



# DEVELOPMENT OF THE RUSSIAN ECONOMY IN A TREND OF CURRENT TRENDS OF TECHNOLOGICAL EFFECTIVENESS AND KNOWLEDGE INTENSITY

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## Abstract

**Purpose:** A research objective is the analysis of the development of the Russian economy in a trend of current trends of technological effectiveness and knowledge intensity and establishment of a problem of the use of the human capital in the hi-tech enterprises of the industry of Russia.

**Methodology:** The analytical base of research was made by the official statistical data characterizing the development of the economic environment of activity of the hi-tech enterprises with emphasis on the sphere of scientific research.

**Result:** The innovative economy which creation is determined by strategically important task of the Russian society ensuring national sovereignty and economic security assigns the central part to a special type of assets - to the human capital which perspective of development is especially relevant for the hi-tech enterprises of the industry which immanent sign is the high share of intellectual work, its innovative and knowledge-intensive character.

**Applications:** This research can be used for universities, teachers, and students.

**Novelty/Originality:** In this research, the model of Development of the Russian Economy in a Trend of Current Trends of Technological Effectiveness and Knowledge Intensity is presented in a comprehensive and complete manner.

**Keywords:** *High-Tech Enterprises, Human Capital, Knowledge Intensity, Scientific Developments, Hi-Tech Economy.*

## INTRODUCTION

The knowledge-intensive and technological development of economy demands formation of new approach to the human capital of the hi-tech enterprises, determination of prospects of development of the human capital for increase in efficiency of work and return of the invested means (Bijl, 2011, Grosman, 2000, Mayo, 2012, Tretyakova, 2015, Becker, 1990, Chiswick, 1974). In relation to a subject of a relevant research it is necessary to carry out establishment of problems and assessment of results of use of the human capital of the hi-tech enterprises, starting with the analysis of tendencies of technological and knowledge-intensive development of the Russian economy that answers specifics of the studied enterprises (Gerasimov, Tretyakova, 2017, Krakovets'ka, 2010, Maltseva, 2014, Vardapetyan, 2009).

## METHODS

The analytical base of research was made by the official statistical data characterizing the development of the economic environment of activity of the hi-tech enterprises with emphasis on the sphere of scientific research. During the research the analysis of dynamics of changes for 2011-2017 of the indicators characterizing volumes of public financing of scientific research, costs of research and development is carried out; volumes of investment into fixed capital of the organizations of the sphere of research and development; the number of the organizations which were carrying out research and development; the quantitative and qualitative structure of the personnel occupied with research and development. A set of indicators chosen for the analysis, according to us, allowed capturing research all basic types of economic resources.

## RESULTS AND ITS DISCUSSION

The share of production of high-tech and knowledge-intensive industries in country gross domestic product acts as the key macroeconomic indicator characterizing technological effectiveness and knowledge intensity of national economy, according to Rosstat for 2011-2014 the tendency of dynamics of this indicator had forward character, and in 2015 was reduced by 0.3 percentage points in relation to the level of 2014 and made 21.3%. It, in our opinion, is a direct consequence of the economic crisis which aggravated because of the beginning of "trade and sanctions wars". This circumstance exerted an impact on the reduction of the specific weight of production of high-tech and knowledge-intensive industries in a total amount of imports reduced only in one 2015 from 61.4% to 58.7%. In 2016 the share of production of high-tech and knowledge-intensive industries in gross domestic product increased to 22.1%.

As the positive characteristic of change of knowledge intensity of domestic economy it is also necessary to note the gain of internal current costs of research and development which made for 2011-2017 67.2%, at the same time growth rate of the expenses on civil science financed from the federal budget in the specified period was lower, growth rate of internal current costs of research and development.

We consider that this circumstance acts as indirect evidence of activation of the financing of research and development made from others except for the federal budget, financing sources, including at the expense of own means of economic

subjects. Confirmation of this assumption is a reduction of the specific weight of expenses on civil science from the means of the federal budget estimated in relation to the total amount of internal current costs of these purposes (tab. 1).

