THE RELATIONSHIP OF SCIENCE AND PERSONNEL POLICY DEVELOPMENT IN THE PROBLEM FIELD OF THE DIGITAL ECONOMY

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ABSTRACT

The relevance of research: *The problem of staffing the digital development of the economy at the global and national levels is a key to the success of its digital transformation. However, there are obvious problems in this area that reflect the digitalization process.*

Objective: *The aim of this study is to identify the problems of staffing for successful digital development at the global level and the level of one country - Russia, assess the ability of these problems to influence the success of digital development itself and development in general.*

Results: *The digitalization development is associated with advances in data processing and storage, as well as with the development of digital literacy of society as a whole. Moreover, the development of science is obviously more important. Since the end of the last century, there has been a significant, more than twofold increase in the number of students and researchers, however, this growth was mainly due to developing countries. In developed countries, the number of scientific publications has not grown so much since 2000, while growth in the current decade is slower than in the past. In general, the contribution of mathematical research and research in the field of directly computational mathematics and computer science since the beginning of the millennium increased by 1.5-2 times. At the same time, taking into account the difficult demographic situation, it is obvious that developed countries replenish their high-level personnel potential in developing countries, and, quite possibly, taking into account the peculiarities*

Conclusion: *In the process of digitalization as global, the following key interrelated problems can be distinguished, which have vivid personnel projections: 1) the problem of information quality; 2) the problem of the need for personnel is more and more qualified to create digital technologies; 3) the problem of ever higher requirements for digital literacy at various levels is to use more and more complex digital technologies; 4) the problem of limited human resources, including a high level, due to a slowdown in the population of the planet; 5) the problem of artificial intelligence, which can be a threat in itself; 6) the problem of personality in a fully transparent digital world; 7) the problem of information security; 8) the problem of the need to increase the energy supply of digital development in the context of understanding the environmental limits of this growth.*

Keywords: Digitalization, Personnel for the Digital Economy, Science, Higher School, Economic Growth, Russia.

INTRODUCTION

Digitalization in terms of describing social processes represents the current stage of the information (cybernetic) revolution, which began as early as the middle of the last century (Grinin & AL, 2015). This stage is associated with hurricane accumulation of digital data and increasing (albeit somewhat delayed) attempts to use them to maximize the management of the economy and other aspects of human life. Formally, its beginning can be considered the first years of the current century, when the amount of digitally stored data by mankind exceeded that in the form of analogue, although in fact its report can be kept from the beginning of the computers' penetration into the economy, i.e., from the 1950s of the last century.

Digitalization at the moment is the instrumental core of the global innovation process. Almost any serious technological innovation today is associated with computer data processing. The latter is closely related to scientific thinking, because it means the processing of information into knowledge that can be used to develop products and benefits that are useful to humans.

At the same time, working with data and even more so, the formation of new technologies for working with them, requires scientific competencies, especially in the mathematical field. That is, the development of the digital economy will require more and more scientific personnel, in any case, until artificial intelligence replaces them. At the same time, the rest of the society will have to some extent catch up with scientific development, increasing its *"digital literacy"* at various levels.

Does the global community have enough scientific resources for sustained digital development? Will the key problem in the near future not be the shortage of personnel for such development, both in developed and developing countries? How does digitalization itself as a global and regional-local process affect the personnel problem of economic development as a whole?

In connection with the foregoing, the aim of this work is to identify the problems of staffing for successful digital development at the global level and the level of one country - Russia, assess the ability of these problems to affect the success of digital development itself and development in general, as well as highlight and discuss possible solutions.

LITERATURE REVIEW

Digital development is a feature of the modern stage of human development, which, as is known, has been exposed to the risks of resource and climate restrictions for several decades. Science, education and innovation have become the key to a comprehensive response to the challenges of humanity, which is enshrined in the Sustainable Development Goals.

Already last decade, digital competencies have been identified as key for all EU residents, where digital competence as one of the eight key competencies is defined as follows: *"Digital competencies involve the confident and critical use of information society (ICT) technologies for work, leisure and communication. It is based on basic ICT skills: using computers to search, evaluate, store, produce, present and exchange information, as well as to communicate and participate in joint networks via the Internet"* (European Commission, 2006).

