Human capital and the knowledge economy as key challenges of post-industrial society

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Abstract. The article examines human capital, which is becoming not just a determinant of competitiveness, but also the dominant form of social wealth, the basis of intellectual and social capital as a condition for not only economic but also civilizational progress as a whole. Against the background of economic globalization, fundamentally different economic relations and production relations are developing, closely connected with changes in social and labor relations, in particular in forms of employment. The problems of formation and development of human capital in the modern world are connected with the fact that, on the one hand, humans create the latest systems, including technology, technological knowledge, high-tech production processes, market opportunities, which need to be competently and comprehensively managed. On the other hand, it is important not only to manage these processes competently, but also to constantly improve them, developing in turn the professional component in order to ensure the competitiveness and strategic sustainability of the company or state.

1 Introduction

The rationale for choosing the topic and its relevance. In today's world, economies are changing and are at a global level. Dynamic development, knowledge, improvement of workers' skills and mobility of the labor force all increase the competitiveness of countries at the global level. Human capital is one of the main drivers of a country's economic growth and increases the level of competitiveness of the economy in the international arena. Therefore, one can conclude that developed countries have a much higher level of human capital than low-income countries. The high level of human capital and a country's economy is achieved through the application of the knowledge economy. In practice, this can be seen in the policy of the European Union, which aims to build a knowledge-based economy.

Russia is no exception, and the economy is developing in line with the chosen course of innovative development, but its level and pace, the raw material nature and liquidation of enterprises during the economic crisis, as well as the weak competitiveness of domestic products at the global level and some other factors that show problems in the economy, hinder the development of the knowledge economy, and therefore human capital.

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This paper explores the place of human capital and the knowledge economy in various countries around the world, as well as in Russia, and identifies the challenges and risks associated with the production of new knowledge.

The study aims to analyze the level of investment in human capital and the knowledge economy and to identify problems that may affect them.

To achieve this objective, the following tasks were set and resolved:
- Consideration of the theoretical aspects of human capital and the knowledge economy;
- Identification of the challenges and risks of becoming a knowledge economy;
- Consideration of how to address the challenges and risks of becoming a knowledge economy;
- Analysis of methods for measuring the knowledge economy and the dynamics of education financing in Russia.

The objects of the study are human capital and the knowledge economy. The subject of the study is the effective functioning of the knowledge economy and human capital, subject to the challenges posed by the level of development of national economies.

The theoretical and methodological basis and information base of the study are the works of domestic and foreign researchers devoted to the issues of the banking sector. Materials from various scientific electronic libraries, as well as monographs were used as an information base. When writing the abstract, the following research methods were used: analysis, synthesis, generalization, comparison, observation, and description.


The concept of human capital can be traced back to the work of economists of past centuries. Political economy scholars viewed capital as a means of production but in conjunction with human labor. Among the few scholars who considered human capital as a means of increasing productivity were Marshall, Smith, and Fisher. T. Schulz and G. Becker introduced the concept of human capital in their scientific publications, and they were later awarded the Nobel Prize for developing new concepts of human capital. Schulz pointed out that human labor is capital, and that capital in the future will bring earnings and consequently satisfaction from it.

Human capital is the most important resource of post-industrial society. In the course of work, workers acquire knowledge and skills, which is a form of capital. It is worth noting that human capital is not an innate property of a person, but is accumulated throughout a person's working life. The growth of human knowledge, i.e. human capital, is the product of deliberate investment, and its growth leads to improvements in the economic system. Investments in human capital can lead to an increase in labor productivity, as well as an increase in the wages of workers. The very definition of investment in human capital refers to cumulative costs distributed over time, affecting human capabilities, and skill levels, and leading to an increase in productivity, and income of the employee, the firm, as well as the state. It implies that by investing in his abilities, a person sacrifices less to get more from his improved abilities in the future, but there is one nuance: he will sacrifice something if he is sure that his losses will be recouped. The clearest example of an investment in human capital is education: the costs of education in the future are recouped according to the profession acquired, even if those costs have been made by the state, companies or private individuals.

