KNOWLEDGE ECONOMY FORMATION IN RUSSIAN REGIONS IN 2000TH

Stepan ZEMTSOV,
Senior Researcher, the Laboratory for studies of corporate strategy and firms' behaviour,
Institute of applied economic research, RANEPA, spzemtsov@gmail.com
Vladimir KOMAROV,
Head of the Laboratory of Knowledge Economy, Institute of applied economic research,
RANEPA, komarov@iep.ru
Vyacheslav BABURIN,
Professor, head of the department of economic and social geography of Russia,
Lomonosov Moscow State University, vbaburin@yandex.ru

ABSTRACT. *The paper discusses approaches to the interpretation of the knowledge economy and its quantitative measurement. Based on the adapted methodology of the World Bank, the dynamics of the knowledge economy conditions in the Russian regions in 1998-2012 years was estimated. The Russian knowledge index (RKI) can be used by regional administrations to adjust their strategies and monitor the conditions for the new economy formation, and the business community may use the index to assess the potential benefits from the placement of high-tech production and sales of innovative products in the leading regions. An original method for estimating the impact of the knowledge economy has offered in the article. It is based on the integration of regional ranks on existing Russian ratings for ecology, human capital, innovation and ICT development. The new Russian knowledge economy index helps to understand the advantages and disadvantages of the regional economies.*

KEYWORDS: knowledge economy, Russian regions, index of knowledge economy, innovation, human development, ICT, sustainable development

JEL: O31. O47, R11, R58

INTRODUCTION TO KNOWLEDGE ECONOMY CONCEPT

Knowledge economy is a stage of socio-economic development, when knowledge became a major factor of growth. It can be associated with creation and dissemination of knowledge. The main agents of the knowledge economy are educational, scientific organizations and innovative business.

For the first time the term "knowledge economy" was proposed by F. Machlup (see. [32]), referring it to one of the sectors of the economy. By this time in the economic literature there are a significant number of approaches to the definition of the knowledge economy, but most of them are, in our opinion, abstractly theoretical [10, 14, 19, 25, 35]. In our view, the emergence of the knowledge economy can better demonstrated and explained by the following two examples. The first example illustrates the rate of accumulation of new knowledge as a structured information in the form of scientific papers, patents, etc. The paper [13, p. 26-27] observed the explosive growth and the rate of accumulation of scientific and technological knowledge in recent years. As mentioned at the conference FutureMed [28], held in Silicon Valley in 2013, the number of publications in many areas of science increases exponentially today. Only from 2010 to 2012, humanity has produced more information than in the entire history of its existence until 2008.

This situation is radically changing the approach to economic efficiency. If the traditional economics is the science of the efficient use of limited resources to meet the increasing demand, the economic theory of knowledge or the theory of innovation (see for more details [11].) is the science of using unlimited resource – knowledge that is necessary to identify and implement in practice. Those countries, regions, companies, that manage to detect the valuable knowledge from the exponentially growing array of scientific and technical information earlier than others, to create on its basis a unique product, to protect it by patent documents and to bring them to market, win in today's economy. This strategy allows innovators to hold a temporary monopoly position in the market.

The second example illustrates the role of human capital as a factor of economic and social development in the modern economy. J. Dickson and his colleagues evaluated the role of different types of capital [7, p. 39-40]: the physical, natural and human. The authors showed that the share of human resources in the overall wealth of most countries (with the exception of the Middle East and West Africa) exceeds 65%. The World Bank has made similar estimates based on an analysis of more than 100 countries worldwide. The study found that in most developed countries, the share of natural capital in national wealth, on average less than 10%, while the share of human capital is more than 70% [10, p. 31].

It is highly important to identify the regions in Russia that are leaders for knowledge economy formation as new areas of growth in conditions of oil prices falling and sanctions. Beginning in the 2000s., the knowledge economy is declared as one of the imperatives of targeted socio-economic development of Russia according to the strategies of long-term socio-economic and innovative development of Russia until 2020. It was declared that "new economy -

the economy of knowledge and high technology, which is becoming one of the leading sectors, will be comparable to oil and gas sector in GDP". In recent years, there is an active development of the new economy in the Russian regions, there are projects of innovative regional centers for the development of science, education and other fields of human capital (in Moscow region (Skolkovo), Tomsk region (INO Tomsk) and Tatarstan (InnoKam).

In world practice there are a significant number of approaches that directly or indirectly speak of the dynamics of the knowledge economy. Existing approaches can be divided into methods that assess key aspects of the knowledge economy (human capital, sustainable development and quality of life, development of information and communication technology (ICT)) and directly related to the study of the knowledge economy as a whole (e.g. World Bank procedure).

The index of quality of life [36], the human development index [33] and the index of social progress [34] are one of the examples of the first approach. The best known and used is the human development index (Human Development Index, HDI), calculated by the United Nations and including indicators of longevity, living standards, literacy and education. [33] The higher is the level of human capital and well-being, the closer is society to a knowledge economy.

