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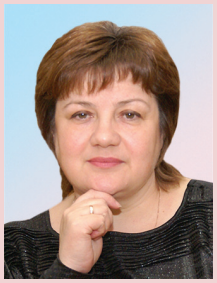
"Knowledge Workers" and Modernization in the Region*



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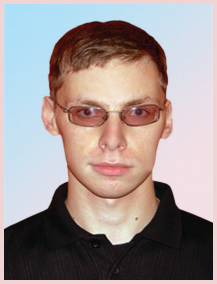

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"Knowledge Workers" and Modernization in the Region

Abstract. Professional education is the main part of personnel training and it serves as the driver of modernization process. "Knowledge workers" are carriers of knowledge provided by the professional training system. Professional activity of "knowledge workers" is strategically important in the economy under transformation. The paper reviews domestic and foreign experience and defines criteria for identifying people as "knowledge workers": educational level, employment in "intellectually demanding" industries. The study identifies specific characteristics of "knowledge workers", represents their typological classification depending on their employment affiliation (professional managers, new workers, certified technicians, scientists, innovator specialists). The paper focuses on determining the level of implementation of employment potential of qualified specialists in the context of economic modernization. The authors define the dependence of the level of regions' modernization on the employment of workers that have vocational education. At the same time, the paper points out that the modernization of the territory is influenced not so much by the training of "knowledge workers" as the fulfilment of their potential in the labor market. This thesis is confirmed by the results of correlation analysis, which evidence the lack of direct connection between the number of college and university students and the level of modernization. From the position of effective implementation of the potential accumulated, the study shows the importance of integrating the graduates of educational organizations into the labor market in accordance with the specialty they obtained. The paper also identifies problems that hamper job placement within the specialty obtained. The study shows that the slowdown in modernization processes is due mainly to the economic and cognitive aspects. In particular, the imbalances in the components of the secondary modernization index stem from an insufficient number of scientists and engineers, people who file patent applications, and from the small amount of allocations to research and development in GRP. The paper reveals that one of the ways to improve human capital is to increase innovative activity of the youth; the authors substantiate the thesis about the direct positive impact of the development of competencies on participation in research and scientific developments. The results of the study can be used to work out strategic plans for the development of innovation industries and social entrepreneurship in Russia's regions.

Key words: region, modernization, education, labor market, "knowledge workers", "over-qualification".

International experience shows that a key role in the modernization process belongs to human resources, human capital as a combination of knowledge, skills, and competences of the employee becomes the main driver of economic growth and the main value of society [17, pp. 3-15].

This thesis is confirmed in one of the works by A. Krueger and M. Lindahl "Education for Growth", in which it is shown that the increase in the stocks of human capital among people with higher education is accompanied by achievement of high technological and economic level in the scale of national economy [21, pp. 1101-1136]. The low level of investment in higher education in European countries compared to the U.S. (1.4% of GDP vs. 3% of GDP) in the early 2000s was considered by foreign researchers as one of the reasons for Europe lagging behind in terms of economic growth [22, pp. 757-777].

Accordingly, the leading role in the transformation of society and economy is allocated to education, to the training of future "generators and producers of innovative ideas". They include people with a high educational level, who work on the basis of knowledge and by means of them, who are able to create new knowledge, new product, new method, etc. [2, p. 50]. OECD experts use the term "human resources in science and technology" to refer to this group. According to OECD staff estimates, the share of this category of professionals among the employed population in the developed EU countries exceeds 35% (in the U.S. – over 40%) [23, p. 88]. This category consists of those who obtained tertiary education (i.e. secondary and higher professional and postgraduate education) and/or those employed in different types of intellectual activities (science, education, information and communication technology) involving high skills and innovation capacity.

In the scientific aspect, the topic of human resources received a notable impetus in its development in the late 20th – early 21st century. This issue was considered by the following foreign researchers: P. Weise, H., Gago, Y. Dai, M. Castells, B. Khadria, S. Nås, H. Fang, and domestic researchers: M.Yu. Barbashin, V.V. Bobrova, E.D. Vil'khovchenko, L.V. Dokashenko, V.L. Inozemtsev, I.P. Tsapenko, M.A. Yurevich and others. We should also mention the works of K. Canibano, T. Pogue, I. Chou, A. Ekeland on the methodology of assessing the supply of and demand for highly qualified specialists.

Generalization of domestic and foreign research on this issue has led us to the conclusion that the group of "knowledge workers" is heterogeneous. For example, Peter Drucker identified "knowledge workers" according to a criterion of possessing intelligence, memory, knowledge, initiative and personal experience, and he identified two categories of "knowledge workers":

– *managers*;

– *specialists* (managers of a certain level, consultants, programmers, software users, etc.) [19].

