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# THE IMPACT OF PUBLIC INVESTMENT ON THE COMPETITIVENESS OF THE RUSSIAN R & D SECTOR

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## ABSTRACT

*The problem of managing the R&D sector sustainability in Russia is of particular relevance in terms of scaling external and internal challenges faced by the country. Such challenges require an even greater intensification of the efforts to solve the problems accumulated in Russian economy and innovation system and associated with the state transition to new technological way. A key criterion of R&D sector competitive sustainability is the creation of practice-oriented and relevant results of intellectual activity. Correlation analysis of innovative activity indicators in developed countries over the 2007-2015 revealed a pattern of two-fold excess of export licenses over the amount of public investment in science. This dependence is crucial in the study of competitive sustainability within R&D sector. The method of assessing the efficiency of public spending on R&D, including an analysis of the dynamics of the growth rate of performance indicators and their financing in case of R&D completed in the period is proposed as the main management tool of R&D sector competitive sustainability.*

**Key words:** Competitive sustainability, R&D, innovation, methods of evaluating the effectiveness of public expenditure on R&D, intellectual property, patents, publication activity.

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## 1. INTRODUCTION

The changing benefits associated with scientific advances, the results of which find their application in the real sector of the economy, are the basis of the modern national competitive sustainability. The sustainable development level of the R&D sector is a key strategic resource and competitive advantage of countries with high economy, providing both scientific–technological and socio–economic growth. The stability of the public R&D sector depends on science and technology policy, in particular, on directions of state support of science development, their funding and relevance of results of intellectual activity (RIA) received, in the future.

Public investment in the R&D sector involve the use of the return mechanism, within which the state invests in science and receives a return in the form of socio-economic effects: increase of level and quality of the population life, the increase in tax revenues from the sale of high-tech products and more.

Some trends of modern public policy in this area can be identified on the basis of the study of legislative acts and policy documents of developed countries in the field of public R&D projects funding and evaluation of their effectiveness. Firstly, the characteristic feature is the use of software method of financing: public expenditure is based on government programmes for individual events, each of which has performance measures for its implementation. Secondly, the R&D projects funding in the framework programmes is carried out on the basis of flexible mechanism, allowing to adjust individual program elements. The flexibility of the mechanism is shown in particular in:

- the possibility to adjust the performance indicators depending on changes in the socio-economic conditions (correlating the change of socio-economic tasks priority) or to identify failure indicators in practice;

- the possibility to adjust plans for the implementation of the program based on objective factors, and the extent of the success and results of the implementation of the previous stages;

- the possibility to reallocate budget funds depending on objective circumstances (for example, changes in the priority areas of research), as well as the performance of specific entities engaged in R&D.

The formation of a stable trend of the state scientific and technical policy realization based on the definition of priority research areas that correlate with the most significant socio-economic challenges is another trend of public expenditure on R&D in innovative developed countries. The available resources, including financial ones, are concentrated on the development of these areas.

The problem of competitive sustainability ensuring in case of R&D sector is multidimensional. On the one hand there is the lack of public funding and support of R&D, on the other hand, there is the lack of effective communication between science and the real sector of economy, ensuring the use of RIA in practice.

The goal of achieving competitive sustainability within R&D sector lies in increasing of the state innovation development level, accessing to world markets, meeting the challenges in the field of technological independence.

# 2. LITERATURE REVIEW

## 2.1. The theoretical basis of the public R&D investment impact on competitive sustainability of R&D sector

One of the tools to control the stability of the R&D sector is the financial management, ensuring the growth of RIA at a more rapid rate than public investment in R&A.

A number of authors contend that there is practically no industry sources of competitive advantage, ensuring the stability of the company for the long term (Collis 1994; D'Aveni 1994; McGrath 2013; Ruefli and Wiggins 2003).

However, other authors highlight the availability and use of the patented invention as the main criterion of company competitive sustainability. Thus, the patent provides long-term competitive advantage and is a major resource for the development (Reitzig 2004; Sander and Block 2011; Schankerman 1998).