**Table 1:** Financing of science

Indicators	2011	2012	2013	2014	2015	2016	2017	2017 2011 (+; -)
Internal current costs of research and development, billion rubles - all	568.4	655.1	699.9	795.4	854.3	873.8	950.3	381.9
Expenses on civil science from means of the federal budget, billion rubles - all	313.9	355.9	425.3	437.3	439.4	402.7	377.9	64.0
as a percentage:								
to expenses of the federal budget	2.87	2.76	3.19	2.95	2.81	2.45	2.30	-0.57 п.п.
to gross domestic product	0.53	0.53	0.60	0.56	0.54	0.47	0.41	-0.12 п.п.
to the total amount of internal current costs of research and development - all	55.23	54.33	60.76	54.97	51.43	46.1	39.8	-15.43 п.п.

Source: compiled and calculated by authors based on data of Rosstat (In Russian)

Since 2011 the tendency of noticeable growth of the specific weight of internal costs of research and development in the priority directions of development of science, technologies and the equipment in a total amount of internal costs of research and development is observed. This growth is especially noticeable and steady by hi-tech types of economic activity, by average tech types of economic activity negative dynamics of change of an indicator is observed. In the structure of internal current costs of research and development on growth rates, other expenses dominate, and the share of the expenses connected with compensation is reduced. [Vasin, S., Gamidullaeva, L., Shkarupeta, E., Palatkin, I., & Vasina, T. \(2018\)](#)

Growth of internal costs of research and development in the studied period was followed by growth of inventive activity and number of the submitted applications for the issue of patents that, in our opinion, it is possible to recognize as the resulting indicator of activation of inventive activity (tab. 2). [Vasin, S., Gamidullaeva, L., Shkarupeta, E., Palatkin, I., & Vasina, T. \(2018\)](#)

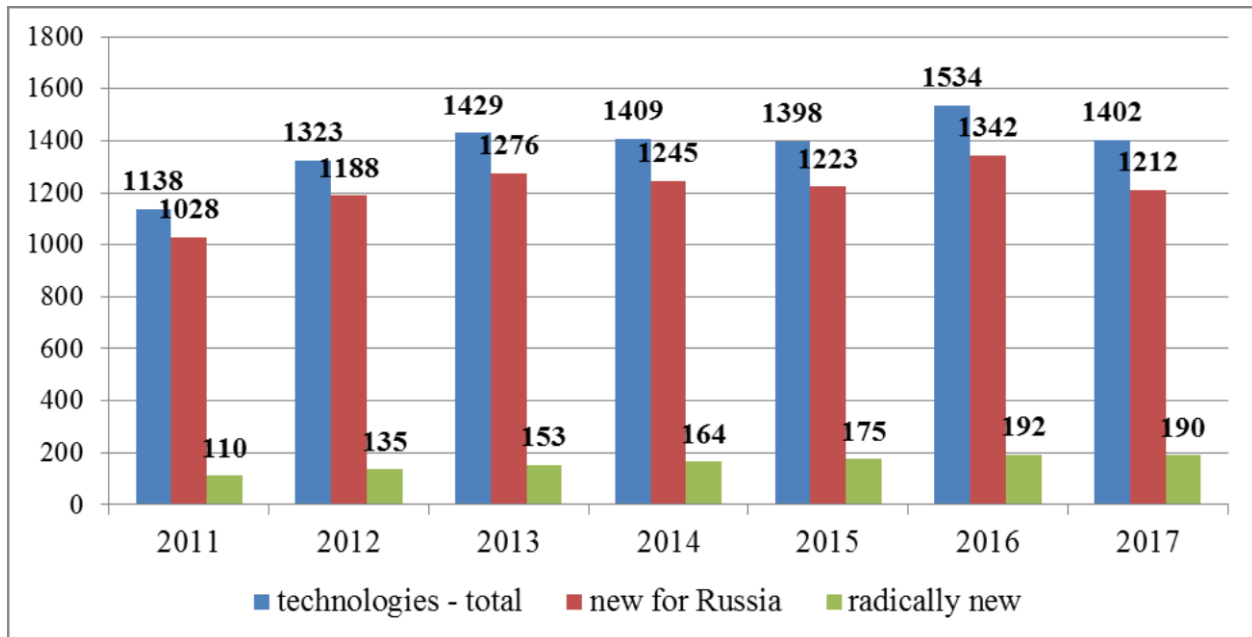
**Table 2:** Efficiency of research and development