A more differentiated approach to the typology of "knowledge workers" was used by E.D Vil'khovchenko. He identifies four subgroups depending on the affiliation with a certain position: *1) professional managers* (carriers of special knowledge in marketing, engineering, management of intellectual and human resources); *2) scientists, innovator specialists* (those who possess expert knowledge, holders of diplomas and scientific degrees); *3) certified technicians* (support staff working in cooperation with specialists); *4) new workers* or "the cognitariat" (workers employed mainly in automated, experimental innovation manufacturing, knowledge-intensive service sectors) [2, p. 50].

The system approach to the interpretation of "knowledge workers" is presented in the Canberra Manual, a document prepared by

the European Commission in collaboration with the Organization for Economic Cooperation and Development in 1995. In addition to economic activities that employ "knowledge workers", this document also defines educational and qualification characteristics of this category [24].

Each researcher has contributed to the expansion of knowledge about the characteristics of "knowledge workers". A synthesis of different viewpoints allowed us to highlight the specific features of this group related to education and qualification, employment, and nature of work *(tab. 1)*.

Table 1. Specific characteristics of "knowledge workers", presented in the works of foreign and domestic scientists

Author	Features
P. Druker (1994)	- Possessing one's own means of production: intelligence, memory, knowledge, initiative and personal experience
M. Castells (1999)	- High saturation with knowledge and information
V.L. Inozemtsev (2000)	- High education standards (higher than in the majority of citizens) - Employment in the new industries and the service sector - Ability to acquire the necessary means of production into private property - Possibility of individual production of information products - Demand for representatives of this group in different structural elements of social hierarchy - Outstanding mobility
B. Khadria (2004)	- Representatives of this group have tertiary education in science and technology and are engaged in scientific and technological specialties in which the higher qualification is not required
S.O. Nås (2008)	- Education level - Employment - Workplace type (university, research institute)
E.D. Vil'khovchenko (2010)	- Continuous enhancement of the level of their education - Multiplication of the knowledge used in their work - Active and competent entrepreneurship, high performance and responsibility for performance results - Ability to create new knowledge, new product, new method, etc. on the basis of their knowledge
H. Fang, Y. Dai (2011)	- The core of scientific and technological processes that is required in order to maintain production, dissemination and application of scientific and technological knowledge
L.V. Dokashenko, V.V. Bobrova (2011)	- Lack of rigid dependence on the organization - Ability to produce information product on one's own, possessing the necessary means of production in private ownership - Employer is offered not the ability to work, but the result of the work, not labor force, but consumer value embodied in the innovative product (technology)
I.P. Tsapenko, M.A. Yurevich (2014)	- Involvement in intellectual activity, which is associated with the development and application of new and updated (including social) technologies - Active participation in intellectual creation of the knowledge society
M.Yu. Barbashin (2014)	- Striving to achieve the goals of self-realization, common good, service to professional duty - Focus on creative work and social initiative - Awareness of the need for change in the interaction of society and the state
Source: compiled by the authors.	

It should be noted that the majority of researchers, when defining the essence of the category "knowledge workers", resort to subjective characteristics such as activity, pursuit of self-realization, innovative thinking, mobility, etc., which by their very nature are almost impossible to calculate. In the framework of our research, we have chosen "working" indicators such as the level of education and employment in the labor market that will provide an objective analysis of the situation of this socio-professional group in society.

Despite the difference in viewpoints, modern researchers agree that the increase in the number of "knowledge workers" in the labor market, especially in the period of transformation and economic instability, is accompanied by the allocative effect, namely, that the population with higher educational level has better adaptive abilities. In general, certified specialists adapt more successfully to unforeseen changes in economic, institutional and technological environment and, therefore, are indispensable for the development of innovation economy.

However, such results are achieved mainly in conditions when the potential accumulated corresponds to the requirements of economic development. In the reverse situation, there emerge certain issues associated with inefficient use or underutilization of human capital, which impede economic modernization. At the individual level, they can include employment beyond the scope of one's specialty, the need for more investment in retraining and improvement of educational level, and unemployment.

Due to the lack of professional experience and information asymmetry, young professionals are faced with significant difficulties when applying for a job. According to the International Labor Organization, there are around 75 million unemployed young people aged 15 to 24 in the world. Youth unemployment level is almost twice as high as the unemployment rate among adults. It is noted that in 2008–2012 the EU countries annually lost 1.2% of their GDP because of the "lost generation" that consists of young people who neither work nor go to college [8].

