Prospects for the development and application of artificial intelligence technologies in Russia

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Abstract. The paper examines the prospects for the design and introduction of artificial intelligence technologies in Russia’s economic system. Based on official rankings of the globe’s leading organizations and the tools of economic and mathematical modeling, we have assessed the impact of artificial intelligence technologies on the level of competitiveness of the national economy. The obtained results indicate a rather strong impact of artificial intelligence technologies on the level of competitiveness of the national economy. We have also analyzed the current level of development of artificial intelligence technologies in the Russian Federation, and pointed out significant risks and threats caused by the introduction of these technologies. The development of artificial intelligence technologies can lead to the fact that, at some point, human capital might cease to be necessary in the economy; simply put, human capital will become an unnecessary factor in economic development. In order for humanity to cope with the challenges, driven by the development of artificial intelligence technologies, the implementation of intelligent information systems should not be thoughtless; their implementation should be reasonable and extremely careful. Furthermore, we suggest how to make the use of artificial intelligence technologies in Russia’s economy more efficient.

1 Introduction

Artificial intelligence technologies are rapidly becoming a factor that significantly affects the level of competitiveness of both an individual enterprise (company) and the national economy as a whole. This trend will only grow in the future. The foregoing explains the significant interest in the development and implementation of artificial intelligence technologies in the economy on the part of both the scientific community and practitioners (companies and the government).
The governments of many countries have already realized the need to introduce artificial intelligence technologies into the economy, since lagging behind in this area will inevitably lead to an economic lag in the future and to a reduced level of national competitiveness. Many advanced economies have designed a national strategy for the development of artificial intelligence. Russia created such a strategy quite recently, in 2019.

Unfortunately, in Russia, applied research in the field of artificial intelligence and the commercialization of the results of these studies are much slower than abroad; and there is a gap between fundamental science and the introduction of its developments into a specific product.

Despite certain difficulties, Russia has a significant potential in the development of artificial intelligence technologies. The importance of artificial intelligence technologies for the prosperity of the national economy has led to a significant interest of researchers in this issue. A large number of scientific publications are devoted to various aspects of the implementation and development of artificial intelligence technologies in the Russian Federation, among which are the works of O.A. Burova and E.A. Dolgikh [1], A.A. Chebotareva et al. [2], S. Kamolov, I. Molchanovskaya and E. Kaunov [3], T. Leshkevich and A. Motozhanets [4], S. Petrella, C. Miller and B. Cooper [5], A.V. Popova et al. [6], A. Saveliev and D. Zhurenkov [7].


Despite many publications on this issue, there are a number of unsolved problems, one of which is the numerical evaluation of the impact of artificial intelligence technologies on the level of competitiveness of the national economy. In addition, the development of artificial intelligence technologies around the world, and in Russia in particular, is very dynamic, which, in turn, requires constant monitoring and comparative analysis.

The objective of this article is to analyze the prospects for the development and application of artificial intelligence technologies in the Russian Federation, and to assess the impact of artificial intelligence technologies on the level of competitiveness of the national economy.

To achieve this goal, we see the need to solve the following tasks:
• using the tools of economic and mathematical modeling and rankings by the most credible organizations in the world, to assess the impact of artificial intelligence technologies on the level of competitiveness of the national economy;
• analyze the current level of development of artificial intelligence technologies in the Russian Federation;
• analyze individual risks and threats caused by the development of artificial intelligence technologies and give recommendations for overcoming them;
• suggest how to improve the efficiency of using artificial intelligence technologies in Russia;
• analyze the application of artificial intelligence technologies in the Russian public health service.
2 Evaluating the impact of artificial intelligence technologies on the competitiveness of the national economy

Over a relatively short period of their development, artificial intelligence technologies have already had a significant impact on economic processes around the globe, as well as in a single country. Intelligent information systems contribute to the restructuring of pre-existing business processes of companies and organizations. According to experts, by 2030 the contribution of artificial intelligence technologies to the global economy will amount to 15 trillion USD [8].

Using the tools of economic and mathematical modeling, we will assess the impact of artificial intelligence technologies on the level of global competitiveness of the national economy. For this purpose, we will use the corresponding ratings of the countries of the world, formed by the most credible organizations, which reflect artificial intelligence development levels and national economy competitiveness levels:

- 2019 Global Competitiveness Index 4.0 (GCI 4.0) by the World Economic Forum;
- 2019 Government Artificial Intelligence (AI) Readiness Index by Oxford Insights;
- 2021 Global Artificial Intelligence Index displayed on the Tortoise Media website;
- 2021 IMD World Competitiveness Ranking.