Indicators	2011	2012	2013	2014	2015	2016	2017	2017 2011, %
Coefficient of inventive activity, per 10 thousand people of the population, piece.	1.85	2.00	2.00	1.65	2.00	1.83	1.55	83.8
It is given applications for issue of patents: on inventions - everything, piece.	41414	44211	44914	40308	45517	41587	36454	88.0
on useful models - all	13241	14069	14358	13952	11906	11112	10643	80.4
on industrial samples - all	4197	4640	4994	5184	4929	5464	6487	154.6
It is given out patents: on inventions - everything, piece.	29999	32880	31638	33950	34706	33536	34254	114.2
on useful models - all	11079	11671	12653	13080	9008	8875	8774	79.2
on industrial samples - all	3489	3381	3461	3742	5459	4455	5339	153.0
A number of existing patents - everything, piece.	236729	254891	272641	292048	305119	314615	326624	138.0

including: on inventions	168558	181515	194248	208320	218974	230870	244321	144.9
on useful models	46876	50746	54420	58238	57448	53263	50078	106.8
on industrial samples	21295	22630	23973	25490	28697	30482	32225	151.3

Source: compiled and calculated by authors based on data of Rosstat (In Russian)

The positive moment in dynamics of security of national economy with the advanced production technologies is the obvious growth of number of the developed technologies as in general (on 264 units), and subdivided by criterion of their novelty: new to the country - on 184 units; essentially new advanced production technologies - on 80 units (fig. 1).



**Figure 1:** Developed advanced production technologies by the degree of novelty, number

The leading positions on the number of developed production technologies are steadily taken by the sphere of research and development and also the knowledge-intensive types of economic activity. In a specific section of the developed advanced production technologies, obvious leaders in 2011-2017 were production technologies, processing, and assemblies. The situation in the sphere of use of nanotechnologies in the economy of Russia appears as similar: the number of the used nanotechnologies obviously exceeds the number of developed. However, as a positive moment, it should be noted the forward growth of a number of the developed nanotechnologies traced throughout the entire period of research here.

[Gassmann, O., & Von Zedtwitz, M. \(1999\)](#)

In general, it is necessary to recognize the dynamics of technological and knowledge-intensive development of national economy positive, but at the same time rates of development remain low, despite a tendency of growth of the number of the organizations which were carrying out research and development, made 107.1% for 2011-2017. And the number of institutions of higher education which are carrying out research and development caused, first of all, by the increase - for 67% (tab. 3).

**Table 3:** Research and development organizations

Indicators	2011	2012	2013	2014	2015	2016	2017	2017 2011,%
Number of the organizations which were carrying out research and development - all	3682	3566	3605	3604	4175	4032	3944	107.1
non-profit organizations	79	77	79	71	91	96	121	153.2
From the total number of the organizations: research organizations	1782	1744	1719	1689	1708	1673	1577	88.5
design organizations	364	338	331	317	322	304	273	75.0
design and design and survey organizations	38	33	33	32	29	26	23	60.5
experimental plants	49	60	53	53	61	62	63	128.6
educational institutions of the higher	581	560	671	702	1040	979	970	167.0

education								
the organizations of the industry which had the research, design directions	280	274	266	275	371	363	380	135.7
others	588	557	532	536	644	625	658	111.9
The volume of costs of performance of research and development counting on one organization, million rubles.	154.4	183.7	194.1	220.7	204.6	216.7	240.9	156.0

Source: compiled and calculated by authors based on data of Rosstat (In Russian)

In staffing of the knowledge-intensive development of the economy of Russia certain changes which, are negative also took place. So, the total number of personnel occupied with research and development for 2011-2017 decreased by 3.7% and was 707887 people, at the same time reduction is observed on all categories of personnel (fig. 2).