The imbalances that lead to inefficient use of human capital include employment beyond the scope of one's specialty, the mismatch between the skills of workers and job requirements. In the Vologda Oblast, according to the monitoring of labor potential quality in 2014, 40% of the population worked beyond the scope of their specialty (in 2009 – 55%). The increase in disparities between the sphere of education and the labor market was accompanied by an devaluation of skilled labor. This is confirmed by the surveys of the population on the issues of employment in Russia's regions conducted quarterly by the Federal State Statistics Service on the basis of a sample survey of households: at least one third of workers with a tertiary education performed the work that did not require high qualification [15]. This phenomenon,

known as "over-qualification", covers, according to some estimates, about 10–30% of employed Russians [17, pp. 3-15]. In the Vologda Oblast, only in half of the cases, the qualification met the job requirements; the qualification of about a quarter of the population was higher than necessary.

Problems associated with the use of human capital at the organizational level include the presence of "hidden" knowledge in workers (the set of information that is not formalized on suitable media and exists only within its carrier), the alienation of this knowledge and its transformation into "explicit" knowledge. In addition, the risk of "brain drain" necessitates large investments to prevent mobility, as well as the use of the practice of concluding long-term contracts [17, pp. 3-15].

It is believed that the aggravation of the mismatch between the education system and the labor market can result not only from the inefficient implementation of the potential accumulated in the labor market, but also from the declining quality of education. Despite the formally high educational level of the population (the share of adult population with the tertiary education in 2012 in Russia reached 53%, on average across OECD countries – 32%, in the G20 countries – 27%), there is an increasing problem associated with the quality of education.

This idea is confirmed by the opinion of leading economists and experts. According to V.E. Gimpel'son, now Russia is "the leader in the possession of human capital, but an outsider in its use" [3].

According to one third of employers, judging by the monitoring of the functioning of the Vologda Oblast industry in 2014, modernization of production is constrained by the shortage of qualified personnel. Moreover, when characterizing the level of training of graduates, virtually none of the respondents identified it as high. The nationwide and regional levels were dominated by satisfactory ratings, the quality of training of university graduates was assessed somewhat higher (in 2013, the average score in the evaluation of vocational school graduates was 3.5 and graduates –3.7 on a five point scale) [14, pp. 26-28].

In 2001–2014, the share of Russian population with tertiary education increased by 37% as calculated per 10 thousand employed population (from 5,640 up to 7,710 people, respectively), which is a positive trend. However, the change took place mainly at the expense of workers with secondary vocational education, and the number of employees with higher education increased at a slower pace (the growth rate was 144% vs. 128%; *tab. 2*).

We should note the uneven distribution of qualified personnel across the territory. A significant part of the employed population with vocational education is concentrated in the Central Federal District (4,530 people with secondary vocational education and 3,750 people with higher professional education per 10 thousand employed), there are comparatively fewer qualified professionals in the rest of the territories.

Table 2. Number of employed people with secondary and higher professional education (per 10 thousand employed population)

Territory	Secondary vocational education				Higher professional education			
	2001	2005	2014	2014 to 2001, %	2001	2005	2014	2014 to 2001, %
Russian Federation	3,130	2,560	4,490	**143.5**	2,510	2,620	3,220	**128.3**
In the context of federal districts:								
Central	3,100	2,600	4,530	**146.1**	2,910	3,050	3,750	**128.9**
Northwestern	3,460	2,410	4,740	**137.0**	2,640	2,830	3,250	**123.1**
Southern	3,000	2,540	4,380	**146.0**	2,420	2,570	3,020	**124.8**
North Caucasian	-	-	2,850	-	-	-	3,090	-
Far Eastern	3,380	2,650	4,440	**131.4**	2,650	2,610	3,170	**119.6**
Volga	2,940	2,390	4,740	**161.2**	2,140	2,290	2,890	**135.0**
Siberian	3,210	2,760	4,390	**136.8**	2,420	2,440	2,850	**117.8**
Ural	3,160	2,660	4,790	**151.6**	2,220	2,160	3,110	**140.1**

Source: Regiony Rossii. Sotsial'no-ekonomicheskie pokazateli. 2015: stat. sb. [Russia's regions. Socio-economic indicators. 2015. Statistics collection]. Moscow: Rosstat, 2015. Pp.156-157.

Taking into account all the problems mentioned above, we emphasize that it is possible to speak about the positive impact of human capital on the pace and quality of economic growth primarily if people find a job within their specialty and if their qualification corresponds to their job requirements. In this regard, it is important to answer the question about the degree of conformity of accumulated human capital with the needs of the economy. In our context, it is interesting to track how the indicators of training of qualified specialists are related to the level of modernization of economic development in constituent entities of the Russian Federation. To solve this problem, we compared the indicators of development of professional education with the integrated index of modernization of Russian regions that reflects the relative gap between the level of modernization of the territory and the world value that was reached [9].