Table 1 briefly describes these ratings.

<table>
<thead>
<tr>
<th>Index</th>
<th>Year / number of economies</th>
<th>Brief description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Competitiveness Index 4.0</td>
<td>2019 / 141 economies</td>
<td>An annual index calculated for most countries of the world to characterize the level of their global competitiveness. It is based on more than 100 indicators combined into 12 pillars: “Institutions”; “Infrastructure”; “ICT adoption”; “Macroeconomic stability”; “Health”; “Skills”; “Product market”; “Labor market”; “Financial system”; “Market size”; “Business dynamism”; “Innovation capability”</td>
</tr>
<tr>
<td>Government AI Readiness Index</td>
<td>2019 / 194 economies</td>
<td>Calculated annually since 2017, Government AI Readiness Index is to assess how well national governments take advantage of artificial intelligence in their operations. The overall score consists of 11 input metrics grouped under four clusters: “Infrastructure and data”; “Government and public services”; “Skills and education”; “Governance”</td>
</tr>
<tr>
<td>IMD World Competitiveness Ranking</td>
<td>2021 / 64 economies</td>
<td>A comprehensive index of the competitiveness of national economies, annually formed by the Institute of Management Development (Lausanne, Switzerland). It comprises 333 criteria combined into four enlarged groups: “Economic performance”; “Government efficiency”; “Business efficiency”; “Infrastructure”</td>
</tr>
</tbody>
</table>

Figure 1 shows the relationship between the Government AI Readiness Index and the Global Competitiveness Index 4.0 for 140 national economies, presented in both ratings [8-
9] in 2019. The first place in each of the ratings belongs to the country with the best value of the analyzed indicator. Countries were ranked from 1 to 140 for each ranking indicator. Based on these data, we set up an equation of linear dependence of the level of global competitiveness on the value of the Government AI Readiness Index:

\[ y = 0.9099x + 6.364, \]  

where \( y \) – a country’s global competitiveness ranking by the World Economic Forum; \( x \) – a country’s ranking by the Government AI Readiness Index.

The coefficient of determination \( R^2 = 0.8282 \), suggesting the significance of the obtained dependence. The coefficient of correlation between the criteria is 0.91, which indicates a direct and very high dependence of the studied indicators.

![Fig. 1](image1.png)

**Fig. 1.** The correlation between the Government AI Readiness Index and the Global Competitiveness Index 4.0 for 140 national economies in 2019.

![Fig. 2](image2.png)

**Fig. 2.** The correlation between the Global AI Index and the IMD World Competitiveness Ranking for 50 national economies in 2021.
Figure 2 shows the relationship between the Global AI Index and IMD World Competitiveness Ranking for 50 national economies, presented in both ratings [10-11] in 2021. The countries were ranked from 1 to 50 for each ranking indicator. The equation of linear regression looks as follows:

\[ y = \beta_0 + \beta_1 x, \]  

(2)

where: \( y \) – a country’s competitiveness ranking by IMD; \( x \) – a country’s ranking by the Global AI Index.

The coefficient of correlation between the criteria is 0.66, suggesting a direct and rather significant relationship between the indicators.

In our opinion, the above results indicate a rather strong impact of artificial intelligence technologies on the level of competitiveness of the national economy.

3 Analysing the development of artificial intelligence technologies in the Russian Federation

We cannot attribute the Russian Federation to artificial intelligence technology leaders, despite the presence of significant scientific potential in this area. In many ways, this can be explained by the rather long period of prohibition of cybernetics in the USSR (artificial intelligence being part of it), and the difficult period of the country’s economic recovery after the disintegration of the USSR (lack of funds).

In 2021, Russia ranked 32nd, being between Italy and Malta, in the Global AI Index among 62 national economies [10], and ranked 38th, being between Latvia and Slovakia, in the Government AI Readiness Index among 160 national economies [12]. We believe that these rankings should be substantially better, given the strong scientific base in Russia. The problem here is the lack of an effective mechanism for the commercialization and implementation of the obtained scientific results into production.