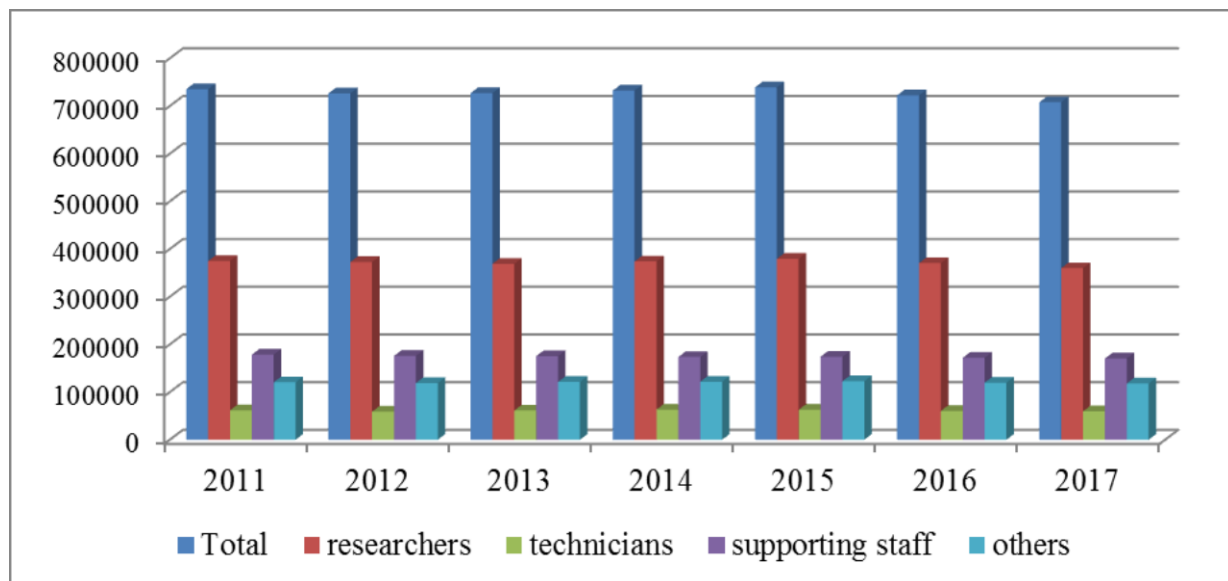


Figure 2: R&D personnel by occupation, persons

Tendencies of dynamics of change of a number of researchers in the fields of sciences also, according to us, are negative. For 2011-2017 growth of number of researchers is observed on public and humanitarian fields of science, respectively for 6.8 and 3.9%; on the technical fields of science the number of researchers was reduced slightly - by 1%, essential reduction of researchers is observed in the field of natural sciences (for 10.9%) and medical sciences (for 11%), on agricultural sciences reduction is the most considerable and makes more than 20%. [Vardapetyan, V. V. \(2009\)](#)

As one more negative tendency, it is necessary to recognize the essential reduction of the specific weight of a number of researchers with academic degrees in the total number of researchers for 2011-2015, so their share was reduced from 29.2 to 21.5%.

## CONCLUSION

In the studied period the specific weight of production of high-tech and knowledge-intensive industries in the gross domestic product was a little more fifth part, was characterized by a tendency of forward, but slow growth. Internal current costs of research and development annually increase, with the outlined tendency of attraction to their financing of others, except the federal budget, sources. In the priority directions of development of science, technologies and the equipment costs of research and development most in high gear grow in hi-tech types of economic activity. In the structure of the expenses current costs of research and development on growth rates, other expenses dominate, and the share of the expenses connected with compensation is reduced. [Vasin, S., Gamidullaeva, L., Shkarupeta, E., Palatkin, I., & Vasina, T. \(2018\)](#)

On static and dynamic indicators, the highest innovative activity characterizes the organizations of the sphere of research and development. The positive characteristic of change of technological security of economy is the growth of a number of the developed advanced production technologies as in general and subdivided by the criterion of novelty on new to the country and essentially new. In the development of new production technologies, the organizations of the sphere of research and development and also the knowledge-intensive types of economic activity are in the lead.

At the same time, the technological development of the economy remains at a low level that is confirmed by the size and dynamics of the specific weight of the developed advanced production technologies in a total of the used technologies. In the sphere of nanotechnologies, a similar situation is observed. [Dzhukha, V. M., Kokin, A. N., Li, A. S., & Sinyuk, T. Y. \(2017\)](#)

Against the background of growth of a number of the organizations which were carrying out research and development (mainly at the expense of institutions of higher education) the number of other organizations is reduced.

Changes of staffing of technological and knowledge-intensive development of economy, in general, are negative that is proved by tendencies: the decrease in number of staff occupied with research and development in a section of all categories; "aging" of shots with academic degrees of doctors and candidates of science; essential reduction of number of researchers in the field of natural, medical and agricultural sciences against the background of growth of an indicator on public and humanitarian fields of science, essential reduction of specific weight of researchers with academic degrees in the total number of researchers. [Bernardini, O., & Galli, R. \(1993\)](#)

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