According to the concept of sustainable development, the knowledge economy should be based primarily on inexhaustible resource management, so it is worth mentioning the index of sustainable economic welfare, and "green" national product [23] and "green" GDP. [21] In Russia ecological-economic indexes of regions has been developed [3]. A growing number of authors recognizes the Genuine Progress Indicator [24] as the best replacement of GDP [25, 31].

The most well-known and used in Russia among all the systems of innovative development assessment for the countries and regions is a system of indicators of the European Innovation scoreboard [6, 27], which is the most comprehensive, constantly updated database on trends in innovation policy in the European union. 29 key indicators of innovation activities are grouped into three units: providing innovation (external factors and conditions), the innovative activity of organizations and the results of innovation. A similar concept is used in The Portfolio innovation index from the USA [6].

Significant work on the assessment of innovative regional development has done in Russia [4 - 6, 12]. For example, in 2012 the Ministry of Economic Development of Russia and the Association of Innovative Regions of Russia (AIRR) has developed a methodology of the Index of innovative development of Russian regions, based on the main approaches of the European innovation scoreboard [5, 6].

Among the methods of the ICT development evaluation, Networked Readiness Index, developed by the World Economic Forum, can be noted [20]. A similar index for Russian regions has been developed by Higher school of economics [16]. V. Baburin and S. Zemtsov [2, 18] have proposed the original method for regional innovativeness assessment. The articles show that the differences between the regions in the diffusion rate are so high that it is possible to identify "five Russias."

The Knowledge Economy Index (KEI) and the Knowledge Index (KI) of the World Bank [22], related to innovation, education and ICT, measures an ability of countries to apply, create and disseminate knowledge. KEI is an extension of the KI and comprise indicators of the "economic incentive and institutional regime."

ADAPTING METHODS OF THE WORLD BANK

In this study, we used the method of the World Bank (the program "Knowledge for Development") for the Knowledge Index (KI) calculation (Table 1), adapted to the existing data of Rosstat ("Regions of Russia", 2000 - 2013).

Table 1. The structure of the Knowledge Index

Group of Variables	Variables
Common	GDP growth rate (%) UN Human Development Index
Innovation	The total amount of royalties and license fees, USD., per 1 mln. inhabitants The number of articles in scientific and technical journals per 1 mln. inhabitants) The number of patents issued by the patent agency of the United States (USPTO) per 1 million. inhabitants
Education	The literacy rate of the adult population (over 15 years),% Gross coverage of secondary education,% Gross enrolment in higher education,%
Information and communication technologies	Number of telephones per 1000 inhabitants The number of computers per 1000 inhabitants Number of Internet users per 1000 population (internet penetration)

Source: [22]

The purpose of the index construction is to identify Russian regions, which has developed the optimal conditions for the knowledge economy formation. To understand the main features it is important to study the dynamics of the main indicators from 1998 to 2012, which was the period of economic growth.

When selecting indicators in accordance with the purpose only those indicators that are measured by Rosstat[1] for the entire period could be used. Therefore, the calculation of the Russian knowledge index (RKI) has been simplified in comparison with the international one and consists of eight variables characterizing four similar blocks:

$$RKI = \frac{GRP\_gr + GRP\_p\_c + Stud + Educ + \mathrm{Re}search + PCT + Mob + Web\_comp}{8} \quad (1),$$

where

(1) indicators of economic and social development:

- *GRP_gr* - GRP growth rate;
- *GRP_p_c* - GRP per capita;

(2) indicators of education and human capital:

- *Stud* - the number of students per 1000 inhabitants
- *Educ* - the average number of years of education of employees;

(3) indicators of Science and Innovation:

- *Research* - the number of researchers per 10,000 inhabitants
- *PCT* - the number of PCT applications 1 million. Inhabitants;

(4) indicators of information infrastructure:

- *Mob* - number of cell phones per 100 people;
- *Web_comp* - the proportion of workers with the Internet access computers.

It was assumed that a high life quality, sustainable rates of GRP growth and development of the knowledge economy are parallel and interrelated processes. Growth of GRP per capita means, ceteris paribus, the growth of productivity per unit of labour, which in turn may be provided by the introduction of technological and organizational innovations. In addition, the growth of labour productivity leads to a change in the structure of the economy - the growth of the share human capital sectors such as science and education, health, sports, social infrastructure, and others. This is partly causes the development of lifelong and distance education. The number of students per 1,000 inhabitants, and the average number of years of education indirectly measure these processes. In addition, a high proportion of scientists and a high intensity of their work, a significant patent activity are an important indicators for knowledge creation. Finally, the efficient operation of the knowledge economy is provided by

[1] Russian federal statistical service – www.gks.ru

the ICT, making it possible not only to provide access to knowledge, but also drastically reduce the costs of organizing collaboration and creativity (crowdsourcing, etc.), the cost of the government and society interaction, including in terms of access to public services.

Indicators of education and science are relatively stable for the Russian regions, so the highest influence on the dynamics of the RKI has the characteristics of the GRP and the ICT, which grew during the 2000s.

Analysis of the cross-correlations matrix showed no extremely high or low rank correlations between indicators.