The term *"digital literacy"* was first coined by Gilster & Glister (1997) in the late 1990s as *"the ability to understand and use information in a variety of formats from a wide range of sources represented by computers"*.

Over the past few decades, the concepts of digital competence and digital literacy are used more and more often and are discussed more often, especially in political documents and discussions on building a knowledge society (Ilomäki et al., 2016).

Digital literacy is also defined in the reports of the British Joint Information Systems Committee, the European Commission, OECD work on technology and education (JISC, 2011, 2014 & 2015); (European Commission, 2010); (Istance & Kools, 2013).

In 2013, the European Commission approved the Digital Competency System, which includes five areas and 21 competencies, which include the concept of digital literacy (Ferrari, 2013). At the system level, policy documents often emphasize the need to invest in continuing education in digital technology for economic growth and competitiveness (European Commission, 2010). In addition, it is argued that in our interconnected world, *"sustainable development and social cohesion critically depend on the competencies of our entire population - with competencies understood as encompassing knowledge, skills, relationships and values"* (OECD, 2005). In addition, in 2008 UNESCO released the program document *"ICT Competency Standard for Teachers"*, which focuses on teacher education and digital literacy without definition (United Nations Educational, Scientific, and Cultural Organization, Paris (France), (2008). In Sweden, digital competency is also used as a fundamental concept in the current national strategy for digitalization of education (Swedish Ministry of Education, 2017).

Finally, the definition of *"critical digital literacy"* (CDL) appeared, for the first time by Ávila & Pandya (2013) as *"the skills and practices that lead to the creation of digital texts"*, Roche (2017) also refers to CDL and emphasizes that *"the ability to access, critically evaluate, use and create information through the digital media when interacting with individuals and communities"* should be considered in the definition of digital literacy.

In general, it is expected that by 2020 the most important for the entire economy will be data analytics, commercialization and communication skills, as well as engineering knowledge and experience in managing a team of multidisciplinary specialists (Ertel & Solomon, 2014). The World Economic Forum called the basic skills of the digital age cognitive flexibility, creativity, logical and mathematical reasoning, sensitivity to problems, visualization, active perception and critical thinking, self-control and emotional intelligence, as well as the ability to coordinate and train others (The Future of Jobs, 2016). At the same time, a survey of more than 100 employees of government bodies in the Russian Federation and government bodies showed that the public administration system is not ready for the transition to digital development of public administration (Vasilieva et al., 2018).

Generally speaking, digital competencies are therefore needed for work, and digital literacy is for life. In different countries, attempts are being made to measure them - mainly through polls that do not always adequately reflect reality. So, recently it was reported that the digital literacy index of Russians over the past year fell by 14.7%. But at the same time, the survey organizers themselves explain this by the fact that users have become more modest in assessing their skills in the field of information security. In addition, more and more people prefer not to try to repair the gadget on their own, but to attribute it to professionals, life requirements for literacy in the field of digital security of citizens are being tightened, causing them doubts about their competence (Shmyrova, 2019).

In general, in our opinion, the key competence in working with information at all times has been analytical abilities, which are most developed among the people of science - scientists. The development of science, in the end, determines and sets the standards of a digital society,

which, in turn, quickly adjusts to them mainly through changes in basic education, through self-education and, if necessary, additional education.

Thus, we assume that the key to the digital skills development (which determine the success of the economy's digitalization) is scientific research in the field of digitalization, the patterns of co-development of which with the development of digital literacy of society itself (as the sum of its digital competencies).

The overall goal of this work is to identify the problems of staffing for successful digital development at the global level and the level of one country - Russia, assess the ability of these problems to affect the success of digital development itself and development in general.

METHODS

The methods of scientometric analysis were used in the work (data of the Scopus database-mainly as of December 1, 2019, Elibrary- databases of scientific publications of Russian sources, SJR resource - Scimago Journal & Country Rank - https://www.scimagojr.com/), comparing indicators of global, regional and national processes in various fields in order to detect signs of co-development.

RESULTS

To date, it is obvious that humanity, apparently, has already experienced a stage of rapid growth in numbers and its growth rate is gradually decreasing, reaching an annual maximum of more than 2% in the late 1960s and early 1970s. In 1960, the annual population growth was 1.8%, in 1970 - 2.1%, but subsequently began to decline, to 1.1% in 2017 and, obviously, will continue to decline.

