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CROSS-INDUSTRIAL PRIORITIES OF ECONOMIC DEVELOPMENT: EXPERIENCES FROM RUSSIA

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Abstract

The study's relevance is determined by the need to form long-term scientific and technological forecasts in the context of national goals and objectives of socio-economic programs. The article proposes a hypothesis about the need to select priorities that have cross-industrial effects. The study aims to assess public administration's implemented mechanisms in terms of achieving the country's strategic goals based on cross-industrial priorities. Using the example of the Russian Federation, the author shows the influence of country specificities on the choice of cross-industrial priorities. The author relies on a comprehensive methodological platform that includes quantitative methods of analysis and scientific and technological forecasting, an approach to assessing the state scientific and technological policy, and program-targeted methods of managing scientific and technological development. The study showed that the main priority of Russia's scientific and technological development is digital technologies, which is due to the prevailing global trends in technological development. At the same time, two more priorities, actively funded by the state, are due to the peculiarities of the spatial and sectoral development of Russia – these are technologies that ensure the connectivity of the territory and the development of transport and telecommunication systems, and technologies for environmentally friendly and resource-saving energy. The study also revealed a critical problem in the process of selecting cross-industrial priorities and their consistent implementation. The problem is related to the mismatch between the mechanisms of public administration and research efficiency.

Keywords: Cross-industrial priorities, technological development, cross-industrial innovation

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1. Introduction

The research of trends in the implementation of science and technology policy outlined in international and national programs, as well as in academic publications (Akerlof et al., 2019; Funk et al., 2020; Rolenc, 2019), shows that the justification of promising areas of technological development is an important component of the strategy development process in various countries.

The choice of national scientific and technological priorities goes far beyond just academic discussion and becomes a key state issue in all economically developed countries (Walsh et al., 2020). OECD (2014) experts note that the participating countries pay special attention to the choice of scientific, technological and innovative priorities when forming a national strategy for socio-economic development. Scientific and technological priorities determine the country's geopolitical position, the development of economic sectors, and the population's quality of life. Today, this issue is related to the expansion of the «scientific field» of research and a sharp increase in their complexity and a considerable increase in research costs.

In many countries, including Russia, the choice of priorities for scientific, technological and innovative development largely determines scientific and technical policy (Bessonova & Battalov, 2019; Georghiou & Harper, 2011; Klingler-Vidra & Wade, 2020; Lavrikova et al., 2019). Simultaneously, attention is focused on solving strategic tasks of socio-economic development and implementing competitive advantages associated with innovative technologies.

2. Problem Statement

The Russian Federation has approved a Strategy for scientific and technological development, which aims to overcome the technological gap between the leading countries and increase the national economy's competitiveness. The Strategy defines seven scientific and technological priorities that are responses to the global challenges facing Russia.

We cannot say that each of the priorities is an independent unit of strategic planning. All seven priorities are deeply interconnected. At the same time, their interconnection is based on end-to-end digital technologies. In recent years, the number of publications devoted to assessing various technologies' cross-industrial effects has grown significantly (Akberdina et al., 2020; Huang & Ji, 2019; Lyng & Brun, 2018; Mahnken & Moehrle, 2018).

Accordingly, the article focuses on cross-industrial priorities. They are understood as a set of innovations, technologies and product solutions that can be used in industries (markets) that are not directly related to each other, but their multiplicative effects will provide a breakthrough in the scientific and technological development of the country.

There are a number of problems in this area. First, scientific and technological priorities and lists of critical technologies change quite often. Some of them are preserved and transformed, some simply disappear. Of course, the country's scientific and technological development should be flexible and respond to «big challenges». However, frequent adjustments to priorities lead to a loss of consistency and consistency in state support decisions.

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Secondly, there is no open information about the correlation between government programs in priority areas and economic effects. For example, there is no assessment of the impact of government subsidies on industrial innovation. There is no monitoring of the correlation between government spending and patent activity level in priority areas. This makes it very difficult to assess the effectiveness of cross-industrial priorities and the Russian Federation's innovative development.

Third, one of the most important problems in implementing cross-industrial priorities in Russia is the inconsistency of approved priorities and foreign economic activity results. It is argued that the implementation of cross-industrial priorities should increase innovative activities, but the balance of foreign trade operations for high-tech positions indicates a strong discrepancy with priorities. Russia continues to be a net exporter of raw materials.

