

Brain Capital as a Factor in the Efficient Digitization of the Economy

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Abstract. The research examines brain capital as a key factor in the digital transformation of a region.

The goal of the publication is to comprehensively study brain capital and develop a mechanism for improving the efficiency of the development and use of brain capital.

The evaluation of brain capital is based on the analysis of a system of indicators that include the fluctuation in the use of information and communication technologies in organizations, the structure of ICT professionals, ICT expert distribution by industries, the number of students receiving bachelor, specialist, master degrees in information and communication technologies, publications of Russian ICT experts that are listed in the international citation bases and the number of relevant patents.

The authors proposed a mechanism to improve the efficiency of the development and use of brain capital that include regulation tools and calls for active role of the state.

Conclusions:

The Russian economy has the sufficient level of brain capital development.

However, in order to efficiently develop the digital economy, active state support of innovations is necessary, as well as a differentiated support system for the creation and development of ICT, international cooperation in information and communication technologies, and regular analysis and adjustment of the tools under support programmes based on the outcomes of the monitoring of their activities.

1. Introduction

In today's world brain capital is a key factor in the sustainable development of any economic system.

Fast technological progress can be ensured both by material and technical resources and by quantitative and qualitative characteristics of labour resources.

This also fully applies to the formation of an economy of a new type that is based on active introduction of scientific and technological innovations, digital economy, full-scale application and distribution of informational technologies, etc.

The academician S.Glaziev said in his publications that brain capital lay in the foundation of the competitive advantages of a country and the so-called intellectual rent.

If the state sells raw materials in the international market and buys products that have intellectual rent, it imports inflation [2].

The vice-president of Cisco J. Sparrow in his article on the foundation for the digital economy says that today the economic development means mainly a transition to new complex systems that include

digital, physical and biological technologies, and that as a result change both the world around us and the very understanding of what people can do.

The new digital era or the fourth industrial revolution is based on recombination innovations that are associated with the digitalization of the existing processes and products, advent of new platform business models and distributed production as well as block chain technologies [8].

The transition of the state and businesses to the digital development provides for the changing requirements for workers.

The key universal competencies today are becoming more prominent, in particular critical thinking, teamwork, complex analytical problem solving skills and expertise in working with big data [6].

In Russia nowadays the digital economy is developing fast with the 3.9% of GDP in 2015.

Its growth rate was 9 times higher than the GDP growth rate.

In order to boost the growth in Russia, the Strategy for Information Society Development until 2030 and the "Digital economy in the Russian Federation" programme has been approved that lists the indicators for the implementation of the aforementioned strategy.

This programme establishes goals for the creation of an ecosystem for the digital economy, eliminating barriers for the establishment and development of hi-tech businesses and improving the competitiveness of Russia on the international level.

In order to achieve these targets, the following five basic development areas were identified:

norms and regulations, human resources and education, R&D skills development, information infrastructure and informational security [7].

Russia has created all the conditions for achieving the targets associated with the development of the digital society.

2. The analysis of the development of brain capital in the Russian economy

The main factor that shows the efficiency of the digitalization of the economy is the availability and necessary level of development of all structural elements of brain capital.

Innovative product and technology development is significantly affected by the existing capacity and quality of knowledge, experience and skills [5].

The main aspect of the modern stage of economic development is more intensive use of information and communication technologies (ICT) in businesses, households, social services and public administration.

Local computing systems are replaced by personal computers, global information networks and servers (Figure 1).

More than 89% of Russian companies use the Internet, about 50% have their own web-sites, and the number of businesses that use cloud services is growing too [4].

Under such conditions, professional support and maintenance of modern business informational technologies is becoming more and more important.

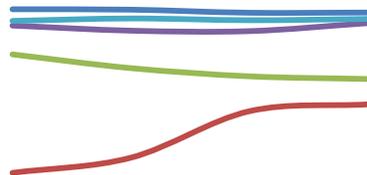


Figure 1. The fluctuations of using ICT in organizations, % of the total number of organizations.

The Russian economy today employs 1077 thousand ICT experts, who account for 2.6% of the total number of employees.

Digital economy human resources are mostly professionals with higher and medium qualification levels.

The share of higher level professionals is 78.8%. These people develop software (55.5% in the total number of ICT employees (Figure 2)), analyse data bases and networks (more than 23%).

228 thousand people are medium level experts that mostly provide ICT support services [3].

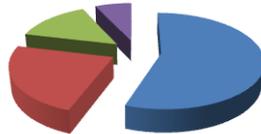


Figure 2. The composition of ICT specialists employed in the economy, % of the total number of ICT experts.

Higher level professionals are mostly represented by software developers (more than 72% of the total number of software developers), and a significant number of experts create software applications (11.5%) (Figure 3a).



1) specialists - developers and analysts

2) data base and network experts

Figure 3. The composition of higher level ICT experts, % of the total number of existing group of experts.

Also higher level professionals who work with data bases and networks mostly fulfil the functions of IT administrators (52.2%) with more than 25% of them engaged in the work with computer networks (see Figure 3b).