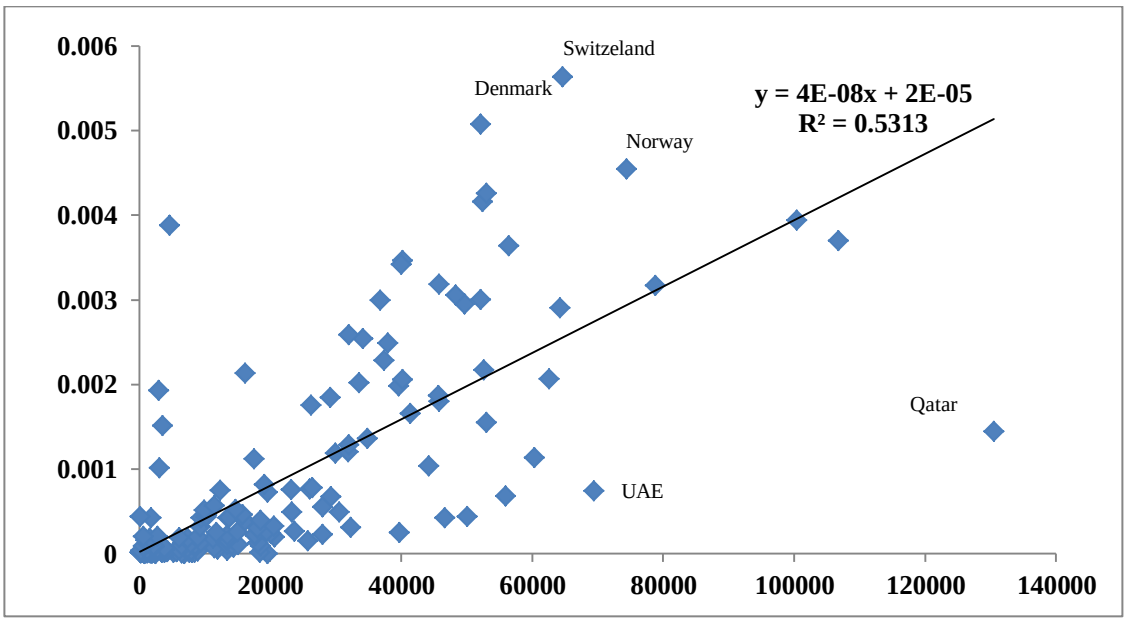
In most developed countries, as well as in countries with a transformed economy, to which Russia (largely due to inertia) belongs, the last surge in fertility occurred in the 1980s. Deloitte Insights Study states that in 2020, the oldest representatives of the so-called millennials' generation will turn 40 years old. They will make up 50% of the total working population. In Russia, the *"older"* millennials born in the 80s of the last century make up a very large category of the population, significantly exceeding the number of Russians of other ages in the number of annually born. That is, it is the generation most actively engaged in the economy (Schwartz et al., 2018). At the same time, the life span of the millennials is shrinking, 35% of them will become obsolete by the end of 2020. It is estimated that by 2030, 400 million people will lose their jobs, and 375 million will be forced to learn new skills. The ability to learn new professions will be a key skill of the future (Kasriel, 2017). According to the data of the Deloitte Global Human Capital Trends report, 86% of respondents considered they should *"rediscover their learning ability"* (Deloitte Insights, 2019).

At the same time, world GDP at PPPs grew in 1992-2016 by 2.3 times at constant prices, per capita GDP for this period increased by 70% (from 8.9 to 15.1 thousand international dollars in 2011), the world's population grew by a third (+1.9 billion people), mainly due to growth in developing countries. Due to the growth of per capita GDP of the world by 2016, the share of poor countries - with an indicator of less than 3.9 thousand dollars/person. - In the total number of countries decreased from 39.3% to 26.4%. At the same time, the share of rich countries (above 25.4 thousand dollars per capita) increased over this period from 15.7% to 23.6%. At the same time, the share of the urbanized population grew from 1990 to 2017 by only 12% - from 43 to

54.7%. Science, technology, industry - all this is usually concentrated in the city (The uneven development of the countries of the world, 2018).