3. Research Questions

If we look at these problems more deeply, it is obvious that the origins of the situation should be found precisely in the setting of priorities for scientific and technological development and the mechanisms for their implementation. In this regard, we believe that the low share of technological innovations and high dependence on imports of technologies and high-tech products are initially associated with low efficiency and effectiveness of research activities. These activities are expressed in the number of patent applications filed and significant prior publications. This, in turn, directly depends on state support for the scientific sector and the implementation of public management mechanisms for scientific and technological development priorities. Therefore, the study's main hypothesis is the hypothesis of misalignment of public administration mechanisms and research performance in the context of priorities of scientific and technological development.

4. Purpose of the Study

The purpose of the study is to evaluate the implemented mechanisms of public administration in the context of cross-industrial priorities. We consider it extremely important to assess not only the amount of research and development funding, but also the level of scientific effectiveness of existing state programs in all sectors of the economy. In addition to direct indicators of science funding, it is necessary to consider mechanisms that ensure the development of infrastructure and research environment. This will allow a comprehensive assessment of the effectiveness of cross-industrial priorities.

5. Research Methods

Research in the field of forecasting scientific and technological development and mechanisms for implementing priorities is focused in a number of relevant areas. Much of the work is devoted to quantitative methods of analysis and scientific and technological forecasting (Funk et al., 2020; Oztemel & Gursev, 2020). These studies also address the assessment of technological gaps, analysis of cases of countries that are leaders of scientific and technological development, and provide justification for the priorities of scientific and technological development.

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A significant layer of research is devoted to the issues of state science and technology policy and the problems of transformation of public funding mechanisms for research and development (An & Ahn, 2016; Cresoi et al., 2020; Gluckman, 2014). Within this area, it is necessary to highlight research related to the analysis of the effectiveness of public funding for research and development (Cattaneo et al., 2016; Kim & Min, 2020; Link & Scott, 2020; Wang et al., 2018).

The main method in this study is the decomposition method: qualitative and quantitative decomposition of public administrative mechanisms into components corresponding to cross-industrial priorities. This will allow us to analyze the structure of government spending on cross-industrial priorities and compare it with the performance of the research sector.

6. Findings

To test the hypothesis we used the following data for the Russian Federation: funding for research on cross-industrial priorities (statistics of Federal state statistics service of the Russian Federation, the Ministry of science and higher education of the Russian Federation, the Russian scientific research Institute of economics, politics and law in scientific and technical sphere), analytical data of National Research University «Higher School of Economics» on the performance of science, data from international databases Web of Science and Scopus on publication activity, World Organization Intellectual Property data on patent applications filed.

The Strategy of scientific and technological development of the Russian Federation has defined cross-industrial priorities, which include: a) digital technologies, new materials; b) resource-saving energy; c) high-tech healthcare; d) agriculture and food; e) national security; f) connectivity of the territory and the development of transport; g) interaction of society, nature and technology.

We analyzed government spending on R&D, government programs and grant funding in the context of cross-industrial priorities and found that the priority «digital technologies and new materials» is quite rightly the most popular (table 1).

Table 1. The TOP-3 most funded cross-industrial priorities, approved strategies for scientific and technological development of the Russian Federation

Public administration mechanisms in the sphere of scientific and technological development		
Government spending on R&D	**State programs**	**Grants from scientific funds**
1. Connectivity of the territory and development of transport and telecommunications systems	1. National security technologies	1. Digital technologies and new materials
2. Environmentally friendly and resource-saving energy	2. Connectivity of the territory and development of transport and telecommunications systems	2. High-tech healthcare
3. Digital technologies and new materials	3. Digital technologies and new materials	3. Environmentally friendly and resource-saving energy

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This priority takes the first place in the implementation of such a mechanism as grant funding. The second popular priority is «connectivity of the territory and development of transport and telecommunications systems». This priority takes the first place in direct funding for research and development. And finally, the third popular priority is the priority «environmentally friendly and resource-saving energy».

The study showed that the main priority of the scientific and technological development of Russia is digital technologies, which is due to the prevailing global trends in technological development. At the same time, two more priorities, actively funded by the state, are due to the peculiarities of the spatial and sectoral development of Russia.