Industrial composition for ICT experts is evident and has a clear differentiation: information and communication account for the majority of more than 34% of the total number of ICT experts (Figure 4).

Modern information technologies in processing businesses provide for a high concentration of ICT experts here (more than 15%) [9].

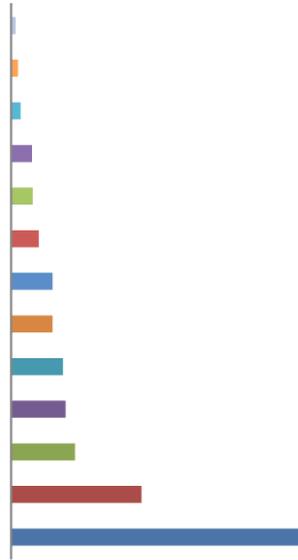


Figure 4. Distribution of ICT experts by industries, % of the total number of ICT experts.

This area is also characterised by the objective need in continuous update of knowledge and development of best practices.

For example, more than 13% of the total number of ICT professionals engage in capacity building through various professional training and capacity building courses including in-house ones, in particular training sessions and seminars [9].

Modern trends associated with the innovative development of the economy, digitization and modernization of the production determine the development of the labour market.

Demand for ICT experts leads to the growing need for education and training in the area of information and communication technologies [5].

About 6% (55 thousand people) that graduated from Russian higher education institutions are ICT experts.

The most thought-after degrees today are the ones in information science and computing equipment, applied information science, information systems and technologies (Figure 5).

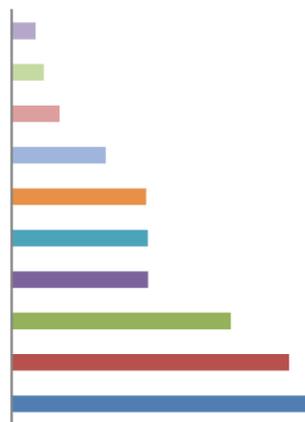


Figure 5. Number of bachelor, specialist, master degrees in the main ICT fields of studies, people.

Knowledge, experience and skills produce intellectual property that is another structural element of brain capital.

Publication activity is a popular indicator for the development of national brain capital.

The fluctuations in the number of works by Russian authors in publications indexed in Web of Science are positive:

today the total number of publications by Russian authors is 4036, which is by 56% more than in 2014. That affected the share of Russia in the global number of publications in the industry (Figure 6) [4].

However, today the growth rate of publication activity in ICT is significantly slower than in 2015.

For example, the number of publications by Russian authors in 2015 was 3678, which was by 41% higher than in 2014, while in 2017 the annual growth was only 3%.

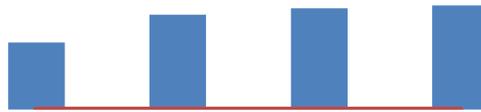


Figure 6. Articles by Russian authors in the field of ICT in publications indexed in Web of Science.

It is worth saying that the share of Russian articles on ICT (computer sciences) in leading global magazines (up to 7% of the total number of publications by Russian authors in scientific magazines indexed in Web of Science) is growing.

Average citation rate of an ICT article published in a publication indexed in Web of Science in 2015-2017 corresponds to the global trends:

most cited publications concern medical information science (2.2), while in other areas the rate is not higher than 1.

This situation allows us to make a conclusion on high demand for knowledge and experience of Russian experts in ICT, the competitiveness of the national brain capital that is a strategic economic resource.

Innovative and scientific and technical potential of ICT experts is partially seen in their inventing activities.

The number of patent applications for inventions concerning information and communication technologies filed by Russian applicants in the analysed period reduced to 80% in 2016 in comparison to 2015, which resulted in a smaller national share in the total number of patents in the world (Figure 7) [3].

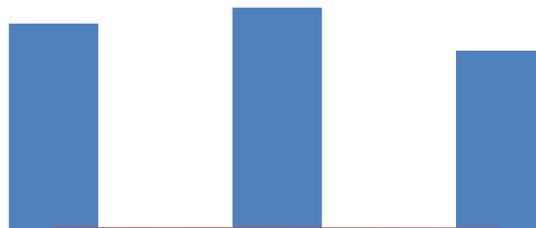


Figure 7. Patent activity of Russian applicants in the ICT area in 2014-2016.

Thus, the conducted analysis allows us to say that today Russia has the necessary brain capital with good education and innovation and invention potential.

3. The creation of a mechanism to improve the efficiency of the development and use of brain capital

However, the use and development of brain capital in the country faces a number of challenges (difficult process of invention commercialization, lack of adequate guaranteed remuneration, imperfect technology transfer system, etc.), once they are addressed, the society will be able to fully employ the economic resources that ensures competitive advantage for Russia and the achievement of the goals and of innovative development and economy digitalization [1].

One of the options associated with the efficient use and development of brain capital can be the mechanism proposed by the authors (Figure 8) that provides for active government support of innovative activities, a differentiated support system for the creation and development of ICT, international cooperation in the area of informational and communicational technologies, analysis and adjustment of the tool kit of support programmes in the follow-up to the monitoring of their activities.