For each selected indicator regional rank Ri was calculated in year t for the following modified equation [22]:

$$R_{i,t} = \frac{R_{low,T}}{R_T} \times 10 \quad (2),$$

where Rlow is the number of regions with a lower rank than the region i in the period T (1998-2012 gg.) of the subject indicator and RT is the total number of regions in the period T (83 subjects * 15 = 1245). Then the average rank index have been determined:

$$AR_{i,t} = \frac{\sum_{i=1}^{k} R_{i,t}}{k} \times 10 \quad (3),$$

where k - is the number of selected indicators.

The calculation was performed for each year. This method allows us to trace the conditions formation for the knowledge economy development in the Russian regions in comparison with Moscow, which had the maximum score over a given period and was considered as a territory, where the knowledge economy is already formed.

CONDITIONS FOR KNOWLEDGE ECONOMY DEVELOPMENT IN RUSSIAN REGIONS DURING 1998-2012

The RKI does not measure the knowledge economy development, but it only assess the conditions for its formation. Moscow (Table. 2, Fig. 1), St. Petersburg, Tomsk, Novosibirsk, Samara and Moscow Region can be distinguished as the leaders for the entire period of observation (the arithmetic mean of the index for all years).

Table 2. The average Russian knowledge index in the 1998-2012 and typology of regions

Regions	**Average RKI**	**Group**
Moscow	8,4	Knowledge-core (> 6.5) - the regions with the best conditions for the development of the knowledge economy
Saint Petersburg	8,1	
Tomsk region	7,3	
Novosibirsk region	6,8	
Samara Region	6,6	
Moscow region	6,5	
Nizhny Novgorod Region	6,2	Knowledge-subcore (5.5 - 6.5) - regions with good conditions for the development of the knowledge economy; in the 2000s
Sverdlovsk region, Tatarstan	6,0	
Chelyabinsk region, Primorsky Krai, Khabarovsk Krai	5,9	
Rostov region	5,8	
Yaroslavl region	5,7	
Kaluga region, Saratov region, Tyumen region, Leningrad region	5,6	
Irkutsk region, Krasnoyarsk Krai	5,5	
Kaliningrad region, Magadan region	5,4	knowledge semiperiphery -I (.,0 – 5.5) – regions, where some conditions was actively formed
Voronezh Region, the Omsk Region, the Murmansk Region, Perm Krai	5,3	
Orel Region, the Republic of Sakha (Yakutia), Kamchatka region	5,2	
Komi Republic, Ryazan region, Republic of Bashkortostan	5,1	
Khanty-Mansi Autonomous Area - Yugra, Arkhangelsk region, Krasnodar region	4,8	knowledge semiperiphery -II (4.0 - 5,0) – regions, where certain conditions were formed for the knowledge economy development in the 2000s, but there is a high proportion of the lower technological industries (agriculture, natural resource extraction, etc.)
Tver region, Ulyanovsk region, Penza region, Belgorod region, Sakhalin region, Volgograd region	4,7	
Tula region, Kursk region, Vladimir region	4,6	
The Republic of Karelia, Udmurtia	4,5	
Novgorod region, the Republic of North Ossetia - Alania, Astrakhan region, the Republic of Mordovia	4,4	
Stavropol, Tambov region	4,3	
Smolensk region, Yamalo-Nenets Autonomous District, Chuvash Republic	4,1	
Vologda region, the Republic of Buryatia	4,0	
Bryansk region, the Republic of Mari El	3,9	Knowledge-periphery (3.5 - 4.0) – regions, where certain conditions were formed for the knowledge economy development in the 2000s, but the lower technological industries are dominated (agriculture, natural resources, mining, light industry, etc.)
Kemerovo region, Ivanovo region, Nenets Autonomous Okrug	3,8	
Amur Oblast, Orenburg region, Chukotka Autonomous District, the Republic of Adygea, Kabardino-Balkar Republic	3,7	
Kirov region, Altai Krai	3,6	
Karachay-Cherkess Republic, Lipetsk region,	3,5	
Kurgan region	3,4	Regions of the "ignorance" economy (<3.5), which loosely formed conditions for the knowledge economy development in the 2000s
Kostroma Region, the Republic of Khakassia	3,1	
The Republic of Dagestan, Pskov region	3,0	
Altai Republic	2,9	
Republic Of Kalmykia	2,7	
Transbaikal region	2,6	
Jewish Autonomous Region	2,1	
Republic of Tyva	1,8	

In general, regions with large agglomerations are among the leaders, which is consistent with the ideas of J.Jacobs [29] and P. Krugman [30] about the presence of agglomeration effects (concentration and diversity) and location of "second nature" factors (human capital and institutions) in large cities. Thus, regions with more diversified economies are among the leaders and agricultural and monospecialized regions dominate among the outsiders.

