

## Human Capital in the Innovative Conditions

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### ABSTRACT

The relevance of the questions dealing with the human capital formation and functioning peculiarities in the innovative development conditions is provided by the fact that highly developed post-industrial economy, manufacturing and service sector cannot do without highly educated and skilled workers, that makes dependable the efficiency and competitiveness at the company level and the whole national economy. The goal of the article lies in certain development within specific provisions in the economic science, which explain the human capital functioning and enhancing its role in the innovative development conditions. The leading approach to study this problem is the structure-functional analysis of the human role in advanced manufacturing and the innovation development when the human capacity to work transformed into capital, increasing the level of education and the formation on this new production relations basis in a modern knowledge economy. Results: the article puts forward the theoretical and methodological concepts dealing with the decisive role of human capital in modern knowledge economy, which is defined the qualitatively new productive forces composition, the science and education transformation in the main factors of efficiency, growth, intelligence, innovation production and management. The article can be useful in a problem-solving process one of the priority tasks in the Russian society - the human capital preservation and development and our country competitiveness in the innovative development conditions.

### KEYWORDS

Human capital; knowledge economy; innovation;  
investment in education

### ARTICLE HISTORY

Received 15 September 2015  
Revised 10 November 2015  
Accepted 22 February 2016

### Introduction

The technological revolution that began in the mid-twentieth century, led to the understanding that in modern society such categories as information, knowledge

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and innovation are major types of economic resources and main factors of economic growth. Due to opportunities and skills to work with a huge flow of information, to master new knowledge, to create and use innovations depend income and success, the efficiency of the company, and the country in General.

Today for effective production development you should to use basic functions and operations set, work, and complex skilled labor, having an extensive set of functions and operations that require a high level of training, experience, and creativity (Nesterov & Forrester, 2010). Such complex intellectual work in a modern company is a tough fight, as highly educated and skilled workers ensure production efficiency and firm's competitiveness in the market. In turn, employees have to be informed about continuously acquire new knowledge and rapid retraining and self-improvement. Such processes show a transition to so-called "knowledge economy", which is characterized by the transition from basic labor to highly skilled human resources with special physical and mental skills that bring income to its owner and the company (Forrester, 2014).

For the first time the concept of "knowledge economy" (or "economy based on knowledge") was proposed by Austro-American economist, President of the International economic Association, F. Machlup (1966) in his work "the Production and knowledge distribution in the US", considering it only for the economy. Since then, this concept firmly established in scientific terminology, and nowadays knowledge economy refers to a type of economy where knowledge plays a crucial role, and knowledge production becomes the most important source of growth. Noteworthy the fact, that contemporary investment in new knowledge exceeds the amount of investments in fixed capital. This is evidenced by statistical data showing that over the past 30 years, the volume of knowledge has increased more than three times, accounting for about 90% of the total amount of knowledge available to humanity (Forrester, 2015), and most researchers are our contemporaries, which clearly indicates the developed countries transition from an economy based on the use of natural resources to the knowledge economy.

Of course, the economy of knowledge did not arise simultaneously, and was the result of a long evolution, closely linked to the information and technological revolutions (invention of writing, printing, electricity, personal computers, and finally, with the information technology and technical means advent for the new knowledge production) (Rakitov, 1991). In the new economy, where the main production development and economic growth factor is knowledge, with a shift from technical skills to the intellectual, knowledge to labor and the inborn man's capital, its intelligence and professionalism, experience, employment potential become central to innovative economic growth and development. Therefore, the analysis of these two components of the new economy – human capital and innovation – is essential for understanding further vector of our country development.

## **Materials and Methods**

### ***Research methods***

The work applied the following methods: theoretical (analysis; synthesis; specification; generalization; method of analogies; modeling); empirical (studying Russian and foreign experience of innovative enterprises, regulatory and

methodological documentation; monitoring); experimental (summative, formative, control experiments); the methods of mathematical statistics and graphical display of results.

### ***Information and the empirical research base***

The study used Federal service data of the Russian Federation state statistics, as well as the research results presented in scientific publications and official reports of Russian and foreign scientists from different directions and schools, in the World Bank official reports.

### ***Regulatory framework work***

The study normative framework is the Russian Federation the Constitution, laws and the Russian Federation Government decrees that defines the socio-economic relations in the country and the problem formal framework.

## **Results**

### ***Human capital and modern economy realities***

According to knowledge economy not natural resources but people, their abilities, and talents – human capital, that is the main development and growth factor for the national economy. Without people it is impossible to implement further new high technologies in the scale of separate firms, industries and the country as a whole, to develop new and more sophisticated computer programs, new knowledge, etc. Long time ago, leading countries in the world paid great attention to that aspect of economic growth having focused on human resources and human capital development. In Russia the situation is completely different, highlighting the natural resources that abound in our country.