Obviously, not only urbanization provides an almost twofold increase in wealth. In part, this growth can be attributed to the number of people living outside the region in which they were born, estimated at 763 million people. The probability of migration is higher among more educated people who see in it the prospect of getting a better education outside their native places. Education-related preferences and aspirations also force people to leave rural areas regardless of earning potential. In 53 countries, the probability of migration was four times higher - among people with higher education, compared to those who did not receive education (UNESCO, 2008).

Obviously, there will always be fewer more educated people standing at a higher educational level than less educated ones. At the top of this pyramid are scientists. This means that the results of their activities should be closely interlinked with economic growth.



Source: According to the International Monetary Fund - (the regression equation and the value of R2 are shown) - most countries of the world (over 150) are shown, for of which these values are known for 2018.

FIGURE 1
THE LINEAR TREND OF CORRELATION BETWEEN THE NUMBER OF ARTICLES IN THE SCOPUS DATABASE PER CAPITA AND GDP PER CAPITA PPP

From the data in Figure 1, it follows that the relationship is strong enough, although the countries of the world are strongly clustered by the strength of this relationship. In the oil-producing countries of the Middle East, it is weak, in countries such as Switzerland, Denmark, Norway and Iceland, this dependence is much stronger than that presented in the regression equation.

Tables 1 and 2 present data on some scientifically leading countries of the world, including Russia, the total number of their publications in the Scopus database in 2000, 2010, 2018, and their share in the field of computer science and mathematics. As can be seen from the table, it is easy to assume that digitalization has not yet led to an increase in the growth rate of

scientific publications, which is especially evident in the current decade. At the same time, the share of scientific publications in computational mathematics in leading countries in scientific relations is expectedly growing, as well as the share of publications in the field of computer science. Moreover, the increase in the share of mathematical work proper is not so obvious. It is interesting that Russia demonstrates a different direction in the dynamics of the share of mathematical, computer and computational publications, which is associated, however, mainly with the rapid increase in the number of Russian publications in Scopus in general, in all areas, including previously poorly represented in this international database (while mathematical science is traditionally at a high level in Russia).

Table 1
THE TOTAL NUMBER OF PUBLICATIONS IN THE SCOPUS DATABASE BY LEADING COUNTRIES IN 2000, 2010, 2018

2000		2010		2018	
1. USA	369874	1. USA	600345	1. USA	683003
2. UK	105265	2. PRC	344420	2. PRC	599386
3. Japan	104552	3. UK	172923	3. UK	211710
4. Germany	89848	4. Germany	150645	4. Germany	180608
5. France	63928	5. Japan	129700	5. India	171356
6. PRC	51868	6. France	107610	6. Japan	131198
7. Canada	44868	7. Canada	90926	7. France	120908
8. Italy	44689	8. Italy	86301	8. Italy	119405
9. Russia	34449	9. India	80802	9. Canada	111561
10. Spain	31236	10. Spain	73359	10. Australia	106228
11. Australia	30333	16. Russia	40390	11. Russia	99099

Source: Scopus Database

Table 2
SHARE OF ARTICLES IN VARIOUS SCIENTIFIC FIELDS IN THE TOTAL NUMBER OF ARTICLES IN THE SCOPUS DATABASE

	Computational Mathematics		Computer Science		Mathematics	
	2000	2018	2000	2018	2000	2018
USA	0.30%	0.42%	8.04%	10.30%	6%	6%
Russia	1.20%	0.76%	6.20%	10.80%	10.90%	10.30%
Germany	0.44%	0.54%	6.90%	12.40%	7.30%	8.40%
PRC	0.48%	0.68%	11.30%	17.20%	9.60%	10.50%
Japan	0.13%	0.28%	7.2%	13%	4.90%	7.10%

Source: Scopus Database

In general, science, that is, information organized into knowledge is largely responsible for economic growth. Does the growth of information received by mankind and processed information in itself lead to economic growth? The exact measurement of digital literacy to a large extent, as we found in the review above, should be determined by analytical skills and competencies. At the same time, the average level of mathematical competencies (mathematical literacy) of young people living in OECD countries who have finished school in the last decade has not increased (the average PISA score in mathematics is 496, 492, 493 in 2009, 2012, 2015). It can be generally assumed that digitalization as such at the local or even national levels will not necessarily lead to an increase in the real productivity of human labor (without taking into account mass robotization). If a person is not predisposed to analytics and does not have

analytical skills, then he is much more likely to simply spend time in the world of information and the virtual reality that is helpfully offered to him. Information may be incomplete, substandard or even false. Compared to 2017, the number of computer and mobile games fans has increased by almost 100 million. User spending on games will increase to $ 180.1 billion by 2021, with an average annual growth of 10.3%. Revenue of digital game manufacturers in 2018 amounted to 125.3 billion dollars, in 2019 - already 148.8 billion. An increased opportunity for the release of human creative energy does not necessarily lead to an increase in the total strength of this energy (Wijman, 2019).