Fundamental research devoted to problems of R&D sector competitive sustainability in Russia is absent. There are works associated with the analysis of industrial organizations competitive sustainability (Borodin 2015; Zakharov 2006; Pecherkina 2005), the market of educational services (Dolatowski 2006; Mokhnachev 2009), the entrepreneurship sphere (Finin 2000) and also competitiveness as the essential properties of the market economy (Larichev 2008).

The category of competitive sustainability involves the ability of a subject to "create, develop and maintain the competitive advantage for the strategic period, as a distributed time-competitiveness" (Zaichkina 2012). Stability of the enterprise has the ability to form and use in the long run the total potential of providing favorable market position" and represents "a set of resources, processes and tools that define the opportunities of a dynamic market environment" (Kiselev, Yakovleva 2012).

A key criterion of competitive sustainability is the subject's ability to allocate time and financial resources in order to consistently obtain the RIA required, providing continuous innovation.

There are different approaches to evaluate public investments in developed countries, which allow us either to reallocate the budget in time or to adjust the indicators according to the changing political and socio-economic conditions. In particular, the American system of budgeting operates on the basis of the U.S. Government Performance Results Act ("On the evaluation of the performance of government institutions", GPRA 1993). In accordance with the GPRA requirements, each agency prepares a report on the results of its activities for the previous financial year indicating the level of planned indicators achievement. If the actual indicators are not met, the agency must explain the reasons and determine the schedule of activities aimed at implementation of indicators. If the results of the reporting period indicate that the initially selected target is unattainable, the agency in its reports require to explain this and to suggest new wording. The evaluation system of the efficiency of public sector investment in R&D in the UK is based on the evaluation of the research potential program (Research Excellence Framework - REF) and provides an assessment of scientific activities of the organizations (universities) in the UK, which is held for 36 research areas by specialized expert subcommittees under the direction of the 4 Central commissions (Panel criteria and working methods).

Thus, there still remain many unresolved theoretical and applied issues within the field of R&D sector competitive sustainability. In particular, there is no theoretical – methodological basis of the content of R&D sector competitive sustainability, as well as the control mechanism of this category.

## 2.2. Empirical base of public R&D sector competitive sustainability

Russia ranks fourth in the world in terms of federal budget financing of R&D (by purchasing power parity) after the US, China and Japan, however, it ranks only eighth in terms of the total volume of science funding (1). This is caused by the fact that the public expenditure in R&D funding sphere is two times more than the expenditure of extrabudgetary sources (Fig. 1).