The head of Sberbank G. Gref (2016), speaking at the Ranepa and the Gaidar forum on January 15, 2016, covering questions about the future of Russia, rather sharply commented on the General Russia's development vector, spoke about the crisis on the hydrocarbons market, mentioned that the era which was, in his opinion, had already passed, and he noted about our country losses, having made a bet on natural resources in global competitiveness. As a result, Russia placed among the countries that lost among the "countries of the downshifters". "The hydrocarbon era is in the past. As the Stone Age came to the end not because of people ran out of stones. Just the same is now - the Oil Age is over", — G. Gref (2016) said "The future came sooner than we expected. We are already in that future. Welcome to the future!" —the head of Sberbank invited. While G. Gref (2016) noticed that the change had indicated negative trends in Russia, having conducted serious reforms, highlighting their importance in education.

Can't but agree with the G. Gref's statements (2016), as education is a vital function, a key sector and the condition for the society existence. It solves simultaneously cultural, social, economic, civil and ethical issues. It is interested in society as a whole and its various sectors, the latter desperately in need. It provides continuity in a society generates norms, knowledge, technique and experience accumulated by mankind for all history of its existence. It develops the capacity that allows the community to move forward, to progress, to update and change, including the economic sphere. In short, education is a leading factor in the formation and human capital development.

Human capital is a complex multidimensional and multilevel concept, which is based on different personal abilities and talents to generate income to you, the firm, the state, and it, is an intense productive and social development factor, as well as economic growth at the level of the national economy.

Human capital has a significant influence on the formation of the innovative potential not only of the company but also the country as a whole. And the innovation promotion and development in the country has a positive effect on attracting foreign investment into the economy. This gives additional competitive advantages to the economy of any country in the world market. And also contributes to the strengthening of economic and political influence on the world stage that naturally enhances economic development. Thus, investment increases not only in economy but also in human capital.

### ***Features of investment in the human capital***

Human capital is formed through investments in education, health, knowledge, entrepreneurial skills, information provision, safety and economic freedom of population, as well as in science, culture and art.

The main drivers of the human capital formation and development are the presence of competition mechanisms, investment and innovation. The public and the private investment size depend on investors' returns, the economic state, the education sector and also from government policies that defines the priorities for the investment budget.

Among the main types of investments in human capital, the leading role belongs to investment in education, which allow not only to master the already accumulated knowledge, but also contribute to the development and the new knowledge acquisition in the process of a practical human activity, creating favorable conditions for their production in the future, eventually leading to socio-economic development of the society (Forrester, 2015). No wonder they say that humanity has the only way to progress - knowledge and the only means of overcoming all obstacles along the way - intellect. Investments in education have their own characteristics (Dobrynin, Dyatlov & Tsyrenova, 1999).

Firstly, the volume, structure and impact of investment in education depend on the term of human life. Initially, investments in education are comparatively large, and the return on these investments is equal to zero, it starts only during the period of the labour activity and receiving income. The accumulation of knowledge, experience, improvement of professional qualities and abilities, the yield from investment in education increased, but to a certain limit (active working age), further decreasing when a person is retired.

Secondly, not all investments in education can be deemed effective, but only those who appropriate public and economically demanded. For example, investment in the suicide bomber education is harmful to society and illegal. Similarly, studying at the University in parents' favor, who pay for it. It's also could be called economically inefficient, if in future the individual never worked on his or her profession, and, therefore, he or she never paid off the investment in the education.

Third, investments in education contribute to knowledge and skills accumulation of people who are exposed to moral and physical obsolescence. By analogy with fixed capital depreciation, knowledge obsolescence associated with

new technologies, new knowledge creation, which give much better return than the previous one. Physical knowledge obsolescence is related to the physical aging of their host, disease, natural wear and tear of the human body.

Fourth, scholastic investment is a "mutual multiplier effect". Its essence lies in the fact that in the process of learning improves and increases not only the student performance and capabilities, but also teaching, which subsequently leads to higher revenues than both, the first and the second. Fifth, scholastic investment is closely associated with other types of human capital investments, such as health, culture, migration, environment investments, etc.

Sixth, scholastic investment as other elements of human capital has to take into account the foregone earnings.