Russia is currently conducting research on speech recognition, face and image recognition, autonomous driving systems, etc., and large Russian companies are actively using artificial intelligence technologies in their operations. Experts note the high prospects for Russian artificial intelligence developments, unfortunately limited through lack of funds and necessary institutional conditions.

The military application of artificial intelligence technologies is most strong in Russia, recognized by the world expert community.

We believe that, first of all, Russia should develop artificial intelligence technologies in relation to the real sector of the economy in order to increase the competitiveness of domestic goods and services and achieve the goal of import substitution.

The effects of the introduction of artificial intelligence technologies, as any other complex phenomenon, have a variety of aspects of all kinds: positive, negative, and neutral. These aspects have an impact on all spheres of the economy and life, both on the life of the society and individuals. The paper [13] conducts a comprehensive survey of risks and threats to the development of artificial intelligence technologies.

The more sophisticated artificial intelligence becomes, the wider the scope of its application will be. This will result in a reduced use of human capital in the economy, that is, the knowledge, skills and abilities of people. This will not only lead to a decline in human capital development. At some point, human capital might cease to be necessary in the economy, simply put, human capital will become an unnecessary factor in economic development.
If, in the past, the scientific and technological progress ousted people from physical labor, then in the future artificial intelligence might oust people from intellectual labor. One of the negative consequences of this will be an exponential rise in unemployment. We believe that the introduction of a universal basic income, to mitigate the effects of artificial intelligence, will only worsen the situation. The introduction of a universal basic income will lead to a mass degradation of the human personality. Andrei Voznesensky had the point when he said, “all progress is reactionary if a person collapses.” In order for humanity to cope with these challenges, the implementation of intelligent information systems should not be thoughtless; their implementation should be reasonable and extremely careful.

4 Applying artificial intelligence technologies to the Russian public health service

We can efficiently use artificial intelligence technologies in almost all spheres of human life, including public health service.

On the one hand, the public health service is a socially important branch of the Russian economy. On the other hand, it is a substantial sector to maintain the national economy. The nation’s health has an impact on the economic and social system. The recent COVID-19 showed that pandemics could cause serious damage to the country’s economic development and hinder economic growth. Moreover, pandemics are hard to predict. The article [14] notes that public health is a factor shaping the competitiveness of the economy, and regards the level of public health service as an essential economic development indicator.

In the near future, we expect that artificial intelligence technologies will find more applications in public health service.

Let us enumerate artificial intelligence technologies already applied in the public health services of some countries; later on, their application may expand:

• Robotics (for example, robotic systems performing a surgery or robots taking care of the bed-bound);
• Computer-aided diagnostic systems (artificial intelligence technologies enable us to specify diagnosis);
• Event prediction systems (for example, while planning the production and procurement of pharmaceuticals at the country level);
• Speech recognition systems (for example, medical penman service, which saves the doctor’s time spent on record maintenance);
• Automatic classification and data verification systems (used to evaluate the performance of the public health service at the regional level);
• Chat bots (used to support aftercare patients and decrease the need for the doctor’s advice).

Russia can apply the above areas of artificial intelligence technologies as well. It is advisable to develop our own systems instead of using foreign ones. The development of such systems requires significant financial expenditures, but these expenditures can be cost-effective. Global practice shows that the implementation of innovative projects to introduce artificial intelligence technologies in medicine can be high-margin. Moreover, it can allow us to achieve the desired changes in the affordability and quality of medical aid. Russia has all conditions, including skilled workforce, to develop such systems, and the Russian market is rather large. Finally, we may export created intelligent information systems abroad.

We should by no means perceive artificial intelligence technologies as a complete substitute for human doctors. These technologies should aim at improving the performance of the public health service as a whole, and separate medical institutions in particular. They
should make labor easier for doctors and other medical staff, improve the quality of
diagnostics, and reduce medical errors. We should always keep in mind potential risks and
threats related to artificial intelligence technologies, and let human doctors make final
decisions. Presently, the “common sense” of the most powerful supercomputer in the world
is comparable to the intelligence of a four-year-old child. Therefore, we cannot talk about
the complete replacement of the doctor by the machine.

5 Conclusions

The results of the simulation carried out allow us to conclude that artificial intelligence
technologies have a significant impact on the level of competitiveness of the national
economy. The Russian Federation needs, first of all, to pay attention to the creation of
intelligent information systems for the real sector of the economy in order to increase the
competitiveness of domestic goods and services and achieve the goal of import substitution.

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