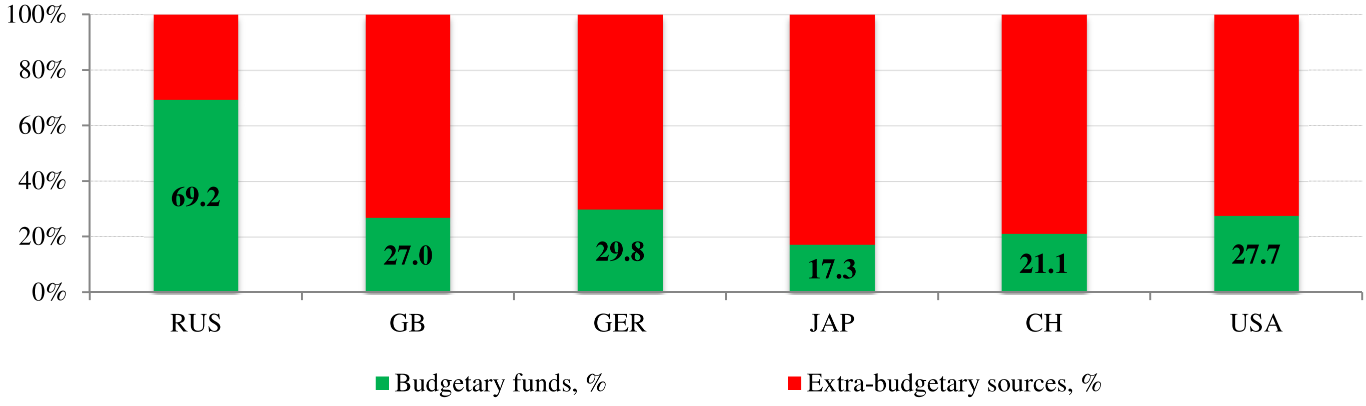


**Figure 1. T**he ratio of budgetary and extra-budgetary support for R&D (%), 2017 (2)

Source: Authors' calculation

The situation in foreign countries is completely different: the business plays the most active role and the government creates and maintains favorable conditions for its development through the introduction of RIA in the economic turnover.

The priority direction of public support of the R&D sector in innovative developed countries is the development of science and high-tech industrial production. In terms of environmental degradation, the rise of the food problem and the emergence of new types of diseases, the countries under study also support the health care research. The US pays special attention to R&D financing in the field of national security and space exploration, Japan considers energy as particularly important sphere and Sweden focuses on the development of transport and telecommunications (3).

The Russian state investment in science correspond in general to global trends: the development of science, industry and technology, health care, space exploration, transport and telecommunications (4).

A new key technology trends are now developing which are not yet fully underlying industry technologies, but can potentially cause substantial change in the technological picture of the world in long-term (and some medium-) period by shifting investment priorities and creating space for new players (Ponomarev A., Dezhina I., 2016). Such trends include: new technologies of hydrocarbon production; new energy; advanced manufacturing technologies -in the development of several additive techniques the creation of physical objects are 3D printers, robotics); new agricultural technologies; new pharmaceutical and medical technology (technology for genome editing); new Photonics (a new generation of information technologies); neurotechnologies.

One of the main conditions of R&D sector competitive sustainability is the availability of relevant practical patented RIA. The level of demand for these RIA is expressed in growth rate of export licenses and high-tech products.

In Russia, the creation of RIA is primarily supported through public investment. Also, the public sector significantly supports the R&D in the United States, Germany and the UK (which totals about 30%).

Dynamics of growth rates of the indicators influencing the level of public R&D sector competitive sustainability are presented on Table 1 (the Appendix).

Analysis of R&D sector competitive sustainability indicators (GDP, exports of high-tech products, the expenditure on R&D, government expenditure on R&D, exports license fees) of the leading countries in GDP 2003-2017 allowed to reveal the correlation between the volume of public investment, the results obtained (the demand for licenses on a global level) and their use in the real economy (the production of high-tech products).

An important pattern has been identified on the basis of the analysis of international public R&D sector competitive sustainability experience (USA, Germany and the UK) for a 2008-2016: the average growth rate of revenues from exports of rights to the results of R&D, including technology is about 2 times faster than the average growth rate of public expenditure on research and development (Fig. 2).