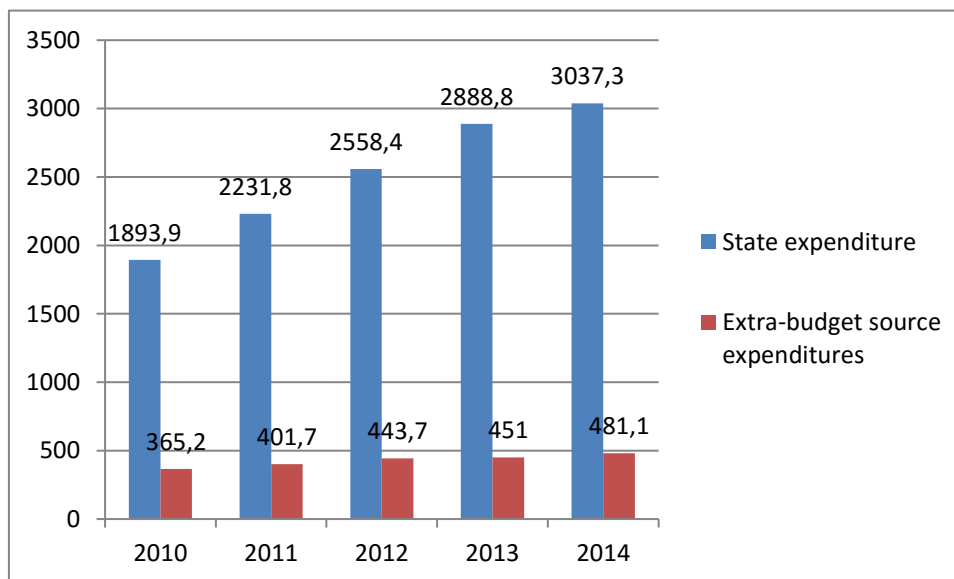
Finally, scholastic investment depends on historical, national, cultural peculiarities and traditions. Analyzing the situation in scholastic investment in the Russian Federation, it could be noticed the negative impact of recent events in the political and economic sphere for the country. If 2014 was marked by positive trends in public expenditure on education, showing a progressive annual increase (30-50%), reaching 3037,3 billion rubles (figure 1), however, from 2015, government spending on education began to decline sharply, reaching just 578.6 billion RUB in 2016 (Ministry of Finance of the Russian Federation). At the same time in the 2016 budget includes an increase spending on defense, public administration, and also the share of secret expenditure. So, on national security in 2016 it is planned to allocate 3 trillion rubles, and law enforcement 2.1 trillion rubles, while 58% of the specified amount of classified spending (Ministry of Finance of the Russian Federation). Thus, the spending budget currently has military focus, rather than social, which entails such effects as the reduction in funding at all levels of education in the country, salary reduction in this field, quality deterioration in educational services, the deterioration of favorable conditions for human capital formation. (Figure 1).

In addition, I would like to note that state expenditures for education in our country is much lower than in foreign countries. This situation negatively affects the formation and development sphere of Russian human capital and consequently on the dynamic in modern innovative society technological development.

### ***Educational quasi-rent - the income from scholastic investment***

Special attention should be paid to income from scholastic investment, which is encouraged to call the educational quasi-rents (Nesterov & Forrester, 2013).

In general, economic rent represents the real resource price to minus the minimum price which must be paid to induce the owner of that resource to sell it. Moreover, the minimum price for a specific resource depends on the opportunity cost of the resource owners, which are determined by the usefulness of the most valuable among discarded alternatives. If the price falls below the minimum, then the resource owners will prefer to either offer it in other markets, or to abstain from the sale.



**Figure 1.** Dynamics of public spending on education, billion rubles (Yuzhakova, 2015)

Therefore, the excess of earned income over alternative forms of income builds economic rent of the resource owners. The same thing happens with the use of human capital as the transformed form of highly creative work. Here the minimum price will be the fee for normal public work, for socially useful employee's knowledge. And the real price of such a resource as human capital is pavement for that unique capital, which is embodied in the increased stock of knowledge over and above the socially necessary level.

The lawfulness of the rent relations as the foundations of the workers' remuneration system in the modern economy is knowledge characteristics, abilities and talents to be in the form of human capital. The first reason is in the process of human capital movement, increasing its usefulness. Any knowledge, information, skills, abilities and experience of the employee as part of human capital in the process of creative work itself, is increasing in quantity and improving in quality. In addition, any capital represents, on the one hand, production resources, and on the other, self-expanding value as the value increasing in use. And human capital is capable in creating added value. Second, the human capital accumulation is done throughout life process. It is an investment in the educational level, until the last stage, where the result appears.

Consequently, in the human capital functioning, it is possible to select a single element of monopoly income – educational quasi-rent (Nesterov & Forrester, 2013), which is divided into two types: absolute and differential. Let us discuss this in details.

Absolute rental income is the result of exclusive conditions for functioning. The human capital owner relies on the educational annuity, as it has a monopoly private (personal) ownership of high knowledge, high skills, the ability to creative high-performance work, which he sells, or you can say, "leases" (as it

cannot separate them from ourselves, and sell the intellectual and physical abilities) to the employer.

More clearly, the assertion about the absolute rental income explains the data of the employee wages differentiation, dealing with their education level in Russia (table 1).

**Table 1.** Average accrued wages of employees, RUR (Russian Federal state statistics service, 2016) all employees, including those with education

	2005	2007	2009	2011	2013
All employees, including those with education:	8694	13570	18084	22717	28702
higher professional	11383	17799	24366	29927	38233
undergraduate	7785	12384	15082	19964	No data
secondary vocational	7722	11830	15276	18901	23869
basic vocational	8123	12136	15321	19746	23926
secondary (complete)	7726	11787	14780	18538	22886
basic General	6418	9992	12343	15970	21622
do not have basic General	5772	8997	10793	14545	19850

The data of Table 1 clearly shows that throughout the studying period there is a strong link between the average monthly workers' wages and their educational level. Overall workers' wages, who got higher education, is 30-40% higher than workers' wages with secondary professional, basic professional and secondary (complete) General education.