Is it possible to train more qualified personnel for the digital economy?

With the increase in the information amount, more and more qualified people are required who are able to use it. At the same time, in developed countries there is already a shortage of such personnel, it is necessary to attract talented students and workers from their developing countries, but this resource is gradually being exhausted.

In 2014, IDC (International Data Corporation) talked about 18.5 million programmers worldwide. Evans Data Corporation in the 2018 Global Developer Population and Demographic Study 2018 Vol. 2 study suggested that by 2023 there will already be 27.7 million developers in the world. IDC cited data for 2018: 22.3 million developers in 2018, of which 11.65 million are full-time professionals, 6.35 million are part-time professionals, 4.3 million are programmers. Current and future growth, as we see, roughly corresponds to the growth rate of the global economy. At the same time, formal education in this context ceases to play a key role in implementation in the field of digitalization of the economy. So, in 2018, it was reported that Apple, IBM and Google are ready to recruit employees without higher education; in particular, Google is ready to hire product managers, developers, recruiters and researchers without higher education.

At the beginning of November 2019, the Professional Cybersecurity Association (ISC) noted a huge shortage of personnel in this area, according to its report, there are 2.8 million such specialists in the world, and a little more than 4 million are missing. The United Kingdom is the leader on the deficit (289 thousand), France (121 thousand), Germany (133 thousand), in the rest of Europe, as well as in the Middle East and Africa, a total of 291 thousand more employees is missing (Scroxton, 2019). 65% of the enterprises surveyed do not have enough cybersecurity service employees, and the shortage of qualified specialists with relevant experience identified 36% of the top executives among companies surveyed as part of this study.

In Russia, the need for companies in IT professionals is growing rapidly: in two years, from 2016 to 2018, the share of relevant ads on Head Hunter increased by 5.5%. On November 20, 2019, IDC and Microsoft presented the results of a study according to which most companies in Central and Eastern Europe, including Russia, is well aware of digital transformation and only 10.5% of them do not consider it necessary. At the same time, only 13% of companies (in Russia - 15.5%, less than in Romania, but more than in Poland, Hungary, Greece and the Czech Republic) actively implement modern technologies or have a digital business transformation strategy. One of the main barriers is the lack of qualified IT professionals. A very alarming conclusion is made; only 3.5% of employees fully comply with modern requirements.

However, the measurement of the digital economy, including in the personnel plane, has not yet been debugged. In this regard, the *"List of indicators of the federal project "Personnel*

for the Digital Economy" of the national project "Digital Economy of the Russian Federation" is obvious.

According to the federal project, the number of vocational education graduates with key competencies in the digital economy, from 230 thousand in 2018, will reach 800 thousand by 2024. In fact, it is assumed that all graduates of all vocational education organizations will be trained in basic skills.

The number of people accepted for higher education programs in the field of information technology and in mathematical specialties should grow from 46 to 120 thousand by 2024. Thus, it is assumed that almost all school graduates with, according to the results of PISA 2015 testing, literacy levels of 5 or higher in at least one of the areas (mathematics, reading or science) should study in the field of IT or mathematics, if we want them to show successful results.

The proportion of people with digital literacy and key competencies in the digital economy should grow from 26% to 40% by 2024. At the same time, the number of specialists retrained in the competencies of the digital economy in the framework of further education will amount to one million people in 2024 (in 2018 - 200 thousand). Since the marks are *"cumulative"*, it can be assumed that approximately 3 million additionally will receive these skills through special programs, it is obvious that all young people who completed their studies in the first half of the 2000s should also possess them (this is still about 4-5 million people), that is, in total - about 7-8 million, which is 5% of the population, but not 14%, which will be prepared in the field of digital literacy additionally according to the previous indicator.