The Institute of Socio-Economic Development of Territories of RAS (ISEDT RAS) calculates the index on the basis of methodological developments of the Center for the Study of Sociocultural Changes at the Institute of Philosophy of RAS and China Center for Modernization Research under the Chinese Academy of Sciences. We apply these provisions to analyze the process of modernization in a particular territory, to determine the stage

of modernization, and factors that promote and hinder this process. The analysis in the territorial context was conducted with the help of the information-analytical system "Modernization" (http://mod.vscc.ac.ru/).

The level of modernization of territories as an integral index was determined on the basis of three sub-indices (economic index, social index, knowledge index) and was calculated on the basis of the following conditions:

$$\begin{cases} IMI = (EI + SI + KI)/3, \\ EI = \sum_{i=1}^{4} \frac{D_i}{4}, \\ SI = \sum_{i=5}^{8} \frac{D_i}{4}, \\ KI = \sum_{i=9}^{12} \frac{D_i}{4}, \\ D_i = 100 \cdot \frac{iav}{isv}, \\ D_i \le 100 \end{cases},$$

where EI – economic index of integrated modernization,

SI – social index of integrated modernization,

KI – knowledge index of integrated modernization,

D_i – relative level of development of i evaluation indicator,

iav – actual value of i indicator,

isv – standard value of i evaluation indicator (the average value of the indicators for 20 developed countries, calculated by China Center for Modernization Research under the Chinese Academy of Sciences on the basis of international statistics).

These indicators were adopted by China Center for Modernization Research under the Chinese Academy of Sciences as the criteria in determining modernization index for 131 countries [9].

The methodology for measuring primary modernization (PM) takes into account three domains of life of industrial society: economic, social, and cognitive (area of knowledge). The values of secondary modernization (SM) are defined for four areas: knowledge innovation, knowledge translation, quality of life, quality of the economy. Analysis of the integrated modernization index was carried out using 12 statistical indicators to measure the aggregate level of the two stages of modernization.

The regions were arranged into five groups according to the value of the integrated modernization index for 2012: 1) high level ($IMI \ge 88$); 2) level above median ($78 \le IMI \le 87$); 3) median ($64 \le IMI \le 77$); 4) below median ($48 \le IMI \le 63$); 5) low ($33 \le IMI \le 47$) [11, p. 155].

The results of the analysis show that the subjects of the Russian Federation with high values of the index of modernization are characterized by high employment rate of workers with vocational education *(tab. 3)*. One example is the city of Moscow that has a high level of modernization ($IMI = 88$) and a large number of employed people with tertiary education (7,690 persons per

Table 3. Indicators of education development (2012) and the integrated modernization index (2012) in Russia's regions

Regions	1*	2*	3*	4**	Modernization level
Moscow	891.7	790.6	7690	88	High
Saint Petersburg	234.1	209.0	6740	81	Above median
Moscow Oblast	434	62.1	6600	75	
Tomsk Oblast	1455	176.7	5170	71	
Tyumen Oblast	857	114.5	5520	70	
Novosibirsk Oblast	1088	138	5390	70	
Nizhny Novgorod Oblast	925	146.2	5450	69	
Samara Oblast	979	138.2	6430	69	
Khanty-Mansi Autonomous Okrug – Yugra	591	65.0	5500	68	
Ulyanovsk Oblast	901	127.2	5540	68	
Yamalo-Nenets Autonomous Okrug	352	44.3	6150	68	
Magadan Oblast	1043	151.3	4860	67	
Sakhalin Oblast	591	85	4880	66	
Sverdlovsk Oblast	923	137.4	5040	66	
Murmansk Oblast	695	111.5	4910	66	Median
Kaluga Oblast	646	101.4	5510	65	
Chelyabinsk Oblast	984	134.6	6340	65	
Khabarovsk Krai	1232	161	5610	65	
Krasnoyarsk Krai	894	112	5360	65	
Primorsky Krai	936	114.5	5380	65	
Kamchatka Krai	884	128.1	5620	65	
Republic of Tatarstan	1039	151	5060	64	
Perm Krai	794	113.1	4970	64	
Republic Of Sakha (Yakutia)	920	127.6	5270	64	
Yaroslavl Oblast	803	108.5	5450	64	
Ivanovo Oblast	886	131.6	4850	64	
Nenets Autonomous Okrug	190	46.5	4810	64	
Republic of Komi	818	102.3	4610	63	
Chukotka	129	19.6	5260	63	
Voronezh Oblast	1084	152.8	5310	63	
Rostov Oblast	1017	131.6	5650	62	
Republic Of Karelia	728	106.8	5260	62	
Arkhangelsk Oblast	638	101.5	5490	62	
Leningrad Oblast	220	24	5090	60	
Irkutsk Oblast	995	137.1	4860	60	
Tver Oblast	675	96.7	5370	60	Below median
Kaliningrad Oblast	820	114.1	6370	60	
Tula Oblast	622	99.2	5630	60	
Penza Oblast	838	108.8	5580	60	
Vladimir Oblast	729	109.7	4900	60	
Volgograd Oblast	851	135.9	5700	59	
Kursk Oblast	1090	165.3	5350	59	
Kirov Oblast	776	128.1	4790	59	
Novgorod Oblast	637	87.9	5180	59	