Another type of annuity in agriculture and in the human capital sphere is the differential rent. As land rent directly associated with various soil fertility and educational quasi-rent, depends on the man's productive capacity, his or her intellectual capabilities. In human capital its owner also receives additional income arising from different skills and education levels of individuals. So, a qualified doctor on average earns several times more than the worker the same medical establishment does, that is commensurate with relevant in these cases, investment in human capital. The doctor, received a medical degree, completed his internship, spent a lot more time and money obtaining his education and experience than a cleaning man, for example, who graduated in the best case, special courses, lasting only for a couple weeks. Moreover, in each case there are nuances. For example, a popular doctor with a special gift for diagnosing diseases and their treatment, who is selfless, sympathetic, attentive, receives differential educational rent, far surpassing the opportunity cost of the education, he or she got. Hence, the reason for the existence of differential rent in the area of human capital stems from the exclusive disposition of the individual unique capabilities.

In addition, noteworthy is the fact that where there are human capital carriers with in excess of socially necessary knowledge level, the production

costs with their participation is lower than in industries with the employees' participation, possessing useful social knowledge or even below this level.

The difference between low individual costs in the application of high level knowledge, compared to public costs, the differential is quasi-rents income, which calculates the human capital carrier due to the fact that he is simultaneously the owner of the capital.

Exploring, for example, the average monthly accrued wages of employees by types of economic activity in Russia (table 2), we can see that the lowest of them are those service sectors employees that do not require higher education and a creative approach to business (municipal and social services; hotels and restaurants; agriculture, hunting and forestry). The paradox here is education, where there is one of the lowest (the third place) average monthly wages (accounting for 80% of the average wage for all types of economic activity). However, it is increasingly peculiar only to our country, where the human capital has not yet raised to the rank of a monopoly resource. The highest returns are observed in the financial sector where education plays a crucial role in the success of this business and increases the workers' income.

**Table 2.** Average monthly nominal employees' wages by types of economic activity in the Russian Federation; RUB (Russian Federal state statistics service, 2016)

	2009	2010	2011	2012	2013	2014
The whole economy	18637,5	20952,2	23369,2	26628,9	29792,0	32495,4
Agriculture, hunting and forestry	9619,2	10668,1	12464,0	14129,4	15724,0	17723,7
Mining	35363,4	39895,0	45132,0	50400,6	54161,2	58959,3
Manufacturing	16583,1	19078,0	21780,8	24511,7	27044,5	29510,5
Production and distribution of electricity, gas and water	21554,2	24156,4	26965,5	29437,1	32230,5	34807,9
Construction	18122,2	21171,7	23682,0	25950,6	27701,4	29354,3
Wholesale and retail trade; repair of motor vehicles, motorcycles, household goods and personal items	15958,6	18405,9	19613,2	21633,8	23167,8	25600,9
Hotels and restaurants	12469,6	13465,8	14692,5	16631,1	18304,4	19759,3
Transport and communications	22400,5	25589,9	28608,5	31444,1	34575,7	37010,5
Financial activities	42372,9	50120,0	55788,9	58999,2	63333,0	68564,5
Operations with real estate, rent and granting of services	22609,7	25623,4	28239,3	30925,8	33846,3	37559,3
State administration and military security; social insurance	23960,0	25120,8	27755,5	35701,4	40448,7	42659,1
Education	13293,6	14075,2	15809,1	18995,3	23457,9	25861,7
Health and provision social services	14	15	17	20	24	
	819,5	723,8	544,5	640,7	438,6	27068,4

A close correlation is observed between education level and wages in different groups of specialists (table 3). Workers got higher education, have higher wages than workers, got other levels of education, all aggregated occupational groups. So, in the groups of organizations leaders and their structural divisions, the workers' wages with higher education exceeds the workers' wage with secondary professional education is 35%, in the group of specialists of higher and medium skill level – 28% in the group of specialists with middle qualification level – 24%.



**Table 3.** Average accrued employees' wages of organizations by occupation and education level in 2014 (RUB thousand) (Labour and employment in Russia, 2015)

	All employees	Got the education				
		higher professional	secondary professional	basic professional	secondary General (complete)	do not have secondary (complete) General ed.
Heads of organizations and their structural subdivisions (departments)	52,0	56,5	36,6	34,9	31,7	-
Specialists of the highest qualification level	33,0	34,7	25,1	26,6	28,0	36,0
Specialists of middle qualification level	25,8	31,5	23,9	23,5	21,3	14,3
Employees involved in the preparation of information, documentation, accounting, and maintenance	18,9	21,8	18,1	17,5	17,4	17,0
The workers in the service industry, housing and utilities, trade and related activities	18,8	24,8	18,2	17,9	18,5	17,5
Skilled workers in agriculture, forestry, hunting, aquaculture and fisheries	16,3	19,3	16,6	17,4	15,9	15,3
Skilled workers of industry, construction, transport, communication, Geology and exploration of mineral resources	27,9	30,6	27,7	27,7	27,7	27,5
Operators, operatives, and machinists of plant and machinery	28,0	31,1	26,8	27,7	28,6	25,7
Unskilled workers	13,5	15,3	13,4	13,7	13,3	12,5