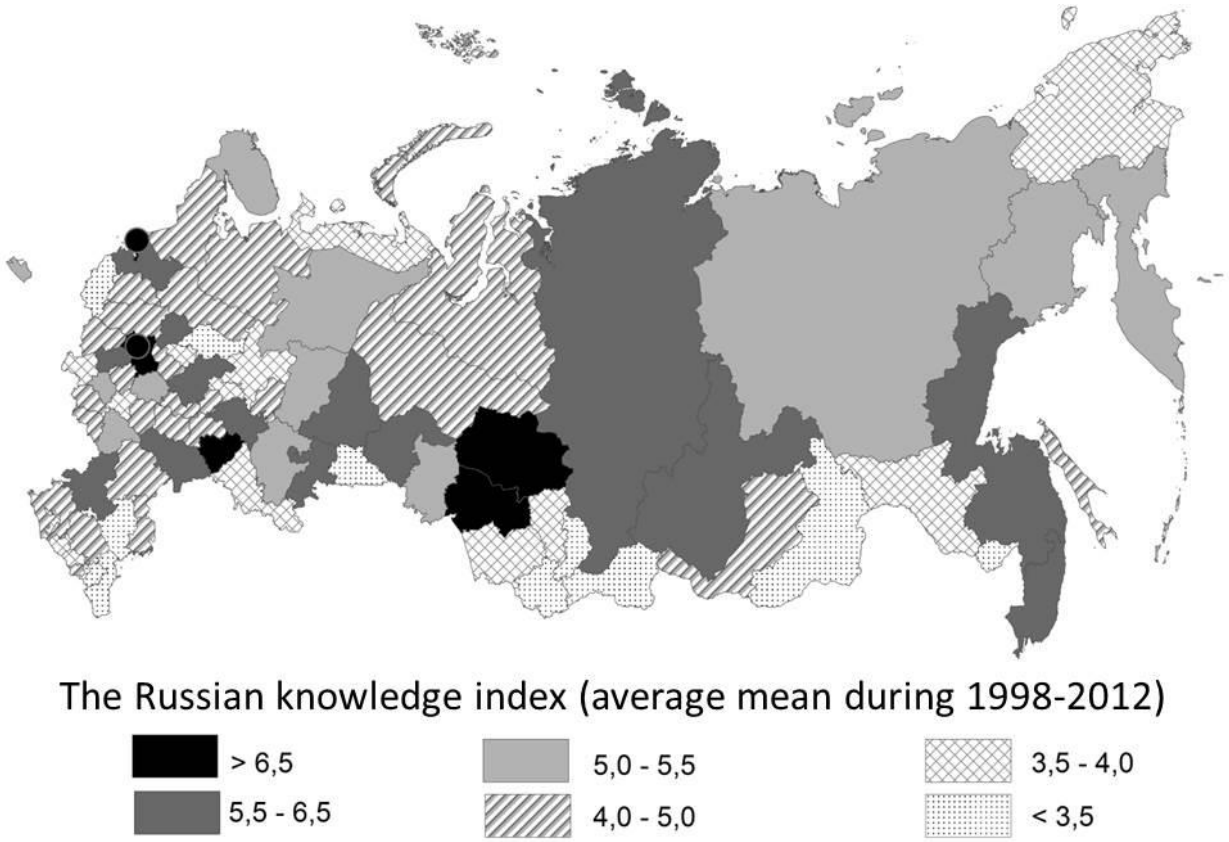

Figure 1. Schematic map of the Russian knowledge index

The RKI dynamics showed that the number of regions, where conditions for the knowledge economy were formed, increased gradually. In 1998, the leaders are Moscow (6.5), St. Petersburg (5.9), Tomsk (4.5), Moscow (4.5), Samara region (3.6), regions with a favourable seaside position – Khabarovsk (3.48) and Primorsky Krai (3.4) and the Novosibirsk region (3.3), but Moscow was characterized by sufficient conditions under which the development of the knowledge economy begins as a basis for economic development (6.5 is the minimum value, required for our method). We note that the revealed centres were leading scientific areas in the Soviet period [1].

In 2005, a much larger number of regions covered by the ICT, besides economic indicators improved, which led to an increase in the number of regions where there are favourable conditions for the knowledge economy development.

The high RKI in 2012 was still observed in Moscow (8.7), but it was higher in St. Petersburg (8.8 points); Tomsk (8.3), Samara (8.1), Tatarstan (8) and Novosibirsk (7.95) region were still among the leaders. By the end of the period, favourable conditions (index above 6.5) were in 37 regions of Russia (45%) (Table 3).

Table 3. The RKI and its components in 2012

№	Regions	GRP_gr	GRP_p_c	Stud	Educ	Research	PCT	Mob	Web_comp	RKI 2012
1	Saint Petersburg	4,2	9,2	9,7	9,8	9,7	10	9,9	7,9	8,8
2	Moscow	3,2	9,3	9,7	9,9	9,8	10	9,9	8	8,7
3	Tomsk region	3,6	8,5	9,6	8,9	9,3	9,7	9,1	7,9	8,3
4	Samara Region	4,9	8,5	7,2	9,6	8,5	9,1	9,4	7,7	8,1
5	Republic Of Tatarstan	5,4	8,9	8,5	9	7,4	8,7	8,7	7,4	8
6	Novosibirsk region	2,3	7,9	8,5	9	9,2	9,7	9,1	7,9	7,9
7	Sverdlovsk region	6,7	9	6,4	7	8,2	9,1	9,3	7,5	7,9
8	Magadan region	3,6	9,1	9,2	7,1	7,5	8,9	9,7	7,8	7,9
9	Kaluga region	8,4	7,1	3,3	8,9	9,4	9,2	9,2	7,5	7,9
10	Voronezh region	8,2	6	8,6	7,8	8,1	8,8	8,5	7	7,9
11	Nizhny Novgorod Region	3,8	7,6	6,7	8,7	9,5	9,6	9	7,3	7,8
12	Irkutsk region	8,3	9	7,2	6,2	6,1	8,2	9,1	7,4	7,7
13	Moscow region	4,7	8,3	1,5	9,7	9,5	9,8	9,9	7,5	7,6
14	Yaroslavl region	4,5	8,5	5,3	8,1	8,3	9,3	9,1	7,5	7,6
15	Kaliningrad region	4,6	6,7	6,2	9,5	5,8	9,5	9,6	7,8	7,5