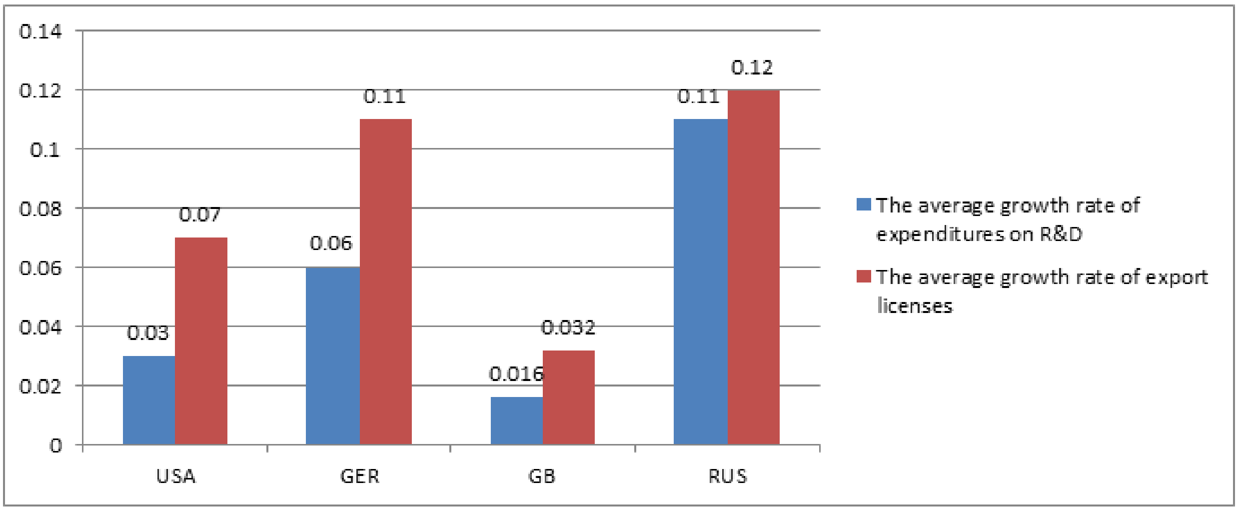


**Figure 2.** The relation of the average growth rate of export licenses to government spending on R&D, 2009 -2017

Source: Authors' calculation

In Russia, this trend is not observed for two reasons: due to the fact that there is no significant involvement of the business sector in R&D and because of the transparency of public R&D expenditure effectiveness evaluation.

The growth rate of R&D expenditures and license fees for the period of 2008-2016 cumulatively helped to identify R&D sector competitive sustainability trends in the United States, China, Japan, EU countries (Table 2, the Appendix).

Public investment in a number of innovative developed countries generally support the strategic directions of development of the R&D sector and application-oriented research is carried out mostly by extra-budgetary investment. In this case, the average growth rate of licenses exceeds the growth rate of public investment (China, Japan, Italy).

Speaking about the countries where public funding is crucial, the economic effect is achieved when the growth rate of public investment exceeds the growth rate of the licenses approximately by 2 times.

In the absence of this pattern the question of the effectiveness of public investment in R&D should be examined.

Thus, in connection with necessity of R&D effectiveness increase in the conditions of innovative economy development and the formation of its potential, development and implementation of a methodology for assessing the effectiveness of public R&D investment is of particular relevance.

# 3. EMPIRICAL PREDICTIONS AND METHODOLOGY

## 3.1. Hypotheses

In some countries there are different approaches to evaluate public sector investment in R&D. The basis of the approaches implied is the project-program principle of governance.

*Project-program approach* involves the assessment of the efficiency of public spending on R&D through the achievement of key performance indicators (KPIs), incorporated in the state programs, i.e. fulfillment of the indicators planned.

The authors have developed the following approach to the assessment of public investment efficiency on the basis of the regularities of R&D sector competitive sustainability formation revealed in the course of the study.

*The approach based on the analysis of growth performance (RIA) and R&D funding, completed on a certain date.* The average growth rate of performance indicators (number of RIA created, RIA introduces, publications) must exceed the average growth rate of public investment in R&D, completed at a certain date. If growth rates are the same, then we can talk about a "break-even point" of public investment.

The first approach focuses on the assessment of the key performance indicators achievement in the R&D sector, while the second approach allows assessing the efficiency of public investment as an indicator of R&D sector competitive sustainability.

If we consider each approach separately, then the project-program approach takes into account only the achievement of the indicators outlined in the state programs, and related results obtained additionally are not taken into account, as planning, in this case, is considered to be ineffective. In the approach based on the analysis of the growth performance dynamics it is necessary to determine the boundaries limiting the growth of performance indicators (where necessary) and the optimal time lag for assessing the effectiveness of public R&D spending.

Common problems specific to these approaches include:

- the determination of the optimal performance indicators set;

- the determination of the extra-budgetary funds share in the total amount of R&D funding as an indicator of the demand for RIA from the real sector of the economy.