Workers with secondary education had higher wages than workers with lower education levels, the groups of organizations leaders and their structural

units (services); specialists of middle qualification level; personnel engaged in the information preparation, documentation, accounting, and maintenance. In groups of the highest qualification level specialists and operators, office workers, equipment and machines operators, higher wages than workers with secondary professional education, have employees with basic professional and secondary (complete) General education. Thus, analyzing the status and the human capital functioning in our country, we can say that nowadays more human capital is used not in full and not at the level required by the knowledge economy.

### ***Research index of knowledge economy to assess the use of human capital in Russia***

This is evidenced by the Index of the knowledge economy that was developed in 2004 by the World Bank in the framework of the program "Knowledge for development" to assess countries ability to create, adopt and disseminate knowledge. It includes a set of 109 structural and qualitative indicators, which are grouped into four groups (Report on human development in the Russian Federation for 2004 year, 2003):

1. Economic and institutional regime index — the conditions under which the developing society and economy as a whole, legal and economic environment, the development of private initiative and business, regulation quality, the society ability and its institutions make effective to use existing knowledge and creating new;

2. The education index – the education level of the population and the availability of skills for the creation, use and knowledge dissemination. The index is calculated, based on indicators of the registered student's ratio to the number of appropriate age men, and a number of other indicators;

3. The innovation index — the level of the national innovation system development, which includes companies, universities, professional associations, research centers and other organizations, perceiving and adapting global knowledge for local needs, and creating new knowledge and technology. This group includes such indicators as number of registered patents, number of researchers involved in R & D; number and circulation of scientific journals, etc.;

4. The information and communication technologies index — the information and communication infrastructure development is used to facilitate efficient processing and information dissemination. For the evaluation of information and communication technologies there are used the following indicators: number of personal computers, telephones, Internet users among the population etc.

The purpose of the Index is to use countries for the analysis of problem areas in their policies and measure the state's readiness for the transition to the economy based on knowledge. Table 4 shows data, calculated at the end of 2011, from the World Bank's 2012 index of knowledge economy in some countries.

**Table 4.** The index of the knowledge economy for countries worldwide (Annual report of the World Bank group 2012)

Place	Change from 2000	Country	Knowledge economy Index	Knowledge Index	The economy Institutional regime	Innovation	Education	Information structure
1	0	Sweden	9,43	9,38	9,58	9,74	8,92	9,49
2	6	Finland	9,33	9,22	9,65	9,66	8,77	9,22
3	0	Denmark	9,16	9,00	9,63	9,49	8,63	8,88
4	-2	Netherlands	9,11	9,22	8,79	9,46	8,75	9,45
5	2	Norway	9,11	8,99	9,47	9,01	9,43	8,53
6	3	New Zealand	8,97	8,93	9,09	8,66	9,81	8,30
7	3	Canada	8,92	8,72	9,52	9,32	8,61	8,23
8	7	Germany	8,90	8,83	9,10	9,11	8,20	9,17
9	-3	Australia	8,88	8,98	8,56	8,92	9,71	8,32
10	-5	Switzerland	8,87	8,65	9,54	9,86	6,90	9,20
11	0	Ireland	8,86	8,73	9,26	9,11	8,87	8,21
12	-8	US	8,77	8,89	8,41	9,46	8,70	8,51
13	3	Taiwan	8,77	9,10	7,77	9,38	8,87	9,06
14	-2	UK	8,76	8,61	9,20	9,12	7,27	9,45
15	-1	Belgium	8,71	8,68	8,79	9,06	8,57	8,42
...	...	...	...	...	...	...	...	...
55	9	Russia	5,78	6,96	2,23	6,93	6,79	7,16
...	...	...	...	...	...	...	...	...
Regions								
1	0	North America	8,80	8,70	9,11	9,45	8,13	8,51
2	0	Europe and Central Asia	7,47	7,64	6,95	8,28	7,13	7,50
4	1	Latin America	5,15	5,31	4,66	5,80	5,11	5,02
5	-2	World	5,12	5,01	5,45	7,72	3,72	3,58
8	-1	World	2,55	2,43	2,91	3,95	1,44	1,90

The data of Table 4 illustrates the position of Russia on key knowledge economy indicators (NEI). Russia ranks 55 out of 146. Recently, there are some positive trends; however, the growth of private indicators in NEI has been insufficient to occupy a leading position in the ranking. The institutional regime index of the economy has the smallest value (or 2.23) in all partial indicators and brings us closer to the average value for this indicator in Africa (or 2.91). According to the World Bank report, weaknesses in the

institutional regime are: low intellectual property protection level, a minor role of the domestic banking system, the low level of competition at the local level and lack of adequate regulation for financial institutions.