End of Table 3

Regions	1*	2*	3*	4**	Modernization level
Saratov Oblast	986	132.2	5570	59	
Republic of Bashkortostan	881	130.5	5160	59	
Omsk Oblast	1121	143.4	5100	59	
Amur Oblast	778	102.8	5700	58	
Udmurtia Republic	916	142.3	4780	58	
Krasnodar Krai	696	110.5	5370	58	
Astrakhan Oblast	934	116.4	5710	58	
Stavropol Krai	894	140.1	5560	58	
Republic of Dagestan	701	89.6	4860	57	
Vologda Oblast	726	107	4780	57	
Kemerovo Oblast	746	97	5120	57	
Chuvash Republic	986	139.1	4920	57	
Orel Oblast	1150	140.5	5220	57	
Pskov Oblast	711	89.1	5410	57	
Jewish Autonomous Oblast	878	104	4140	57	
Bryansk Oblast	840	118	4860	56	
Belgorod Oblast	941	132.4	5410	56	
Kurgan Oblast	799	123	5070	56	
Republic of North Ossetia-Alania	949	124.6	6380	56	
Zabaykalsky Krai	834	104.1	4710	56	Below median
Mari El Republic	817	120.3	5370	56	
Kostroma Oblast	689	95.6	5650	56	
Republic of Tuva	554	83.9	6030	55	
Republic of Khakassia	636	114.4	5030	55	
Republic of Buryatia	1079	140.9	5160	55	
Ryazan Oblast	958	142.5	5630	55	
Smolensk Oblast	901	129.2	6060	55	
Orenburg Oblast	876	121	5170	54	
Lipetsk Oblast	680	105	5210	54	
Republic of Mordovia	1011	140.4	5150	54	
Altai Krai	761	103.4	4370	54	
Republic of Adygea	829	107.9	5500	53	
Tambov Oblast	788	115.2	5520	53	
Kabardino-Balkar Republic	585	88.5	4820	52	
Republic of Kalmykia	921	130.3	5640	51	
Altai Republic	691	95.2	5370	50	
Karachay-Cherkess Republic	674	93.2	5370	49	
Republic of Ingushetia	609	61.1	6050	48	
Chechen Republic	610	70.2	3780	46	Low

Conventions: 1 – number of students per 10 thousand population, people; 2 – number of graduates per 10 thousand population, people; 3 – number of employed people with secondary vocational and higher professional education per 10 thousand employed population, people; 4 – integrated modernization index. Ranked according to the integrated modernization index.
Sources:* Rosstat (2013); ** Calculations were prepared by ISEDT RAS with the use of the Information-analytical system for monitoring modernization parameters of Russia's regions (IS "Modernization". patent No. 2012661285. 2012) in accordance with the methodological developments of the Center for the Study of Social and Cultural Change at the Institute of Philosophy, RAS. The tables contain detailed data, including those obtained from China Center for Modernization Research under the Chinese Academy of Sciences.

10 thousand population). Such a pattern is typical of a number of territories with the median and above median levels of modernization – Saint Petersburg, the Moscow, Samara, Chelyabinsk oblasts, and Yamalo-Nenets Autonomous Okrug.

In some cases, for example in the Far Eastern Federal District regions (the Magadan and Sakhalin oblasts), the above dependence is not observed. At the median level of modernization, the number of employees with tertiary education here does not reach the nationwide average value (5,318 persons per 10 thousand employed population). The reasons for this situation include a significant out-migration: in 2013, net migration amounted to -142 and -44 people per 10 thousand population, respectively [12, p. 79].

It should be noted that in some regions (the Tomsk, Voronezh, Rostov, Orel, Novosibirsk, Omsk oblasts, the republics of Tatarstan and Buryatia) there is a significant gap between the performance of students and the number of graduate qualified specialists (more than in seven times). This suggests that in recent years these areas have had a considerable impetus to the strengthening of the network of professional education organizations. Therefore, in the future, the employment situation here can change dramatically.