Assessing the effectiveness of public R&D investment is based on the following principles:

- redistribution of public investment to promote scientific and technological potential and research capacity, ensuring the creation of new knowledge-intensive industries and technological upgrading of existing industries;

- continuity of R&D support at all stages of the intellectual property object life cycle;

- coordination of financial instruments that support the creation of intellectual property and regulatory measures to stimulate their introduction into economic turnover;

- involvement of the existing scientific and technological potential in R&D and its commercialization;

- achieving the target values of the ratio of budgetary and extra-budgetary financing of R&D works depending on the level of financial risk and development sectors of the economy;

- continuity and regularity of the monitoring process of the public R&D investment effectiveness.

### 3.2. Methodology

Methodical approach to assessing the effectiveness of public financial support of R&D should establish common rules and determine the key indicators reflecting the performance of such support and the use of science as a tool for ensuring the achievement of the indicators of the state socio-economic development.

The author's approach to assessing efficiency of public investment, based on the analysis of growth performance (RIA) and R&D funding, completed on a certain date, by progressive total, includes the following steps:

Step 1. The calculation of the growth rate of R&D performance indicators.

$$S^{`} = \frac{S^T}{S^{T-1}}, \quad (1)$$

where $S^T$ is the value of the corresponding indicator of the R&D impact in the reporting year;

$S^{T-1}$ is the value of the corresponding indicator of the R&D impact in the previous year.

$S^{`}$ is the growth rate of R&D performance indicators.

Step 2. The calculation of growth rate of extra-budgetary funds aimed at financing R&D activities.

$$R^{`} = \frac{R^T}{R^{T-1}}, \quad (2)$$

$R^T$ is the amount of extra-budgetary funds aimed at R&D funding in the reporting year;

$R^{T-1}$ is the amount of extra-budgetary funds aimed at R&D funding in the previous year;

$R^{`}$ is the growth rate of extra-budgetary funds aimed at R&D funding.

Step 3. The calculation of the growth rate of public spending, aimed at financing R&D activities.

$$F^{`} = \frac{F^T}{F^{T-1}} \quad (3)$$

$F^T$ is the amount of public funds aimed at R&D funding in the reporting year;

$F^{T-1}$ is the amount of public funds aimed at R&D funding in the previous year;

$F^{`}$ is the growth rate of public funds aimed at R&D funding.

Step 4. The calculation of the ratio of the average growth rates of R&D (E) productivity and public investment by progressive total (I).

$$\frac{E}{I} = \frac{(\sum_{i=1}^{n}((\sum_{i=1}^{k} S^{`} + R^{`})/m))/n}{\sum_{i=1}^{n} F^{`}/n} \quad (4)$$

n is the number of periods analyzed (at least 3 years);

k is the number of S-indicators;

m is the total number of performance indicators for the period;

$E$ is the average growth rate of productivity for the period by progressive total (for at least 3 years);

$I$ is the average growth rate of state funding over the same period by progressive total (for at least 3 years).

Public investment in R&D is in the "breakeven point" if either the following condition:

$$\frac{E-1}{I-1} = \frac{1}{1}, \quad \text{or else } E = I \quad (5)$$

is met. Public investment in R&D will be effective if their average growth rate by progressive total will be less than the growth rate by progressive total performance: E > I

## 4. DATA AND SAMPLE DESCRIPTION

In Russia a significant proportion of research is carried out by the public sector, particularly organizations under the sectoral Federal Executive authorities (FEA) and organizations subordinate to the Federal Agency of scientific organizations (FASO). Information about the funding and impact of research conducted by these organizations is represented in the unified state information system of accounting of research results, skilled-design and technological works (1). This system aggregates information from 2016, at the moment the data contained therein are checked for compliance with annual reports

However, data loaded in the unified state information system of accounting of research results, skilled-design and technological works is sufficient to identify general R&D competitive sustainability trends within the institutions run by the federal authorities studied (Ministry of education and science, FASO, Ministry of industry and trade and the Ministry of healthcare).

Such indicators as the number of R&D works completed in the current year, R&D funding, attraction of extra-budgetary funds at carrying out of R&D works, the number of publications made in the framework of the R&D, the number of the RIA, the use of the RIA, the RIA funding, are used as effectiveness evaluation indicators.