By the rest specific indicators Russia is not so far from the average value in the group of countries in Europe and Central Asia. The education index (6.79) makes Russia comparable with countries such as Switzerland and the UK. This is due to the consistently high level of education in our country.

The information and communication technologies index increased from 6.6 in 1995 to 7.16 in 2012, this suggests that in Russia, there is a growing level of information and communication infrastructure development, development of cellular communications, the Internet and computerization of the economy.

Causes of lag upon the innovation index (6, 93) are: low level of foreign direct investment, weak cooperation between universities and private companies, high administrative barriers to the emergence of new businesses, low availability of venture capital.

In 2012, Russia was on the 51 place on the level of innovative development (The Global Innovation Index 2015). Innovative component in Russia is very small. On the basis of the data presented in the publication "the Global innovation - 2014", Russia takes 49th place on the level of innovative development among 143 countries (table 5).

**Table 5.** Countries Ranking on the innovation index 2014 (The Global Innovation Index, 2015)

Ranking	Country	Index
1	Switzerland	64,8
2	UK	62,4
3	Sweden	62,3
4	Finland	60,7
5	Netherlands	60,6
6	United States of America	60,1
7	Singapore	59,2
8	Denmark	57,5
9	Luxembourg	56,9
10	Hong Kong	56,8
49	Russia	39,1

Among the BRICS countries, Russia is second best behind China (29th), ahead of South Africa (57), Brazil (61) and India (76). Among former Soviet countries covered by the study, Russia ranks fifth after Estonia (24th place), Latvia (34), Lithuania (39) and Moldova (43) (Terentyev & Mironov, 2016). The global innovation index is calculated on the basis of the analysis of 80 different variables that characterize details of countries innovative development the in the world. The study is based on the hypothesis that the success of the economy is associated, with the presence of the innovative potential and conditions for its implementation, in line with this, indicators are divided into 2 groups: Innovation Input, Innovation Output. Thus, the final Index is the cost and effect ratio, allowing objectively evaluate the effectiveness of efforts to innovations development in the country" (The Global Innovation Index, 2015).

In 2015 our country has fallen according to this indicator at 48th place (The Global Innovation Index, 2015). This decline is associated largely with the

introduction of economic and political sanctions against Russia that directly affected the investment component of the country innovative development. Thus, according to the Russia Central Bank, admission to the country's economy of foreign direct investment in 2014 compared to 2013 decreased by 3.3% from \$69.2 billion to \$20.9 billion, respectively.

The reduction of investment in research and development has occurred on the part of all actors of the market economy.

**Table 6.** Domestic expenditures on research and development by sources of financing (percent) (science Indicators 2015)

Year	Domestic expenditures on research and development	State Funds	Business sector Funds	Higher education institutions Funds	Private nonprofit Funds	Foreign sources
2000	100	54,8	32,9	0,3	0,09	12,0
2007	100	62,6	29,4	0,6	0,1	7,2
2008	100	64,7	28,7	0,5	0,2	5,9
2010	100	70,3	25,5	0,5	0,1	3,5
2011	100	67,1	27,7	0,8	0,2	4,3
2012	100	67,8	27,2	0,8	0,1	4,0
2013	100	67,6	28,2	1	0,1	3,0

In connection with the global crisis of 2008, there was a sharp reduction in the domestic research and development financing by foreign investors from 2008 to 2013, funding from foreign sources declined by 2.9%. The business sector involvement in scientific research in Russia is insignificant, which greatly burdens the budget. This is a consequence of the low interest of private entrepreneurs in research and development, low efficient state policy in the field of economic development. Decreasing funding trends in research and development reflected the same decline in innovative organizations activities (see Table 6).

However, if we consider innovation activity by type of economic activity, there is a positive dynamics in the manufacturing industry. Despite the difficult economic situation in the country, when all the types there is an activity decrease in manufacturing, an increase from 13.3% in 2013 to 13.6% in 2014 (see Таблицу7). This means that the economy is trying to change the vector of its development, videlicet, to become competitive in the global market not only due to the resource potential, but also due to the finished products release.

**Table 7.** Organizations innovation activity in economic activities (percent) (Federal state statistics service, 2016)

	2010	2011	2012	2013	2014
Total	9,5	10,4	10,3	10,1	9,9
Mining	7,8	8,4	8,2	7,6	7,5
Manufacturing	13,0	13,3	13,4	13,3	13,6
Production and distribution of electricity, gas and water	5,4	5,6	5,6	5,3	5,1

Communication	15,6	13,8	13,3	14,2	12,2
Activities related to computers and information technologies	10,0	9,2	9,4	9,6	8,8

According to date, the most promising areas of innovation are biotechnology and nanotechnology in the part, they relate to human health, as it is ensuring that human health and the extension of his life is one of the main incentives of the global innovation process based on the human capital (Interfax CEA). And without the use of the human capital it is impossible to carry out the development in these areas, as in all others. In addition, you should continue to invest in those sectors where there has been sufficient groundwork for further development.