On average, ceteris paribus, an increase in the number of employed population that has tertiary education promotes the likelihood of implementation of modernization processes. Another situation occurs when the study takes into account indicators that characterize education as such. Thus, the correlation analysis of the number of college and university students and the level of modernization shows a lack of direct connection between them. This is confirmed by the values of the Pearson correlation coefficients *(tab. 4)*.

It should be noted that though the relationship between the index of modernization level and the number of employed people with tertiary education is weak, it still exists. The weakness of this

Table 4. The degree of closeness of the statistical relationship between the integrated modernization index of the regions and some indicators of development of tertiary education

Indicator	Pearson correlation coefficient	Closeness of the paired association
Number of students per 10 thousand population	-0.001	Absent
Number of employed people with higher professional education per 10 thousand employed population	0.457	Weak
Including:		
- with secondary vocational education	0.058	Absent
- with higher professional education	0.460	Weak
Source: authors' calculations.		

relationship can be explained by the fact that the indicator "the number of employed people with higher education per 10 thousand employed population" gives the overall information about the employees with high education and does not indicate the number of graduates of institutes, universities and academies, who have a job within their specialty. At the same time, studies show the significance of the impact of the latter indicator on modernization [16, pp. 509-601].

The level of development of the competences that are "the most relevant to employers" (innovation, communication, initiative, entrepreneurship, etc.) is often low. Thus, at the start of their professional career, "knowledge workers" are not ready to work in today's economy. In some cases, their potential remains unclaimed by employers. Thus, the "hampering" of modernization processes is connected not only with economic but also with cognitive aspects.

Thus, in order to boost the processes of modernization in the economy and society, quantitative indicators of training "knowledge workers" are not as important as the fulfilment of their potential in the jobs relevant to their qualification. Moreover, it is necessary to promote the accumulation of talents in the most "productive occupations, and not in those that are associated with the redistribution of the rent" [3]. In the field of professional training, it is required to stimulate the work on the formation of cognitive and social skills, and behavioral characteristics.

In such circumstances, the key issue for authorities should be to improve the human potential of future generations, including by means of increase in innovative activity of young people. Thus, in 2000–2012, the difference between the index of secondary modernization and the knowledge transmission sub-index (KTI) increased by an average of 20 percentage points. We note that imbalances in the components of the secondary modernization index in 2012 were due to an insufficient number of scientists and engineers, the people who file patent applications, a small share of R&D expenditures in GRP, low GRP per capita, low level of people employed in the service sector [18, pp. 52-53].

The consequences of this imbalance for innovative activity of the young generation are demonstrated clearly by the materials of a pilot sociological survey conducted in October 2015 among students of higher and secondary vocational educational institutions of Vologda[1]. According to the results of this study, young people with competences at the level of 3.71 points and above participated in the creation of inventions three times more often *(tab. 5)*.

[1] The pilot sociological survey aimed to identify the level of competences in the students of secondary vocational and higher professional institutions of Vologda. The sample comprised 500 people and was formed taking into account the share of students of a particular educational organization in the total number of students.

Table 5. Distribution of young people by the presence of inventions, %

Level of competences development (average score)	Inventiveness		Types of inventions			
	There are inventions	There are no inventions	Device	Technique	Software	Methods and technologies
Option 1 - grouping on the basis of average and standard deviation						
Less than 3.18	6.0	94.0	0.0	0.0	25.0	25.0
3.18 – 3.71	3.7	96.3	20.0	20.0	40.0	0.0
3.71 – 4.25	14.0	86.0	26.9	26.9	26.9	11.5
More than 4.25	12.3	87.7	12.5	50.0	25.0	12.5
Option 2 – arrangement into 3 groups (division of the scale from 1 to 5 into 3 equal groups)						
Low level (less than 2.33)	11.1	88.9	0.0	0.0	0.0	100.0
Median level (2.33...3.66)	3.9	96.1	14.3	14.3	28.6	0.0
High level (more than 3.66)	13.3	86.7	22.9	31.4	28.6	11.4
Option 3 – division on the basis of the average						
Below average (less than 3.71)	4.5	95.5	11.1	11.1	33.3	11.1
Above average (3.71 and higher)	13.5	86.5	23.5	32.4	26.5	11.8

Source: data of a pilot sociological survey of the level of competences of students of secondary vocational and higher education institutions of the city of Vologda, 2015, N=500 people.