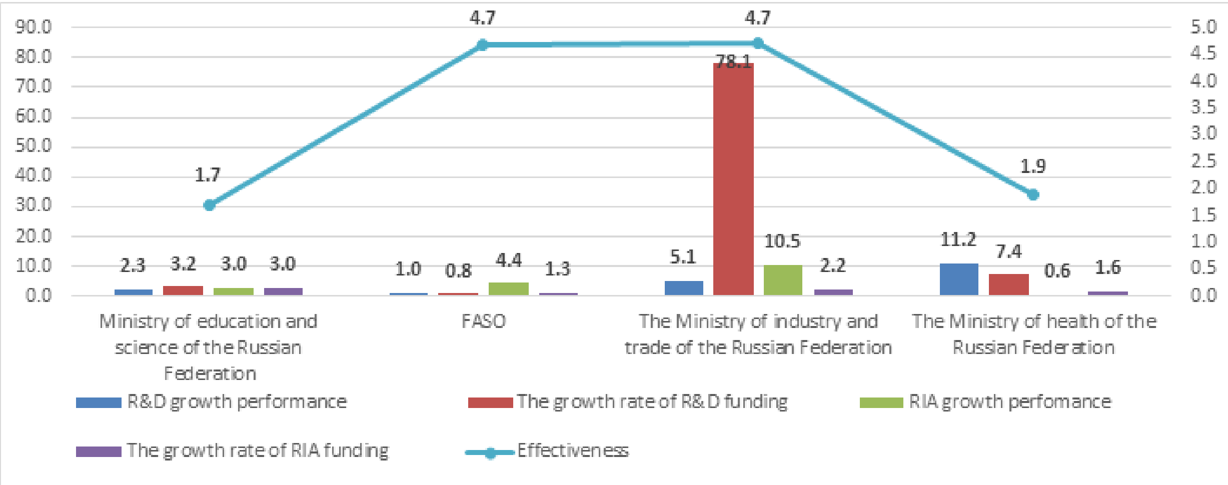


**Figure 3.** The efficiency of public investment in R&D of the FEAs studie

All FEAs studied are effective stewards of public funds in R&D sector. However, the highest level of public investment efficiency was demonstrated by FASO (while reducing funding significant growth in R&D productivity) and the Ministry of industry and trade of the Russian Federation (the increase in funding mainly from extra-budgetary funds, which has led to increased efficiency).

The Russian Ministry of education demonstrates the effectiveness of public investment in the creation of RIA at "breakeven point", but while financing R&D the volume of attracted extra-budgetary funds also increases.

The Ministry of health of the Russian Federation has serious difficulties in the practical application of the RIA in spite of the growth of R&D efficiency.

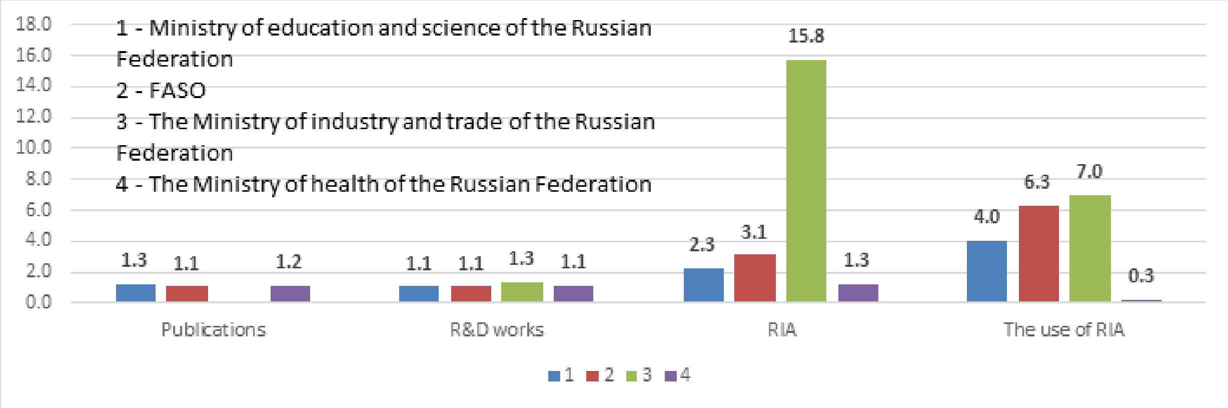


**Figure 4.** The growth rate of R&D performance indicators for organizations subordinated to Federal Executive authorities.