It is advisable to develop and support the innovative activity in the electrical and optical equipment manufacture, electrical power equipment. The production specificity of these products allows receiving orders for several years ahead. As energy resources are exhausted in near future (after 28 years, see above), it will require new technology development in complex fields, where we'll need innovative equipment.

Major oil companies began to reconsider their views on oil production. In oil production we have almost the world's lowest coefficient of oil extraction from the depths, at 30%, whereas in USA the figure is 50% (Gazizov & Galeev, 2014). Consequently, about 70% of the oil just is ruined due to the technological imperfections. Up to a certain point this circumstances was common, until the American companies started the shale oil production, which made significant competition due to its prevalence. The resource extraction technology represents a significant threat to Russian oil and gas companies. The United States already produce shale gas in large volumes and are developing a plan for the shale gas supply in Europe that will make a serious competition to Gazprom. And then the world advantages of Russia in the gas supply to Europe will be completely lost, therefore lost a considerable profit for the economy.

Thus, new technologies, and contributed to the views revision on the business conduct by large corporations. Namely, in 2011, 46 large companies with state participation have developed and approved the innovative development program (Gazizov & Galeev, 2014). The list of these corporations included oil and gas companies as "Rosneft" and "Gazprom".

**Table 8.** R & D funding, RUB mln (Gazizov & Galeev, 2014)

Years	2011	2012	2013	2014	2015
«Rosneft»	8552	9160	10605	11492	12524
«Gazprom»	8310	7710	7870	11200	15730

Table 8 shows that the volume of R & D funding in these companies is increasing every year. In the "Rosneft" company R & D financing for 5 years increased to 1.46 times and the "Gazprom" company 1.89 times. This is a very good dynamics of innovative processes development in the extractive sector of the economy. According to the natural resources and ecology Minister Sergey Donskoy, our country has oil reserves for approximately next 28 years that is about 29 billion tons. Gas reserves are 48-49 billion tons.

Increased investment in innovative products by state-owned companies may cause the incentive to invest in new technologies development by other companies. Such process will result an increase in aggregate demand for various innovative products. This will involve in the innovation processes of small and medium businesses, as well as various scientific organizations.

### Discussions

In post-industrial society there was a transition to use the complex workers' labour, capable to receive the vast knowledge and rapid retraining, to make independent mastery of the knowledge and to use it in the course of employment. A natural resource based economy came to a knowledge economy where the main resource is an intellectually trained worker, formed on the basis of global information networks and intellectual technologies.

The formation of the human capital theory began in the late 1950's – early 1960-ies of XX century. A pioneer, who has devoted serious work on human capital, was the American economist T.W. Schultz (1971). In 1960 he published his work "the Formation of capital education" and in 1961 "Investment in human capital". Major work Professor of Economics and sociology, University of Chicago, G.S. Becker (2003), "Human capital" has become a classic of modern economic thought of the West. Thanks to these work the human capital theory formed, and its authors were awarded the Nobel Prize, which confirms the significance of this theory in the development of the world community.

There are many definitions and approaches to the concept of "human capital". T.W. Schultz (1971) and his followers in the definition of human capital focus on education, G.S. Becker (2003) and his supporters talking about the versatility of this concept, calling for investing not only in education but also in health, migration and give a broad interpretation of human capital. It's very popular the human capital interpretation by L. Thurow (1970), Y. Ben-Porath (1970), F. Machlup (1966) as the ability to produce goods and services and generate income. Quite interesting is the definition of human capital by Russian scientists A.I. Dobrynin, S.A. Dyatlov & E.D. Tsyrenova (1999), which treat human capital formed as a result of investment and accumulated human's health, abilities, knowledge, skills and motivations, which is advantageously used in the working process, promoting the productivity and earnings growth.

Despite the difference of approaches to human capital definition, they have in common; that the basis of human capital is different abilities to generate income, and this is an intense productive factor of economic growth in the knowledge economy.

In addition, the human capital refers not only to the stock of knowledge, not only to its use but also to self-expansion. If capital self-expansion is provided by labor and work force, than transformation of the latter into a kind of human capital supposed to have social knowledge, which gives employees a certain wage level. And knowledge over savings will provide higher individual income and highly skilled workers compared to the average level and below it. It will be over wage, part of which is educational quasi-rent that is similar to the profits derived from the use of capital.

Among the main investments types, human capital can be called investments in education. The analysis of the current situation in the field of public investment in education showed negative trends in Russia, in particular the expenditures reduction in this area in 2014, which negatively affects the formation of human capital in our country.