Here a logical question arises: does the development of all competencies equally leads to innovation activity? The study confirms that the innovative activity is influenced more by innovative qualities such as creativity, ability to invent, ability to research, project management skills. Thus, the difference in the level of development of innovative competences (project management, creativity, ability to perform research) depending on the presence (absence) of developments reached 0.4–0.5 points, and the difference was 0.1 points in the level of development of some professional and common cultural competences (ability to communicate and interact, critical assessment and self-criticism, orientation toward achieving career success, ability to take into consideration the norms and values of other cultures) [18, pp. 52-53].

It is necessary to pay attention to the fact that students of universities and technical colleges give higher assessments (a score of 4 on a five-point scale) of communication and understanding skills, of the willingness to take responsibility and achieve results, as well as the orientation toward achieving career success and toward individual work. Lower assessments are given to the skills of forecasting and management, and to the ability to carry out research and present one's work in written form in a foreign language. Similar

findings are contained in the World Bank Report on Developing Skills for Innovative Growth in Russia. It points out that higher education gives you a minimal increase in the possession of in-demand skills such as ability to work in a team, leadership and openness to new ideas, efficiency in decision-making [11]. At the same time, these competencies are most in demand in innovation economy.

We emphasize that the success of economic modernization is largely determined by the level of development of labor potential. In this regard, it becomes important to find an answer to the question about the adequacy of human capital accumulated for the implementation of innovative transformations from the perspective of both quantitative and qualitative characteristics. In the conditions of the forecast reduction in the working age population, it is necessary to focus on the development of the latter. In addition, it should be noted that the stocks of human capital similar in their volume are often not comparable in their quality.

Thus, human capital reproduction efficiency will be determined not so much by a formally high educational level of the population, as the improvement of the quality of human capital through the development of competencies demanded in innovation economy, and the effectiveness of their use as a result of employment within one's specialty and compliance of one's qualification with job requirements.

Inefficient reproduction of human capital may lead to the risks in the implementation of modernization. In turn, the slowdown in modernization rates has a negative impact on human capital, since it is accompanied by social and economic losses both for the individual and for society as a whole. Our analysis shows the uneven development of territories by level of education and indicators of modernization. This demonstrates the nonlinearity of the processes, and also shows that, despite the availability of highly qualified personnel, regions may lag behind in the development of innovative industries. The latter creates prerequisites for inefficient use of human capital, leading, in particular, to the increase in the prevalence of the phenomenon of "over-qualification". Overcoming the disparities between the education system and the labor market should involve, on the one hand, creation of new jobs that meet modern scientific and technological requirements; on the other hand, it should involve the retraining and advanced training of employees and creation of conditions for training the population in new occupations.

