Priority Areas of Scientific and Technological Development

Ayna Salamova[1,*], *Zara* Makazieva[1] and *Mira* Kantemirova[2]

[1]Kadyrov Chechen State University, Grozny, Russia
[2]North Ossetian State Medical Academy, Vladikavkaz, Russia

Abstract. The accelerated scientific and technological development of Russia requires the development of both platform (end-to-end) technologies with significant multiplicative potential and targeted areas that form the basis of the Russian economy and are focused on solving the most important socio-economic problems. Accounting for the effects of global trends, combined with the expected demand for new technologies from the sectors of the economy, made it possible to form promising areas of scientific and technological development, which are presented in the report in the form of a three-level hierarchical structure.

1 Introduction

ICTs are intersectoral in nature and ensure the digital transformation of all sectors of the economy and the social sphere, the formation of a network economy and a sharing economy. There is a virtualization of many areas of activity, including the provision of financial and medical services. The interaction of authorities with business and the population is moving into the digital space. The rapid development of immersive technologies that create the effect of immersion in artificially created conditions will lead to the transformation of many industries, primarily science, education, the entertainment industry, and tourism. Fast and ubiquitous access to the Internet changes social and individual values, lifestyle, forms of communication and socialization, increases the mobility of the population, levels social inequality, and erases national and religious characteristics. Machine learning and artificial intelligence technologies contribute to solving both routine and complex tasks, where they can completely replace a person, even in those areas that, as previously thought, could not be automated, for example, in research and other creative activities. In the field of ICT, several promising areas of scientific research have been identified.

2 Research methodology

Achieving the strategic goals of Russia's development depends not only on the level of development and the efficiency of using its scientific and technological potential, but also on a number of external conditions associated with the action of global trends - large-scale

* Corresponding author: salamova_chgu@mail.ru

long-term economic, social, technological and natural shifts leading to radical changes in living conditions and human activities, economy and society. Such trends, which are closely interconnected and capable of both reinforcing and neutralizing each other's influence, give rise to “big challenges” for our country, windows of opportunity or threats to the sphere of science and technology. Climatic processes, the growth of anthropogenic pressure on the environment lead to a reduction in biodiversity and degradation of ecosystems. At the same time, natural resources (mineral raw materials, water, land, forests, etc.) are being depleted, and competition for them is intensifying. With the accelerated growth of the Earth's population, its natural agro-climatic potential decreases, and the problems of food supply are exacerbated. Environmental pollution negatively affects the health and quality of life of the population. In the forecast period, demand for hydrocarbons and their high price volatility are expected to remain, which will require an increase in the resource and energy efficiency of the economy, the expansion of the use of renewable energy sources (RES), the introduction of more stringent environmental standards, and new technologies for processing and disposing of waste. The most significant threats to Russia include the increased aridity of the black earth agro-industrial regions, the increase in electricity costs for cooling and air conditioning, the operation of freezers, the increase in the number of natural disasters and the economic damage from them. It is likely that pathogens of epizootics and epiphytoties will spread to uncharacteristic areas for them. Degradation of permafrost will lead to deterioration in conditions and increase in the cost of oil and gas production, which, combined with the depletion of cheap reserves of high-quality hydrocarbons and their low recovery rate, threatens to exhaust the possibilities for extensive economic growth.

3 Results and discussions

As a result of the globalization of economic relations and the spread of new technologies, global value chains are concentrated around the centers of knowledge creation, the importance of “smart” specialization of countries and regions based on existing scientific and technological reserves is increasing. New markets will be characterized by a horizontal (platform) structure, flexible organization of industrial relations, and an increase in the role of intellectual products and services. In the context of increasing competition in the world, accelerating scientific and technological progress, shortening the life cycle of products, models are being transformed and the innovation cycle of developing and distributing technologies, products and services is being compressed, and the intensity of innovation activity in all sectors of the economy is increasing. The ability to create new products, modernize production, organizational innovations are becoming one of the key factors for ensuring the flexibility and adaptability of production to demand, successful integration into value chains and long-term competitiveness of enterprises and the economy as a whole. New models of open innovation are based on large-scale networking, pre-competitive cooperation, active trade in technologies and other objects of knowledge capital. These changes concern not only large enterprises, but also scientific organizations and universities, small and medium-sized businesses, innovation infrastructure facilities and other participants in the innovation process. Institutional mechanisms are being transformed, including providing a favorable environment for entrepreneurship, protection and commercialization of intellectual property rights. Business models based on the principles of the sharing economy and electronic platforms will make it possible to eliminate intermediaries from production chains and reduce inefficient costs for companies and the public. The structure of the labor market is changing under the influence of robotization processes, the replacement of routine work with artificial intelligence, the dynamic updating of requirements for competencies and skills, the growth of remote

employment and labor mobility. The key threats to Russia are the persistence of a low share of value added created in the country; models of catch-up development and technological dependence on foreign suppliers; imbalance of supply and demand in the labor market, including a shortage of highly qualified specialists; barriers to population mobility; autonomy of science from the real sector of the economy; weak innovative activity of enterprises; unfavorable investment and business climate; generally ineffective mechanisms for protecting property rights and ensuring fair competition. Russia runs the risk of remaining a global supplier of innovative raw materials, while its material and intellectual capital will continue to be absorbed by transnational companies.