The analysis showed that the reduction in education systems financing, the decline in investment in the field of scientific developments and research lead to the decreasing trend in innovative development. This affects our country innovative development index, which makes it less attractive for foreign investments, so important for our economy at the present stage. Without innovative component in our country economy, it is quite difficult to escape from natural resources dependence. Because of this, we still can't move on to a new way of development. That leaves Russia behind many innovation processes, which could serve for the development of the economy and society as a whole. The innovations development in the economy will directly affect the welfare of the whole society in our country, improving the life quality of the population. This vector of development in the economy will reduce the outflow of qualified specialists from the country.

Innovations provide the opportunity to look from another point of view at the limited resources usage. Thanks to introduction of new innovative products, the income of the business increases, which improves the quality of extracted resources and, therefore, increases their value on the world market, that brings more income to the economy. It attracts new investments not only in production but also in scientific, educational centers that will allow our country to be a leader as in natural resources as also in innovative technologies.

Thus, it is safe to say that human capital development contributes to innovative breakthroughs in many areas.

### **Conclusion**

It is established that the developed countries have moved to the knowledge economy where the main resource is human capital, which is a complex multidimensional and multilevel concept. It is based on different abilities and talents of a person to generate income for himself, the firm, the state. Income is an educational quasi-rent, which is produced by highly skilled workers with knowledge in excess of the socially necessary level.

Highly qualified specialists are required in all sectors of the economy. In turn, highly qualified experts reinforce innovation processes in the economy. Therefore, it is necessary to increase innovation financing not only from the state but also business. And for this the government needs to provide tax relief to businesses investing in the innovative products creation. In addition, the government needs to increase subsidies of many research centers.

In the analysis process there are new questions and problems. It is necessary to continue studying human capital in the conditions of innovative development.

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## References

- Becker, G. S. (2003) Human behavior: economic approach. Selected works on economic theory. Moscow: higher school of Economics. 672p.
- Ben-Porath, Y. (1970) The production of Human Capital and the Life Cycle of Earnings. New York: London. 245p.
- Dobrynin A. I., Dyatlov S. A. & Tsyrenova E. D. (1999) The human capital in transitive economy, St. Petersburg: Nauka. 309p.
- Federal state statistics service. (2016) Retrieved from <http://www.gks.ru/>
- Forrester, S. V. (2014) Human capital as the subject of analysis of economic science. *Vestnik of Samara state Technical University. Series "Economics"*, 1 (11), 17-21.
- Forrester, S. V. (2015) Analysis of investment in education of the Russian Federation. *Modern Economics and Finance*, 12, 173-176.
- Gazizov, O. V. & Galeev, A. R. (2014) "Innovative technologies in the oil and gas sector of Russia: myth or reality". *Bulletin of Kazan technological University*, 16(18), 247-251.
- Gref G. (2016) Russia – the country-the downshifter. Direct access: <http://news-front.info/2016/01/15/gref-rossiya-strana-daunshifter/>
- Interfax CEA. Development of the innovation component of Russia's economy: the prospects and role of economic policy. Direct access: <http://www.group.interfax.ru/default.asp>
- Labour and employment in Russia. (2015) Retrieved from [http://www.gks.ru/wps/wcm/connect/rosstat\\_main/rosstat/ru/statistics/publications/catalog/doc\\_1139\\_916801766](http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/publications/catalog/doc_1139_916801766)
- Machlup, F. (1966) The production and distribution of knowledge in the United States. Moscow: Progress. 464p.
- Nesterov, A. A. & Forrester, S. V. (2010) The issue of human capital in modern economies. Samara: Samara state technical University. 179p.
- Nesterov, A. A. & Forrester, S. V. (2013) Educational quasi-rent as a new income from the use of human capital. *Vestnik of Samara state Technical University. Series "Economics"*, 3(9), 16-25.
- Rakitov, A. I. (1991) The philosophy of the computer revolution. Moscow: Publishing house of political culture. 287p.
- Report on human development in the Russian Federation for 2004. (2003) Retrieved from <http://www.undp.ru/index.php?lid=2&cmd=publications1&id=49>
- Science indicators (2015). The statistical compilation. Direct access: <chrome-extension://ecnphlgnajanjnkembpancdjoidceilk/https://gisp.gov.ru/upload/iblock/8e6/indikatory-nauki-2015.pdf>
- Schultz, T. W. (1971) Investment in Human Capital. New York, The Free Press. 272p.
- Terentyev, A. M. & Mironov, D. D. (2016) State and main problems of innovative entrepreneurship at the present stage of development of the Russian economy .VII international student electronic scientific conference "Student scientific forum". Direct access: <http://www.scienceforum.ru/2016/1592/17201>
- The Global Innovation Index (2015) Direct access: [http://www.wipo.int/econ\\_stat/en/economics/gii/](http://www.wipo.int/econ_stat/en/economics/gii/)



The Ministry of Finance of the Russian Federation. Direct access: <http://minfin.ru/ru/>

Thurow, L. (1970) Investment in Human Capital. Belmont: Belmont University. 351p.

Yuzhakova, T. & Karkachev, I. (2015) Bulletin on the state of Russian education 4. Direct access: <http://ac.gov.ru/files/publication/a/5474.pdf>