References

1. Barablina S.V., Mekhrishvili L.L. Sotsial'naya otvetstvennost': rol' vysshikh uchebnykh zavedenii [Social responsibility: the role of higher educational institutions]. *Vestnik mezhdunarodnykh organizatsii* [Bulletin of international organizations], 2012, no. 1 (36), pp. 203-218. [in Russian].
2. Vil'khovchenko E.D. *"Lyudi znaniya" – novaya rabochaya sila pozdnekapitalisticheskikh obshchestv i ee mesto v tsivilizovannykh protsessakh* ["People of knowledge" – a new workforce in the late capitalist societies and its place in civilization processes]. Moscow: IMEMO RAN, 2010. 139 p. [in Russian].
3. Gimpel'son V.E. *Vystuplenie na Krasnoyarskom ekonomicheskom forume* [Speech at the Krasnoyarsk economic forum]. Available at: https://www.hse.ru/expertise/news/177478566.html. [in Russian].
4. *Departament truda i zanyatosti Vologodskoi oblasti. Ofitsial'nyi sait* [The Vologda Oblast Department of Labor and Employment. Official website]. Available at: http://www.depzan.info. [in Russian].
5. Lapin N.I. Izmerenie modernizatsii rossiiskikh regionov i sotsio-kul'turnye faktory ee strategii [Measurement of modernization in Russia's regions and the socio-cultural factors in its strategy]. *Sotsiologicheskie issledovaniya* [Sociological research], 2012, no. 9 (341), pp. 4-24. [in Russian].
6. Lastochkina M.A. Territorial'nye osobennosti modernizatsii Rossii [Territorial peculiarities of Russian modernization]. *Regional'naya ekonomika i upravlenie: elektronnyi nauchnyi zhurnal* [Regional economy and management: electronic scientific journal], 2013, no. 2 (34). Available at: http://region.mcnip.ru. [in Russian].
7. Lastochkina M.A., Shabunova A.A. Vozmozhnosti i ogranicheniya modernizatsionnogo razvitiya regionov Severo-Zapadnogo federal'nogo okruga [Opportunities for and constraints in the modernization development of the regions of the Northwestern Federal District]. *Ekonomicheskie i sotsial'nye peremeny: fakty, tendentsii, prognoz* [Economic and social changes: facts, trends, forecast], 2013, no. 5 (29), pp. 39-52. [in Russian].
8. *Molodezhnaya bezrabotitsa v Rossii sostavila bolee 28%* [Youth unemployment in Russia has exceeded 28%]. Available at: http://www.hr-journal.ru/news/events/events_2963.html. [in Russian].
9. *Obzornyi doklad o modernizatsii v mire i Kitae* [China Modernization Report Outlook]. Ed. by He Chuanqi. Moscow: Ves' mir, 2011. 256 p. [in Russian].
10. *Problemy sotsiokul'turnoi modernizatsii regionov Rossii* [Problems of socio-cultural modernization of Russia's regions]. Compiled and edited by L.A. Belyaeva, N.I. Lapin. Moscow: Academia, 2013. 416 p. [in Russian].
11. *Razvitie navykov dlya innovatsionnogo rosta v Rossii* [Developing skills for innovative growth in Russia]. Available at: http://www.hse.ru/data/2015/04/06/1096342275/russia_skills.pdf. [in Russian].
12. *Regiony Rossii. Sotsial'no-ekonomicheskie pokazateli* [Russia's regions. Socio-economic indicators]. Moscow: Rosstat, 2013. 990 p. [in Russian].
13. Stetsunov V.V. Trudoustroistvo sistemy professional'nogo obrazovaniya v usloviyakh krizisa: problemy i perspektivy [Employment of the vocational education system in conditions of crisis: problems and prospects]. *Vestnik Adygeiskogo gosudarstvennogo universiteta. – Seriya 5: Ekonomika* [Bulletin of Adygea State University. Series 5: Economics], 2011, no. 2, pp. 216-223. [in Russian].
14. *Trebovaniya rabotodatelei k tekushchim i perspektivnym professio-nal'nym kompetentsiyam personala: informatsionnyi byulleten'* [Employers' requirements for current and future professional competencies of personnel: information bulletin]. Moscow: NIU VShE, 2014. 61 p. [in Russian].
15. *Federal'naya sluzhba gosudarstvennoi statistiki. Ofitsial'nyi sait* [Federal State Statistics Service. Official website]. Available at: http://www.gks.ru. [in Russian].
16. Tsapenko I.P., Yurevich M.A. Rabotniki znanii: kakuyu rol' oni igrayut v sovremennoi ekonomike? [Knowledge workers: what role do they play in modern economies?]. *Vestnik Rossiiskoi akademii nauk* [Bulletin of the Russian Academy of Sciences], 2014, no. 7, pp. 509-601. [in Russian].
17. Tsapenko I.P. Chelovecheskie resursy v sfere nauki i tekhnologii: sostoyanie i effektivnost' ispol'zovaniya [Human resources in science and technology: their status and efficiency of utilization]. *Mirovaya ekonomika i mezhdunarodnye otnosheniya* [World economy and international relations], 2014, no. 4, pp. 3-15. [in Russian].
18. Shabunova A.A., Leonidova G.V., Kalachikova O.N. Deti i molodezh' v Rossii: global'nye vyzovy sovremennosti [Children and Young People in Russia: Global Challenges of Modernity]. *Ekonomicheskie i sotsial'nye peremeny:*

fakty, tendentsii, prognoz [Economic and social changes: facts, trends, forecast], 2015, no. 6 (42), pp. 36-57. [in Russian].

19. Drucker P. The age of social transformation. *The Atlantic Monthly*. Available at: http://www.theatlantic.com/politics/ ecbig/ soctrans.htm.
20. Ilyin V.A. The problems of development of a region under the conditions of the global crisis (Using the Vologda Region as an example). *Studies on Russian Economic Development,* 2010, no. 1, pp. 78-87.
21. Krueger A.B., Lindahl M. Education for growth: why and for whom? *Journal of Economic Literature,* 2001, vol. 39, pp. 1101-1136.
22. Md. Rabiul Islam, Ang J.B., Madsen J.B. Quality-adjusted human capital and productivity growth. *Economic Inquiry, Western Economic Association International,* 2014, vol. 52, no. 2, pp. 757-777.
23. *Science, Technology and Industry Scoreboard*. Paris: OECD, 2013. 275 p.
24. *The measurement of scientific and technological activities: Manual on the measurement of human resources devoted to S&T ("Canberra Manual")*. Paris: OECD and ECSC-EC-EAEC, 1995. 111 p.

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