The following types of investment in human capital can be distinguished:

1. Expenditure on education, as education affects a person's intellectual development and the level of his/her professional training.
2. Health expenditure, since a person's physical development and health affect his or her vocational training.
3. Birth and upbringing costs
4. Costs of labor market mobility, as there may be a need to change to a better job.

What is the relationship between human capital and the knowledge economy? A knowledge economy is an economy based on the dissemination and use of knowledge to achieve economic growth and global competitiveness of a country as well as the competitiveness of individuals. It encompasses the aggregate knowledge of individuals used in different sectors of the economy. The knowledge economy uses not only individual knowledge (education, competencies, qualifications) but also various scientific developments (high-tech products, innovations, etc.), as well as know-how in the form of tacit knowledge.

The knowledge economy includes the following components:
1. Priority on education and human capital development. Employment in the knowledge economy is characterized by an increased level of competitiveness in people with more skilled labor.
2. Research and Development (R&D) and scientific activities. It is common knowledge that scientific activities result in new knowledge, which is then used in practice and forms the basis for new research. As for the application of knowledge at the firm or production level, it is used in the implementation of innovations and intellectual products derived from the research and development process.
3. The institutions of the knowledge economy. The knowledge economy has its institutions, which include legal regulation, such as copyright protection, as well as state development institutions that fund innovative developments, create the necessary infrastructure and subsidize innovative activities.

2 Materials and methods

Measuring the knowledge economy is one of the central issues. In recent years, along with the formation of the knowledge economy methodology, the question of the degree of advancement of this economy, both in dynamics and in comparison with other countries, has been raised. There are various methods for determining the level of innovative development. For example, the global innovation index most succinctly reflects the ranking of countries in the world according to the level of economic development.

The Global Innovation Index is calculated using the methodology of the INSEAD international business school in France. This index is made up of 80 different variables that characterize the development of countries around the world at different levels of economic development, so the index is calculated based on available resources and conditions for innovation and the practical results achieved by innovation. In simple terms, the index is a ratio of innovation inputs to innovation outputs, which can effectively reflect the effectiveness of a country's efforts.

Russia has good prospects for the development of a knowledge economy, as the country has high educational potential, opportunities for innovation, and a significantly developed material and technical base, but the limiting factor for the development of countries towards a knowledge economy is the unresolved problems of the institutional environment.

From the UNESCO Science Report: Towards 2030, we can list the main challenges facing the knowledge economy in Russia.
1. A periodic slowdown in economic growth due to changes in world oil prices and various EU and US sanctions, affecting international scientific cooperation.
2. The citation rate for articles written by Russian academics is half that of the G20 average.
3. The absolute level of patenting is increasing, but 70% of these patents are not related to major technological innovations and remain only on paper.

4. Between 1990 and 2021, the level of higher education has almost tripled, but there is still a shortage of specialists in science and mathematics.

5. Based on the Cornell University Global Innovation Index database, the position of the Russian Federation in terms of innovation performance at various income levels for 2020 is below the expected results for this level of development.

6. Russia ranks 5th in the absolute size of the research sector but is behind more than 20 countries in the number of researchers per 1000 people employed in the economy. There is an annual increase in funding, but due to a reduction in the number of researchers, the level of costs per researcher in Russia is rising [10].

In the development priority, the strategy identifies 3 key priorities: developing human capital, increasing business innovation, and promoting innovation in the public sector.

To address the challenges of transition to a knowledge economy, several important challenges need to be addressed:

1. To ensure the competitiveness of human capital and develop human potential.
2. Develop and move towards a new model of the knowledge economy through effective public policy for regional development.
3. Allocate capital to all sectors of the knowledge economy in such a way that underfunded sectors are funded with the possibility of reducing funding in high-budget sectors, and all necessary funds are allocated according to innovation activity.

3 Results and discussion

In 2021, Russia ranked 45th according to the Global Innovation Index. This year, the Russian Federation ranks 43rd in innovation capacity, down from 2020 and equal to 2018. In terms of innovation performance, the Russian Federation ranks 52nd. This position is higher than the results from 2018 (Table 1).

Table 1. Dynamics of the ranks of the Russian Federation from 2018–2021.