DYNAMICS OF KNOWLEDGE ECONOMY DEVELOPMENT IN RUSSIAN REGIONS DURING 1998-2012

All regions improved the characteristics of the knowledge economy over the period 1998-2012, in particular poorly developed republics of the North Caucasus, the Far East and Siberia.

Voronezh region, Tatarstan, Tyumen Oblast and the Republic of Bashkortostan demonstrated the highest growth rates of the RKI (2012/1998) among the regions with the medium and high index (> 5 on average for the period). It was an increase of more than 3 points of the index. In these regions, more innovative infrastructure was created, and the investment

climate has improved. The lowest rates were observed in the cities of federal importance, Moscow and Tomsk regions (increase of less than 2 points). Overall, the gap between Moscow and other regions decreased (Fig. 2).

All regions have experienced the negative effects of the global financial crisis in 2008, Moscow in 2010 gave way to St. Petersburg to be the leading region and the Moscow region in 2011 left the top ten leading regions.

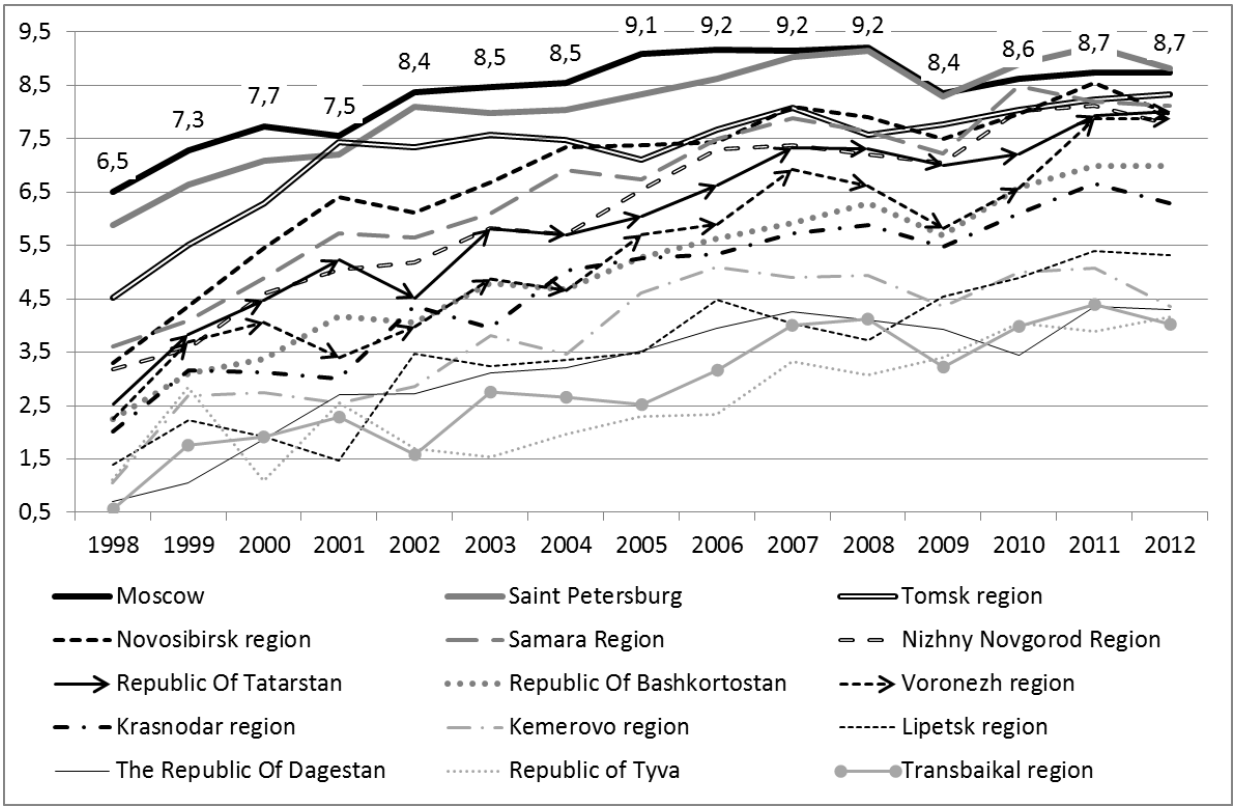

Figure 2. The Russian knowledge index dynamics for the different types of regions

The developed methodology allows using radar chart to track the indicator framework of the RKI in each region both in years and in comparison with other regions (for example, Fig. 3). This in turn makes it possible to identify problem areas, as well as the competitive advantages of the region.