The next step is to compare the relevance of cross-industrial priorities in public administration mechanisms with the effectiveness of research activities, which is determined primarily through patent and publication activity (Figure 1).

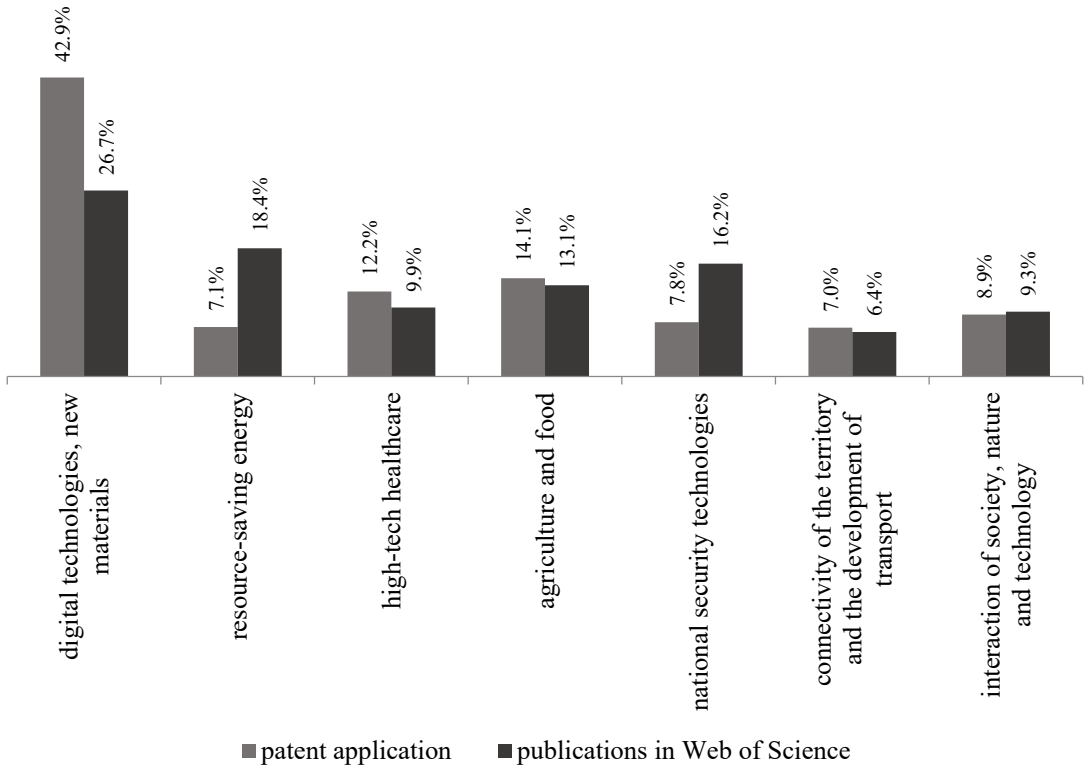

Figure 1. Structure of patent applications and publications in Web of Science by cross-industrial priorities of the Russian Federation, 2018

Data source:
World Organization Intellectual Property https://www.wipo.int/portal/en/index.html
Web of Science Core Collection www.webofknowledge.com

Patent applications are a practical manifestation of the implementation of cross-industrial priorities of any country. In 2018, 42.9% of all patent applications filed by residents of the Russian Federation are related to priority (a) - digital technologies. This corresponds to the financial efforts made by the government to implement this priority. This priority, as shown by the analysis above, is the most common in Russia in terms of public administration mechanisms.

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Among the mechanisms of public administration, the second and third most important places are occupied by priorities (e) – connectivity of the territory – and priority (b) - environmentally friendly and resource-saving energy. However, patent activity for these priorities is extremely insignificant – 7.0% and 7.1%, respectively. This fact clearly demonstrates the discrepancy between the volume of state support for priorities and their effectiveness. While government funding supports some priorities, patent applications are filed under completely different priorities, namely priorities (d) and (c).

In general, Russia ranks 9th in the world in terms of the number of patent applications filed, and Russia ranks higher in terms of patent activity in terms of priorities (e) and (e) – national security technologies and territorial connectivity (table 2).