The place in the Global Talent Competitiveness Index talent rating is rightly considered an important indicator of the effectiveness of digital training in Russia. It should rise according to the program from 52 to 30th.

The share in the All-Russian verification work of tasks, the implementation of which allows the use of digital resources (tools, sources, environments, services) should grow to 100% by 2024.

Thus, the project plans for staffing the development of the digital economy in Russia are very ambitious, however, for their implementation, there will be a fundamental restructuring of the educational system associated with the total training in the basics of IT technologies for almost all students with serious mathematical abilities of the Russian higher school system.

Will humanity have enough opportunities to further increase staffing for technological growth?

The issue is associated with a slowdown in the world's population, with the gradual convergence of the level of development of advanced and developing countries. This means that everyone is able to get the highest qualification and corresponds to it, will receive such an opportunity in the coming decades, and the world will reach the maximum of its *"intellectual productivity".*

At the same time, the spread of higher education is accelerating thanks to educational migration, which is a powerful tool for globalization. Half of all international students study in five English-speaking countries: Australia, Canada, New Zealand, the United Kingdom and the United States. The percentage of international students in France and Germany has increased, respectively, to 8% and 6%, in part because these countries are increasingly offering postgraduate programs in English. At the same time, 25% of all students abroad in 2016 were students from China, India and the Republic of Korea. In 2016, 23% of students who went to

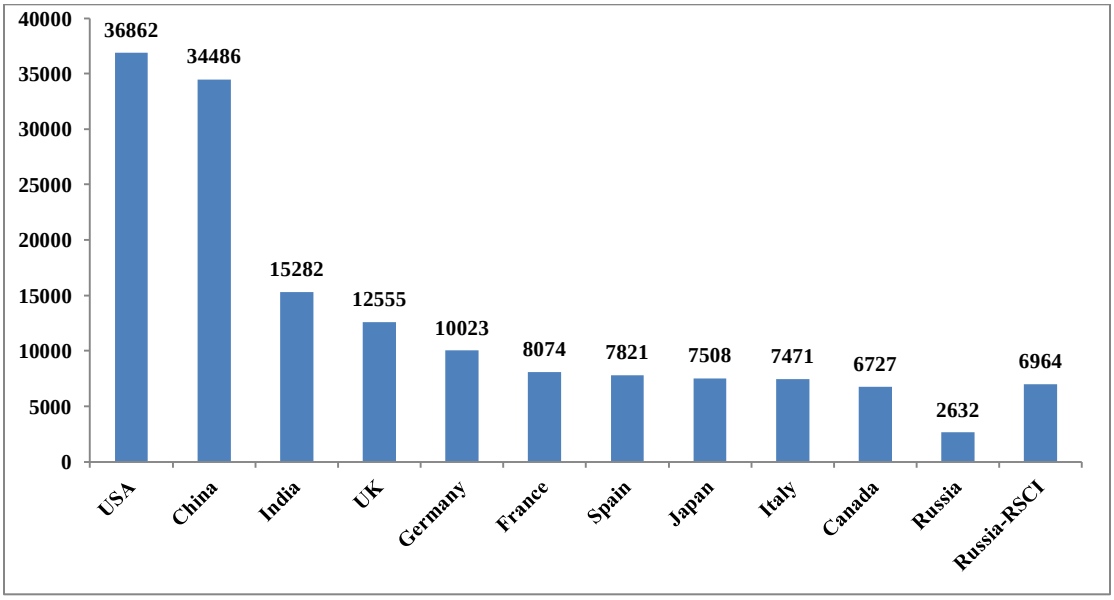
study abroad fell to Europe, but 76% of the 900 thousand of these students remained in the region. In 2011-2014 the number of Indian students in the United Kingdom fell by almost 50% after the new policy restricted the issuance of work visas to students at postgraduate level; however, their number increased by 70% in Australia and by 37% in the United States. Some countries, including Germany and China, are keen to use international students in their labor markets to fill local labor shortages. The amount that the US economy received in 2016 from foreign students is estimated at $ 39.4 billion.

Although 57 million children do not attend school, global enrollment rates are rising. Already in 2013, 92% (an increase from 81% in 1990) of children worldwide received primary education, and 74% received incomplete secondary education. Only a small part, 103 million young people around the world do not have basic literacy (World Development Indicators, 2016).