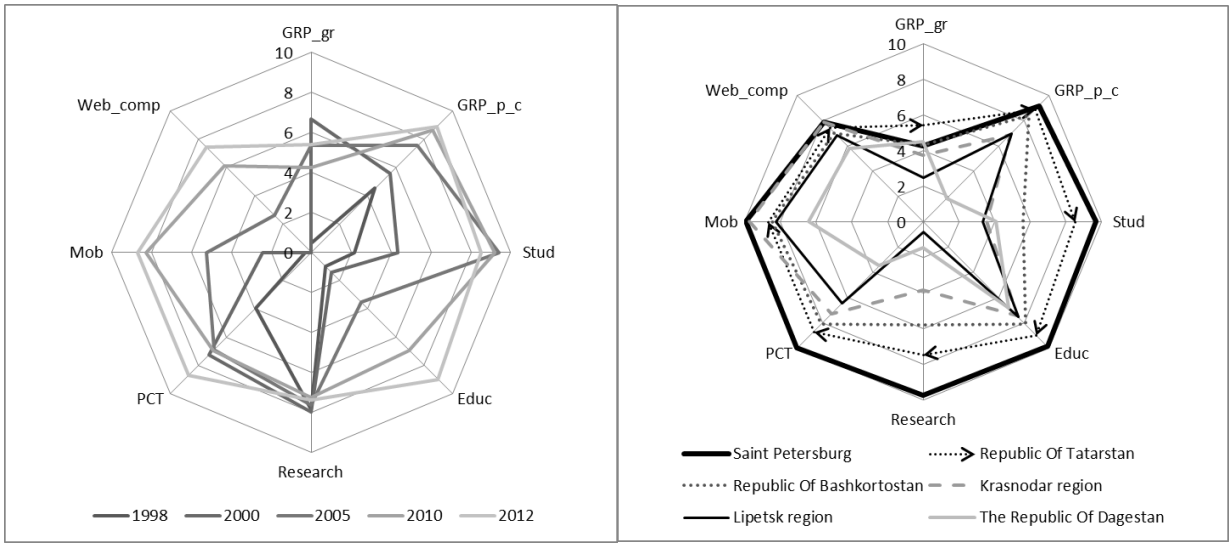

Figure 3. Dynamics of the RKI structural elements for the republic of Tatarstan (left) and comparison of the structural elements for regions of different types (Fig. 1) (right) in 2012

Overall, the results of the RKI calculation coincided with the results of innovative development ratings [5, 6].

PROPOSALS FOR IMPROVING THE METHODOLOGY: DEVELOPMENT OF THE RUSSIAN KNOWLEDGE ECONOMY INDEX

The technique was developed in 2004 and can be considered dated. It was originally designed to evaluate the potential ability of countries to generate and disseminate new knowledge. In other words, the methodology assesses the necessary, but not sufficient conditions for the development of the knowledge economy and takes into account mainly the preconditions of its development - the education system, the system of research and development of information and communication infrastructure.

In our view, a more promising technique will be to assess not environment for the emergence of the knowledge economy, but its outcome. For example, mobile telephony or the Internet is not sufficient conditions for the knowledge economy emergence. The Internet cannot be used as an access to knowledge.

Firstly, the result of the knowledge economy formation is to ensure a high quality of life in a particular area. In addition, it is possible to identify indirect effects: the more developed is an access to knowledge and information, the more society makes the demand for high-quality public goods such as environmental protection, access to clean water and air, etc. In our view, a perspective direction of the knowledge economy development is a transition to a sustainable

development model that takes into account the needs of future generations and the quality of life parameters.

Secondly, the knowledge economy is not possible without investment in human capital. There is also found an indirect link: people, having access to information, do tend to be more rational. At the state level, the development of the knowledge economy also contributes to finding the best solution, maximizing the total social utility. In European countries today are being actively implemented standards of "evidence-based public policy" with the scientific substantiation for regulation choices, or major national projects. For example, the development of environmentally friendly technologies of high-speed public transport along with the availability of evidence-based data on its comparative advantages has created an efficient public transport system in most European capitals, which reduced total transportation and environmental costs.

Finally, the effective knowledge economy development means a drastic reduction in the cost of interaction (transaction costs), primarily between state and society, between society and producers. This is achieved through the implementation of technologies and instruments of direct democracy, the joint work of government and society, social self-organization technologies to address socially important problems (crowd and wiki technologies), the development of Internet services. People finds items at the lowest price online, users of electronic government services reduces the wasted time in queues. Assuming that the saved time was given to the work, the benefits for the economy are significant.

To calculate the Russian Knowledge Economy Index (RKEI) (table 4) the rank technique (equations 2, 3) was used.