Table 2. Russia's ranks in the world in terms of patent and publication activity in the context of cross-industrial priorities, 2018

Cross-industrial priorities	Patent applica-tions	Publica-tions in WoS	Publica-tions in Scopus
digital technologies, new materials	9	9	6
resource-saving energy	10	7	6
high-tech healthcare	11	17	15
agriculture and food	9	12	10
national security technologies	7	9	9
connectivity of the territory and the development of transport	8	13	6
interaction of society, nature and technology	9	4	8

Data source:
World Organization Intellectual Property https://www.wipo.int/portal/en/index.html
Web of Science Core Collection www.webofknowledge.com
Scopus www.scopus.com

With regard to publication activity, the situation with inconsistent funding priorities and the effectiveness of scientific activities is repeated. So, naturally, the first place in the number of publications of Russian scientists in the Web of Science takes priority (a) – digital technologies and new materials – 26.7% of articles. Next in the number of articles are priorities (b) – environmentally friendly and resource-saving energy (18.4%) and priority (e) - countering threats (16.2%). Priority (e), which is significantly supported by public administration mechanisms, ranks only in the last seventh place.

In terms of publication activity, Russia is also ranked 9th in the world according to Web of Science and Scopus, with higher places marked by priorities (b) and (g).

Thus, we have confirmed the hypothesis of misalignment of public administration mechanisms and research performance in the context of cross-industrial priorities.

Given the results of the study, the implementation of cross-industrial priorities is not sufficient. We must recognize that scientific and technological priorities require additional attention, improvement of mechanisms for supporting scientific research, and development of infrastructure elements.

7. Conclusion

The study allowed us to confirm the hypothesis of misalignment of public administration mechanisms and research performance in the context of cross-industrial priorities. Thus, based on the analysis of the structure of internal expenditures on R & d, financing of state programs and grant funding in the context of priorities, the top 3 priorities of scientific and technological development were established: priority (a)-digital technologies and new materials, priority (e)-connectivity of the territory and the development of transport and telecommunications systems, and priority (b) – environmentally friendly and resource-saving energy.

However, Russia's position in the patent and publication fields for these three priorities is not significant. A comparison of popular priorities in public administration mechanisms and the effectiveness of research activities showed that patent activity in priorities (e) and (b) is extremely insignificant. This fact demonstrates the discrepancy between the volume of state support for priorities and their effectiveness. While government funding supports some priorities, patent applications are filed under entirely different priorities, namely priorities (d) and (c). Concerning publication activity, the situation with inconsistent funding priorities and the effectiveness of scientific activities is repeated. For example, priority (e), which is significantly supported by public administration mechanisms, ranks only in the last seventh place.

Thus, public administration mechanisms require more attention in improving the efficiency of public spending and non-financial support measures, taking into account the performance indicators of the research sector in the context of scientific and technological priorities.

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References

Akberdina, V. V., Tyulin, A. E., & Chursin, A. A. (2020). Influence of cross-industry information innovations of the space industry on the economic growth of the Russian regions. *Ekonomika Regiona - Economy of Region, 16*(1), 228-241. https://doi.org/10.17059/2020-1-17

Akerlof, K., Tyler, C., Foxen, S. E., Heath, E., Gual Soler, M., Allegra, A., Cloyd, E. T., Hird, J. A., Nelson, S. M., Nguyen, C. T., Gonnella, C. J., Berigan, L. A., Abeledo, C. R., Al-Yakoub, T. A., Andoh, H. F., Boeira, L. dos S., Boheemen, P. V., Cairney, P., Cook-Deegan, R., … Yarime, M. (2019). A collaboratively derived international research agenda on legislative science advice. *Palgrave Communications, 5*(1), 108. https://doi.org/10.1057/s41599-019-0318-6

An, H. J., & Ahn, S.-J. (2016). Emerging technologies-beyond the chasm: Assessing technological forecasting and its implication for innovation management in Korea. *Technological Forecasting and Social Change, 5*, 132-142. https://doi.org/10.1016/j.techfore.2015.06.015

Bessonova, E., & Battalov, R. (2019). Innovative development of the Russian economy: formation of support mechanism based on the world's experience. *Economic Annals-XXI, 180*(11-12), 97-109. https://doi.org/10.21003/ea.V180-11