<table>
<thead>
<tr>
<th>Year</th>
<th>Place</th>
<th>Place in terms of innovation capacity</th>
<th>Place according to the effectiveness of the practical application of the innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021</td>
<td>45</td>
<td>43</td>
<td>52</td>
</tr>
<tr>
<td>2020</td>
<td>47</td>
<td>42</td>
<td>58</td>
</tr>
<tr>
<td>2019</td>
<td>46</td>
<td>41</td>
<td>59</td>
</tr>
<tr>
<td>2018</td>
<td>46</td>
<td>43</td>
<td>56</td>
</tr>
</tbody>
</table>

Source: compiled by the authors according to [11-13].

It must be said that Russia ranks 6th among 37 upper-middle-income countries and 12th among 39 European economies.

The Russian Federation scores highly in six of the seven core GII indicators: Human capital and research, Infrastructure, Knowledge and technology outputs, and Creative outputs, which are above average for the upper-middle-income group. Of all the indicators, human capital and science are the highest. Having analyzed the dynamics of this indicator, we can say that every year it gets a little better. This means that Russian specialists are competitive in the world market, which means that increased investment in education has shown good results.

Another indicator of the strength of the knowledge economy is the International Property Rights Protection Index. This index measures the level of protection of property rights in countries. It has been produced by the International Property Rights Alliance since
2007. According to the International Property Rights Protection Index, Russia was ranked 81st in 2021 with a score of 5.055. Russia's IPRI score dropped by 0.057 to 5.055, ranking it 20th in Central Eastern Europe and Central Asia region. Russia's legal and political sub-index declined by 0.026 to 3.708, scoring 3.717 for judicial independence, 3.552 for rule of law, 4.224 for political stability, and 3.336 for anti-corruption. The subindex of physical property rights in Russia increased by 0.062 to 5.882, scoring 4.472 for perceived protection of property rights, 9.554 for property registration, and 3.808 for ease of access to credit.

Russia's intellectual property rights sub-index increased by 0.138 to 5.514, scoring 4.729 for intellectual property protection, 6.527 for patent protection, 3.8 for copyright protection, and 7.001 for trademark protection.

To analyze investment in human capital, the dynamics of expenditure on research and development and education can be considered (Figure 1).

![Fig. 1. Dynamics of domestic R&D expenditure in Russia as a percentage of GDP. Source: compiled by the authors according to [14].](image)

Domestic spending on education in Russia in 2020 was 1.175 billion roubles. The annual growth rate of domestic spending in the last two years has outstripped the dynamics of the country's GDP. Spending on education has been increasing markedly every year, especially on higher and postgraduate vocational education. This is due to structural changes in the higher education system to improve its competitiveness at the global level.

Thus, several important methods can be used to analyze human capital and the knowledge economy, which fully reflect the current situation in the country and the world as a whole. Russia is not a world leader in the Global Innovation Index and the International Property Rights Index, but it tries to rise one point higher in the rankings each year. The competitiveness of Russian education and working professionals is increasing in the global market, which is certainly a big plus for our country.

### 4 Conclusions

Undoubtedly, there are risks and problems in the development of the knowledge economy in Russia, but despite them, the government is developing strategic plans, the achievement of the goals of which will favorably affect the international ranking of Russia in terms of human capital and knowledge economy. In 2021, Russia, despite the coronavirus restrictions, moved up 2 positions in the global innovation index rating, which positively shows the development of Russia at the global level.
Among the most important risks facing the knowledge economy and human capital is the inability to apply in practice the knowledge acquired by personnel, and the uncompetitiveness of education and knowledge at the global level.

The key problems are: low citation rate of Russian scientific publications; high level of higher education attainment, but lack of specialists in science and mathematics; growth of absolute patenting rate, but a large percentage of patents is not related to major technological innovations.

Public policies implementing innovative development programs should be comprehensive, systematic, and reflect realistic goals in line with the level of economic development, as there are many problems and risks that the wrong policies can exacerbate.

Despite the risk of non-competitiveness of education at the global level, the competitiveness of Russian education and working professionals is increasing on the global market, which is undoubtedly a great plus for our country. Funding for education is increasing annually, which is caused by structural changes in the education system.

References

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