Table 4. The structure of the Russian Knowledge Economy Index (RKEI)

Group of Variables	Variables
Common variables	I. Rank of the region in Human Development Index in 2013. [15]
Quality of life and sustainable development of the region	II. Rank of the region in quality of life RIA Novosti index in 2013 III. Rank of the region in ecological-economic rating in 2012 [3]
Science and technology, human capital	IV. Rank of the region in Rating of innovative regions of Association of innovative Russian regions (AIRR) in 2013 [5]
Remote services (e-services and e-government)	V. Rank of the region in the ranking of innovativeness for Russian regions in 2012 [2] VI. Rank of the region in the index of open government in 2012 (http://eregion.ru/opengov)

There is a problem of the intersection of indicators from different ratings, leading to some multicollinearity. In this paper, the problem is solved by introducing ranks, but in the future it is

necessary to analyse the whole set of indicators for each of the indices (see [8]) to select the most relevant and independent figures.

The calculations show (Fig. 4, Table. 5) that the knowledge economy in its most comprehensive sense is highly concentrated in seven regions, strongly differing in the individual components of the index.

Figure 4. Schematic map of the Russian knowledge economy index in 2012-2013

Table 4. The ranks of the leading regions in the RKEI

	I	II	III	IV	V	VI	RKEI
Regions with the highest value of the RKEI (≥7,5)							
Moscow	1	1	30	2	1	2	9,4
Saint Petersburg	2	2	41	1	2	58	8,0
Krasnodar region	19	5	6	44	8	27	7,9
Novosibirsk region	22	21	45	14	6	10	7,8
Kaluga region	34	17	14	11	39	6	7,7
Republic Of Tatarstan	6	4	53	3	23	33	7,7
Moscow region	35	3	34	7	13	39	7,5
Regions with a medium-high value of the RKEI (6.5-7.5)							
Voronezh region	43	7	29	17	29	14	7,3
Tomsk region	9	30	67	6	9	18	7,3
Nizhny Novgorod Region	33	10	21	4	7	66	7,3
Ulyanovsk region	48	42	26	16	11	1	7,2
Sverdlovsk region	12	11	64	12	15	32	7,2

Samara Region	25	14	62	8	10	30	7,1
Perm Region	26	28	55	9	21	15	7,0
Yaroslavl region	23	12	19	5	30	70	6,9
Kaliningrad region	32	13	23	40	19	40	6,8
Rostov region	40	16	44	29	20	23	6,7

Note that in the Krasnodar region, whose figures are close to St. Petersburg, and in the Kaluga region, whose figures were higher than those of the Republic of Tatarstan and the Moscow region, there is no agglomeration with a population over 1 million people.

CONCLUSION

The method of the World Bank was adapted in the article as the Russian knowledge index. It helps to identify potential leaders for the knowledge economy formation, which include the country's largest metropolitan areas, Tomsk, Novosibirsk, Samara regions and the Republic of Tatarstan. All Russian regions improved the characteristics of the knowledge economy over the period 1998-2012, but have experienced the negative effects of the global financial crisis in 2008. The developed methodology allows using radar chart to track the indicator framework of the RKI in each region both in years and in comparison with other regions. This in turn makes it possible to identify problem areas, as well as the competitive advantages of the region

After analysing the advantages and disadvantages of the used methodology, the authors proposed a system of indicators for the knowledge economy performance and developed the Russian knowledge economy index, consisting of the respective all-Russian indices on several individual components: human capital, quality of life, including environmental situation, innovative development, the ICT development and the openness of Governments. The calculations show that the knowledge economy in its most comprehensive sense is highly concentrated in seven regions, strongly differing in the individual components of the index: Moscow, Saint Petersburg, Krasnodar region, Novosibirsk region, Kaluga region, Republic Of Tatarstan and Moscow region.

The next phase of work will be an assessment of the knowledge economy development in large cities of Russia, as the knowledge economy is concentrated mainly in urban areas.

LIST OF REFERENCES

1. Baburin V., S. Zemtsov The geography of innovation processes in Russia // Vestnik. Mosk. Univ. Ser. 5. Geography. 2013. № 5. C. 25-32.

2. Baburin V., S. Zemtsov Regions innovators and innovative peripherals Russia. Investigation of the diffusion of innovation as an example of ICT products // Regional studies. 2014. № 3. C. 27-37

3. Bobylev S., Minakov V., Solovyov S., Tretyakov V. Ecological-economic index of regions of the Russian Federation // WWF Russia, RIA Novosti reported. 2012

4. Bortnik I., Barinova V., Zemtsov S., Infimovskaya S., Sorokina A. Competitiveness factors analysis of high-tech companies // Innovations, № 3 (197), p. 25-31

5. Bortnik I., Zinoviev V. Kotsjubinsky V., Sorokina A. Indicators of innovative development of the Russian regions for the purposes of monitoring and control // Innovations. №11. 2013. pp 2-13.

6. Bortnik I., Senchenya G. Mikheeva N., Zdunov A., Kadochnikov P., Sorokina A. The system for assessing and monitoring of the development of Russian innovative regions // Innovations. № 9. 2012. S. 48-61.

7. Dixon J., Bekkes J., K. Hamilton, A. Kant, E. Lutz, S. Pedzhiola, Hee J. A new look at the wealth of nations. Indicators of sustainable development / Translated from English. - M .: Center for the preparation and implementation of international technical assistance projects, 2000, p. 40.