The distribution of genetically modified (transgenic) products causes an ambiguous attitude of society and the state, primarily due to the lack of objective information about its impact on the human body and the environment in the long term and the risks generated by this. At the same time, the development of this direction can serve as a serious impetus to the creation of food and industrial crops with improved or fundamentally new properties and often at a lower cost. As a result, one can expect a noticeable increase in agricultural production, as well as the involvement in agricultural activities of regions that were previously not involved in it due to adverse climatic conditions. The depletion of cheap hydrocarbon reserves determines the development of biotechnologies that make it possible to increase the efficiency of extraction and processing of raw materials, which will ultimately lead to more active development of new hard-to-reach deposits with lower cost and greater returns. With vast agricultural land and significant volumes of agricultural, food and forest industry waste (250 million tons of concentrated agricultural and 50 million tons of forest waste annually), Russia can become one of the strongest players in the global market for large-tonnage biotechnological products from renewable raw materials, including biofuels, subject to the effective organization of scientific research, sufficient investment in technology development and infrastructure, and implementation of the necessary institutional changes. Today, the world is witnessing a transition to multipolarity, an increase in regional instability, an intensification of the struggle for spheres of influence, an increase in differences in the interpretation of international legal norms, and the emergence of new standards and rules. As a result, the requirements for the effectiveness of relevant instruments and institutions are increasing, and new international and regional blocs and alliances are emerging. In response to the “great challenges”, the role of states and the policy agenda are changing. Political and economic alliances will be formed around the new centers of power. Economic and trade levers of geopolitical influence are spreading, including tightening restrictions on the movement of people, the flow of technology, knowledge, capital, products and services. Growing threats to environmental, energy, food, cyber security, military conflicts and terrorist attacks may become a reason for increased state intervention in the economy and private life. For Russia, the growth of these and other threats is likely, the increase in foreign policy pressure on world and domestic markets due to the increase in conflict in international relations, attempts to oust Russia from among the countries that determine the new “rules of the game”. Windows of opportunity are determined by maintaining the stability of the internal political and economic situation, strengthening/establishing mutually beneficial cooperation with traditional and new players in the global arena, active participation in the formation of new management institutions, equal norms and rules of international relations.

4 Conclusions

Windows of opportunity for Russia are associated with the use of human capital and scientific achievements to involve domestic companies in high-tech parts of value chains, modernize capacities, optimize production processes, gain a foothold in new markets,

including niche high-tech ones; creating conditions for the localization of advanced technologies and managerial competencies; reduction of transaction costs as a result of adaptation to changing forms of economic relations. Taking into account the technological backwardness in a number of sectors of the economy, the creation of industries based on fundamentally new technological and organizational innovations, the formation of technical regulations and standards that are ahead of established international practice will be of particular importance. The formation of a new paradigm of scientific and technological development is due to the pronounced orientation of technological changes towards strengthening the cognitive and physical capabilities of a person, including in connection with the unfolding of a new industrial revolution (creation, convergence, penetration into all areas of ICT, artificial intelligence, robotics, biotechnologies; practical use of materials with desired properties, modern electronics, new energy sources, methods of its storage and transmission). A significant factor in the transition to a new paradigm is the digitalization of research and experiments, the development of new methods and technologies for their implementation (modeling, big data processing, robotization of experiments, network tools for analyzing and exchanging information, etc.). The interdisciplinarity of R&D is growing, and the capital intensity of the research infrastructure is growing. Scientific and technological advances increasingly affect socio-cultural, ethical and legal issues. Social orientation becomes the basis for new management approaches in the paradigm of "responsible" research and innovation. Under these conditions, many countries are actively moving to a new model of organizing and supporting science, in particular, based on the harmonization of institutions and the effective adaptation of the best international practices to national conditions. The key characteristics of the model are the strengthening of the strategic orientation and attention to the global context of the policy, its focus on solving socio-economic problems, achieving specific goals and effects (productive knowledge); emphasis on increasing the requirements for the productivity of scientific activity; stimulating the transfer of knowledge and the commercialization of technologies created in scientific organizations and universities (including on a network basis, the principles of superiority and openness), the innovative activity of companies in various sectors of the economy; development of international cooperation, in particular in the implementation of megascience projects and the creation of global centers of excellence. Contacts between scientists from different countries are intensifying, which leads to an increase in academic mobility, international co-authorship and joint patenting.

References

1. A. Yu. Apokin , D. R. Belousov, Scenarios for the development of the world and Russian economy as a basis for scientific and technological forecasting, **3(3)**, 12-29 (2009).
2. A. A. Chulok, Forecast of prospects for scientific and technological development of key sectors of the Russian economy: future challenges, **3(3)**, 30-36 (2009).
3. V. P. Emelyanova, G. N. Danilova, T. Kh. Kolesnikova, *Assessment of the quality of land surface waters by hydrochemical indicators*, **115** (2020).
4. A. A. Daukaev, R. Kh. Dadashev, L. S. Gatsaeva, R. A. Gakaev, IOP Conf. Series: Earth and Environmental Science, 378 (2019).
5. R. T. T. Forman, M. Godron, *Landscape Ecology*, 620 (2010).
6. E. Reynard, M. Panizza, *Geomorphosites: definition, assessment, and mapping. Geomorphol Relief*, 177-180 (2018).

7. Bio-Economy Technology Platforms. The European Bioeconomy in 2030: Delivering Sustainable Growth by addressing the Grand Societal Challenges (2021).
8. C. Cagnin, E. Amanatidou, M. Keenan, Orienting European Innovation Systems towards Grand Challenges and the Roles that FTA Can Play, **39(2)**, 140-152 (2020).
9. EU-Russia Energy Dialogue, Energy Forecasts and Scenarios 2009–2010 Research. Final Report. Moscow: Publishing House «Economica, Stroitelstvo, Transport» (2021).
10. K. Haegeman, F. Scapolo, A. Ricci, E. Marinelli, A. Sokolov, Quantitative and qualitative approaches in FTA: from combination to integration? **80**, 386-397 (2021).