The number of university students increased from 69 million in 1990 to 88 million in 1997, and then increased sharply to 207 million from 2000 to 2014 and continues to grow. Foreign educational migration is growing faster, from 2010 to 2015 the number of students studying at universities has increased by 65%, and the number of foreign students in the world has increased by 80%.

It is possible that in the near future, an assistant of a person will become artificial intelligence equal or close to him. The current digital era is only a stage in the era of scientific and technological revolution, which began as early as the middle of the 20th century, perhaps it will be followed by another - the era of artificial intelligence.

However, the introduction of artificial intelligence is a problem in itself, a process that has known risks.

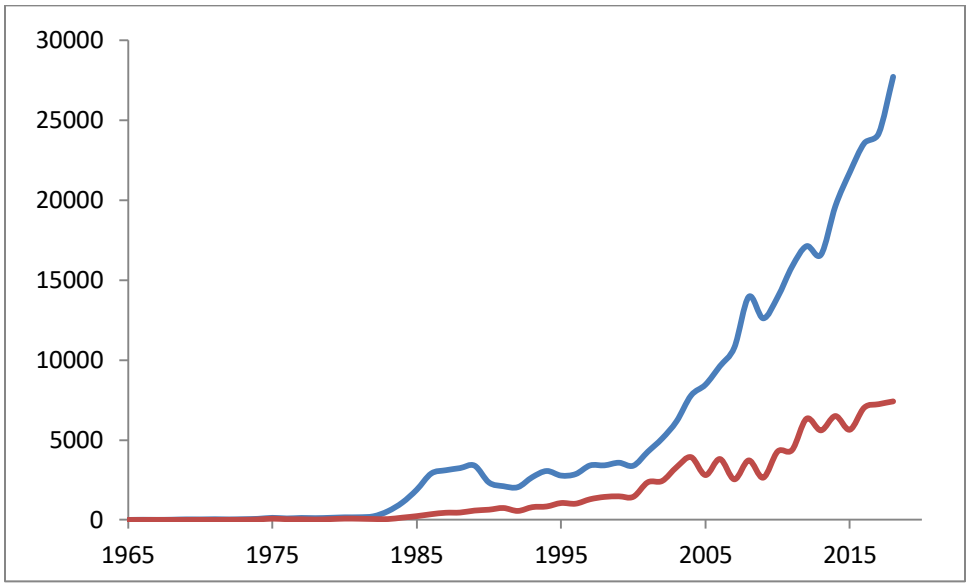


Source - Scopus and e-library databases (RSCI) to artificial intelligence since 2011 (the phrase was present in the title, keywords or resume of the article) - by countries of the world (showing the top 10 countries and Russia - 19th place). Data received by the authors on December 1, 2019.

FIGURE 2

THE NUMBER OF PUBLICATIONS IN THE SCOPUS AND E-LIBRARY DATABASES (RSCI) DIRECTLY DEVOTED TO ARTIFICIAL INTELLIGENCE SINCE 2011

As can be seen from Figure 2, the United States and China are far ahead of all other countries in the concentration of scientific efforts to develop artificial intelligence; India is more than 2 times behind each of them, followed by Europe, Canada and Japan. Russia is only in 19th place, although the number of publications in the last decade is growing rapidly. 92% of such publications in the Russian RSCI database have been written since 2011.



Source - Scopus database as a whole and publications in this field (upper line of the graph) related to mathematics (lower line). Data received by the authors on December 1, 2019.

FIGURE 3
THE NUMBER OF PUBLICATIONS ON ARTIFICIAL INTELLIGENCE"IN THE SCOPUS DATABASE

Figure 3 shows that the main leap in the scientific (i.e., mathematical) provision of artificial intelligence (research on which has been known since the 1950s) occurred in 1997-2003, in 2010-2012 there was another small leap (possibly related to the expansion of the capabilities of super computations and the development of technologies for processing *"big data"* and *"machine intelligence"*). At the same time, the practical use of AI (through other areas of science not related to mathematics) has sharply intensified since about 2005. That is, the fundamental achievements of mathematics are apparently being mastered, however, there are major fundamental breakthroughs that make it possible to talk about the possibility of achieving an AI equal to human, most likely, not yet.