8. Zemtsov S., Baburin V., Barinova V. How to measure the immeasurable? Assessment of innovatiion potential of Russian regions // Creative Economy. №1 (97). 2015. pp 35 - 53.

9. Indicators for sustainable development of Russia (ecological and economic aspects). / Ed. S. Bobylev, P. Makeyenko - M .: CPPI, 2001.

10. Komarov V. The main provisions of the theory of innovation. - M .: Publishing House "Delo" RANHiGS, 2012. 190 pp.

11. Kolesov V. Knowledge Economy. The collective monograph. - Moscow, 2008

12. Kurakova N., Zinoviev V., Tsvetkov L., Erëmchenko O., Komarov A., Komarov V., Sorokina A., Pavlov P., Kotsjubinsky V. National Science and Technology Policy of "rapid response": Recommendations for Russia (analytical report). - M .: Case. 2014. 160 p.

13. Kurakova N., Zinoviev V., Komarov V., Pavlov P. Long-term projections as a tool for the formation of science and technology policy // Economic Policy. №4. 2014.

14. Minaeva O. Measuring the Knowledge Economy: Problems and Prospects - - Nizhniy Novgorod: NFGU- HSE 2009

15. The United Nations Development Programme: Human Development in the regions of Russia in 2013. URL: http://gtmarket.ru/news/2013/06/17/6014

16. Rating of regions of the Russian Federation in terms of the development of the information society and e-government / Institute for Statistical Studies and Economics of Knowledge of the HSE. URL: http://issek.hse.ru/rating2

17. Shtertser T. A role of human capital in the economic development of regions of the Russian Federation // Bulletin of the Novosibirsk State University. Series: Socio-economic sciences. 2006. №6 (2). S. 37-51.

18. Baburin, V., Zemtsov, S. (2014). Diffussion of ICT-products and "five Russias" // Uddevalla Symposium 2014: Geography of Growth, The Frequency, Nature and Consequences of Entrepreneurship and Innovation in Regions of Varying Density. University West Trollhättan, Sweden

19. Bell, D. (1974). The Coming of Post-Industrial Society: A Venture in Social Forecasting. London: Heinemann.

20. Bilbao-Osorio, B., Dutta, S., Lanvin, B. (2014). The Global Information Technology Report 2014: Addressing New Digital Divide Key for Balanced Growth. URL: http://www3.weforum.org/docs/WEF_GlobalInformationTechnology_Report_2014.pdf

21. Boyd, J. (2007). Nonmarket benefits of nature: What should be counted in green GDP? // Ecological economics, 61(4), 716-723.

22. Chen, D., Dahlman, C. (2005). The knowledge economy, the KAM methodology and World Bank operations. World Bank Institute Working Paper, (37256).

23. Cobb, C., Cobb, J. (1994). The Green National Product: a proposed index of sustainable economic welfare.

24. Costanza R., Kubiszewski I., Giovannini E, Lovins H., McGlade J., Pickett K.E., Vala Ragnarsdóttir K., Roberts D., De Vogli R., Wilkinson R. (2014). Time to Leave GDP Behind. // Nature, Volume and Issue: 505 (7483). P. 283-285.

25. Drucker, P. (1969). The Age of Discontinuity; Guidelines to Our changing Society. New York: Harper and Row.

26. Dutta, S., Lanvin, B. (Eds.). (2013). The global innovation index 2013: The local dynamics of innovation.

27. European Commission. Innovation Union Scoreboard 2011, p. 10. doi: 10.2769/88936.

28. FutureMed 2013 Conference. URL: http://exponential.singularityu.org/medicine/

29. Jacobs, J. (1969). The Economy of Cities. New York: Random House.

30. Krugman, P. (1995). Development, geography, and economic theory. Cambridge, Massachusetts: MIT Press

31. Kubiszewski, I., Costanza, R., Franco, C., Lawn, P., Talberth, J., Jackson, T., Aylmer, C. (2013). Beyond GDP: Measuring and achieving global genuine progress. Ecological Economics, 93, 57–68.

32. Machlup, F. (1962). The Production and Distribution of Knowledge in the United States. Princeton: Princeton University Press

33. Malik, K. (2013). Human development report 2013. The rise of the south: Human progress in a diverse world. The Rise of the South: Human Progress in a Diverse World (March 15, 2013). UNDP-HDRO Human Development Reports.

34. Porter, M., Stern, S. (2013). Social progress index 2013. Washington, DC: Social Progress Imperativ.

35. Powell, W., Snellman, K. (2004). The knowledge economy. Annual review of sociology, 199-220.

36. Rackwitz, R. (2002). Optimization and risk acceptability based on the life quality index // Structural Safety, 24(2), 297-331.

37. Zubarevich, N. (2013). Four Russias: Human Potential and Social Differentiation of Russian Regions and Cities. In Russia 2025: Scenarios for the Russian Future, pp.67–85. URL: http://www.palgraveconnect.com/pc/doifinder/10.1057/9781137336910.0009

38. www.worldbank.org/kam