Cattaneo, M., Meoli, M., & Signori, A. (2016). Performance-based funding and university research productivity: the moderating effect of university legitimacy. *Journal of Technology Transfer, 41*(1), 85-104. https://doi.org/10.1007/s10961-014-9379-2

Cresoi, G., Garone, L. F., & Maffioli, A. (2020). Public support to R&D, productivity, and spillover effects: Firm-level evidence from Chile. *World Development, 130*, 104948. https://doi.org/10.1016/j.worlddev.2020.104948

Funk, P., Davis, A., Vaishnav, P., Dewitt, B., & Fuchs, E. (2020). Individual inconsistency and aggregate rationality: Overcoming inconsistencies in expert judgment at the technical frontier. *Technological Forecasting and Social Change, 155*, 119984. https://doi.org/10.1016/j.techfore.2020.119984

Georghiou, L., & Harper, J. C. (2011). Foresight priority-setting to articulation of demand: foresight for research and innovation policy and strategy. *Futures, 43*(3), 243-251. https://doi.org/10.1016/j.futures.2010.11.003

Gluckman, P. (2014). Policy: The art of science advice to government. *Nature, 507*(7491), 163-165. https://doi.org/10.1038/507163a

Huang, C.-Y., & Ji, L. (2019). Cross-industry growth differences with asymmetric industries and endogenous market structure. *Journal of Macroeconomics, 19*(2), 20170045. https://doi.org/10.1515/bejm-2017-0045

Kim, W., & Min, S. (2020). The effects of funding policy change on the scientific performance of government research institutes. *Asian Journal of Technology Innovation, 28*(2), 272-283. https://doi.org/10.1080/19761597.2020.1734951

Klingler-Vidra, R., & Wade, R. (2020). Science and Technology Policies and the Middle-Income Trap: Lessons from Vietnam. *Journal of Development Studies, 56*(4), 717-731. https://doi.org/10.1080/00220388.2019.1595598

Lavrikova, Yu. G., Akberdina, V. V., & Suvorova, A. V. (2019). Soglasovaniye prioritetov nauchno-tekhnologicheskogo i prostranstvennogo razvitiya industrial'nykh regionov [Coordinating the priorities of scientific, technological and spatial development of industrial regions]. *Economy of Region, 15*(4), 1022-1035. https://doi.org/10.17059/2019-4-5

Link, A. N., & Scott, J. T. (2020). Creativity-enhancing technological change in the production of scientific knowledge. *Economics of Innovation and New Technology, 29*(5), 489-500. https://doi.org/10.1080/10438599.2019.1636449

Lyng, H. B., & Brun, E. C. (2018). Knowledge transition: A conceptual model of knowledge transfer for cross-industry innovation. *International Journal of Innovation and Technology Management, 15*(5), 500438. https://doi.org/10.1142/S0219877018500438

Mahnken, T. A., & Moehrle, M. G. (2018). Multi-cross-industry innovation patents in the USA – A combination of PATSTAT and Orbis search. *World Patent Information, 55*, 52-60. https://doi.org/10.1016/j.wpi.2018.10.003

Oztemel, E., & Gursev, S. (2020). Literature review of Industry 4.0 and related technologies (Review). *Journal of Intelligent Manufacturing, 31*(1), 127-182. https://doi.org/10.1007/s10845-018-1433-8

OECD (2014). OECD Science, Technology and Industry Outlook 2014. Paris: OECD Publishing. https://doi.org/10.1787/sti_outlook-2014-en

Rolenc, J. M. (2019). Technological Change and Innovation as Security Threats. *19th International Scientific Conference Globalization and Its Socio- Economic Consequences - Sustainability in the Global-Knowledge Economy, Rajecke Teplice, 74*, 02015. https://doi.org/10.1051/shsconf/20207402015

Walsh, P. P., Murphy, E., & Horan, D. (2020). The role of science, technology and innovation in the UN 2030 agenda. *Technological Forecasting and Social Change, 154*, 119957. https://doi.org/10.1016/j.techfore.2020.119957

Wang, J., Lee, Y., & Walsh, J. P. (2018). Funding model and creativity in science: Competitive versus block funding and status contingency effects. *Research Policy, 47*(6), 1070-1083. https://doi.org/10.1016/j.respol.2018.03.014