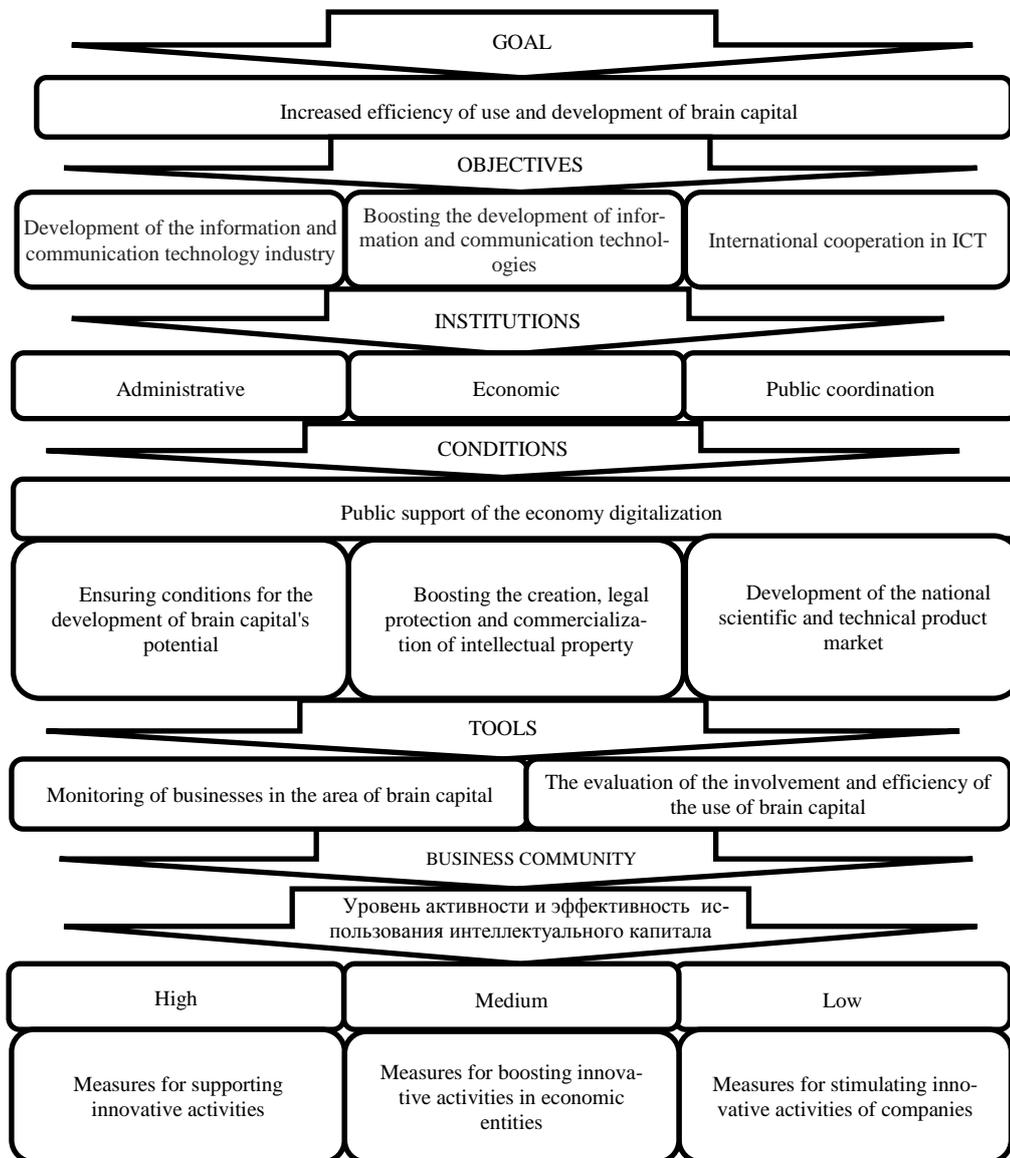


Figure 8. Mechanism to improve the efficiency of the development and use of brain capital.

4. Conclusions

1. The course of Russia aimed at faster digitization of the economy determined the changes in the requirements for the labour market.

Workers need to have key universal competencies associated with critical thinking, teamwork, complex analytical problem solving skills and expertise in working with big data.

2. The factor that shows the efficiency of the digitalization of the economy is the availability and necessary level of development of all structural elements of brain capital.

Innovative product and technology development is significantly affected by the existing capacity and quality of knowledge, experience and skills [5].

3. The main aspect of the ICT development in Russia is the majority of young qualified experts.

At the same time there is a constantly rising demand for experts in this area, which in its turn provides for a bigger number of degrees on different education levels in information and communication technologies.

4. The Russian economy has the sufficient level of brain capital development.

However, in order to efficiently develop the digital economy, active state support of innovations is necessary, as well as a differentiated support system for the creation and development of ICT, international cooperation in information and communication technologies, and regular analysis and adjustment of the tools under support programmes based on the outcomes of the monitoring of their activities.

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