Digitalization can lead to exacerbation of global imbalances in society, economy, politics, energy and access to other resources, including information. Possible processes of socio-political destabilization around the world, and not only in developing countries.

World Economic Forum (WEF) says potential job loss for 75 million people by 2022 already. Among the occupations of the *"risk group"*, there are *"accountants, notaries, cashiers,*

couriers, security guards, drivers, secretaries, packers, bank workers, surveyors, museum keepers, proofreaders, decoders and call center operators". Over the next 10 years, if digitalization is active in various sectors of the Russian economy, reductions to 6 million people may occur, and for 25 million, job requirements will radically change, which means, on one hand, the need for mass retraining, and on the other hand, the possibility of increasing social tension. And this is a very possible reality, even despite the fact that artificial intelligence today is just a complex program that does not have access to the key features of human thinking (The Future of Jobs, 2018).

Above all this complex of problems, there is an increase in risks for the production and life of people associated with cyber security and the availability of personal data. In addition, digital development may require a sharp increase in the energy supply of national and global economies, while developed countries are struggling to reduce it in accordance with the prevailing environmental paradigm.

DISCUSSION

Economic growth, as follows from the data presented, is in a high degree of interaction with the development of science. This connection is obviously stronger in the countries of Central and Northern Europe and significantly less strong in the countries of the Middle East - the leaders of the global oil and gas industry. The growth rate of the number of publications in most countries - leaders of advanced economies in recent years has slowed somewhat compared with the first decades of the XXI century. We attribute this to a decrease in the growth rate of scientists (*"people of science"* who are not necessarily formally researchers) due to the slowdown (or cessation, or even *"change of sign"*) of the demographic growth of developed countries, and this growth can no longer compensate for the increase in the number of talented migrants. Another explanation is the rapid development of applied science, publications on the results of which are not always reflected in databases such as Scopus. Another reason is the *"flow"* of talents into high-tech areas that are not directly related to research. This question is interesting and requires a separate study.

Digitalization as a process is accompanied and fueled by research primarily in the field of computational mathematics and computer science. The relative increase in the number of articles in these areas indicates the active development of new technologies, however, very rapid, breakthrough growth in such a direction as the mathematical foundations of artificial intelligence has not been recorded in recent years. This casts doubt on the imminent onset of the era of *"artificial intelligence"* and digitalization may run into problems that they require a scientific solution.

These problems include the problem of the optional positive relationship between the accumulation of information and economic growth, which can exacerbate the exit of some people from economically useful activity in the game (virtual) sphere; the problem of lack of qualified personnel; the problem of the margin and limitation of human resources; problems of artificial intelligence; problems of possible aggravation of social, economic and other imbalances in the development of society, problems of preserving personal space in the digital world, problems of cybersecurity and problems of a possible lack of energy for the transition to a fully digital world.

All these problems are interconnected and have the maximum expression in the personnel plane.

The personnel problem of the development of the digital economy, therefore, is based on the need to support the number of researchers and the intensity of research aimed at solving the problems of economic and social development through the creation and implementation of digital technologies. At the same time, the solution to this problem in the coming decades, perhaps, *"rests"* in the chronic shortage of specialists to solve the most ambitious tasks.

CONCLUSION

Thus, the personnel problem for ensuring the national and global digital economy is very serious, and it can be completely attributed to the global problems of mankind in the era of the cybernetic revolution.

In the process of digitalization as global, the following key interrelated problems can be distinguished, which have vivid personnel projections: 1) the problem of information quality; 2) the problem of the need for personnel is more and more qualified to create digital technologies; 3) the problem of ever higher requirements for digital literacy at various levels is to use more and more complex digital technologies; 4) the problem of limited human resources, including a high level, due to a slowdown in the population of the planet; 5) the problem of artificial intelligence, which can be a threat in itself; 6) the problem of personality in a fully transparent digital world; 7) the problem of information security; 8) the problem of the need to increase the energy supply of digital development in the context of understanding the environmental limits of this growth.

Russia has problems with qualified personnel, and the *"supersaturation"* of one of the industries with the best specialists can have the effect of lacking them in another, also important industry. At the same time, in the field of public administration, in high-tech industries, digitalization is vital for national interests and only its insufficient planning and implementation will create risks.

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