethics of science and technology, scientific research activities can be carried out more steadily, avoiding potential ethical disputes and social conflicts, thus providing a solid foundation for scientific research innovation.

5.3. Multiple Roles of Scientific Research Funding Institutions

The role of scientific research funding institutions in promoting open science and the ethics of science and technology is multifaceted. They comprehensively promote the openness and standardization of scientific research activities by formulating funding policies, providing financial support and infrastructure, implementing supervision and evaluation mechanisms, promoting interdisciplinary and international cooperation, setting up incentive and reward mechanisms, and providing education and training. The support from funding institutions not only improves the efficiency and innovation ability of scientific research but also provides a stable and sustainable research environment for scientific researchers.

5.4. Comprehensive Impact of the Enhancement of New Quality Productive Forces

With the support of scientific research funding institutions, the practices of open science and the ethics of science and technology have significantly enhanced new quality productive forces. The progress of scientific research, the promotion of economic development, and the facilitation of social progress are all direct manifestations of the enhancement of new quality productive forces. Through the implementation of open science policies and the ethics of science and technology norms, scientific research activities have become more efficient, transparent, and responsible, providing a powerful driving force for the sustainable development of society.

5.5. Future Prospects

Looking ahead, scientific research funding institutions need to continue to strengthen open science policies, promote the open access of more research results and data, and perfect the ethics of science and technology norms to ensure the integrity and social responsibility of research activities. Meanwhile, promoting interdisciplinary and cross-field cooperation, pushing forward the reform of the scientific research system, and strengthening international cooperation are all key paths for further enhancing new quality productive forces.

Through the research in this paper, the importance of open science and the ethics of science and technology in the process of enhancing new quality productive forces, as well as the crucial role of scientific research funding institutions in this process, has been fully demonstrated. It is hoped that this study can provide references for the formulation and implementation of relevant policies and theoretical support for further promoting the openness, standardization, and innovation of scientific research.

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