The Ministry of industry and trade of the Russian Federation is the leader among the FEAs analyzed in terms of extra-budgetary funding growth and the use of the RIA created; FASO is the leader in terms of popular RIA creation.

The results of the evaluation can be used to make management decisions in the redistribution of budgetary funds, aimed at creating critical mass of both radically new technology and technology that removes the dependency on imports and increase the level of R&D sector competitive sustainability.

## 5. CONCLUSION

The R&D sector competitive sustainability, as world experience shows, contributes to the transition of the state economy to a new technological way, the key success factor in this case is the financing efficiency of this sector.

Currently, Russia's share in the structure of global spending on basic R&D is 1.7% (USA total 28%, the share of China is 19.6% and the share of EU amounts 19%), moreover, it has a rather low level of patent activity and imports technology three times more than it exports. In spite of various measures undertaken in recent years, aimed at the development of R&D sector, its level does not meet the needs of economic and technological development of the economy and the global trends. Hence the reduction of spending on science per capita: nowadays they are 7 times lower in Russia than in the US, Japan and Germany. The cost of one researcher in Russia is 6 times less than in the US and 4 times less than in China.

The analysis of R&D sector competitive sustainability of developed countries has helped to identify the correlation between public investment and demand for the results from the real economy.

This study propose a mechanism for transparent assessment of the effectiveness of public investment in R&D on the basis of data from the unified state information system of accounting of research results, skilled-design and technological works. The results of approbation of this methodology allow us to conclude about the effectiveness of investment in R&D with the state budgetary funds.

A significant role in ensuring the scientific, technological and innovative potential of the state's economy is played by instruments for supporting scientific, scientific, technical and innovative activities, including scientific foundations. The main type of support for research and development of such funds in this area is grant financing, carried out on a competitive basis, as well as subsidizing and co-financing.

Funds for the support of scientific, scientific, technical and innovative activities contribute to the creation of favorable conditions for research and development that correspond to the modern principles of the organization of scientific, scientific, technical and innovative activities. Tools for supporting such funds aimed at improving the level of development of highly qualified personnel in the research and development sector are financing internships both Russian and foreign, holding conferences, symposiums, seminars and other events necessary to gain experience and popularize the results of domestic research and development.

The results of such evaluation allows, firstly, to correct the current state scientific and technical policy taking into account the political and socio-economic changes (adjustment of the effectiveness and efficiency indicators set), secondly, to monitor and change the allocation of public funds according to the effectiveness of specific agencies that support RTD, and, thirdly, to adjust the strategy of scientific and technological development of the state. Consequently, the assessment of the effectiveness of public investment in R&D in order to identify existing and potential opportunities for the production and commercialization of IP will solve the challenges that government faces in the field of re-industrialization of the economy and import substitution.

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# THE APPENDIX

**Table 1. Dynamics of growth of public R&D sector competitive sustainability indicators, 2007-2015**

| Indicator | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | The average growth rate |
|---|---|---|---|---|---|---|---|---|---|---|
| **USA** | | | | | | | | | | |
| The growth rate of total R&D expenditure | 1,08 | 1,08 | 1,07 | 1,00 | 1,01 | 1,05 | 1,02 | 1,05 | | 1,04 |
| The growth rate of budgetary R&D expenditures | 1,04 | 1,05 | 1,12 | 1,07 | 1,01 | 1,00 | 0,97 | 0,98 | | 1,03 |
| The growth rate of expenses of the budget | | | | | | | | | | |
| The GDP growth rate | 1,06 | 1,04 | 1,02 | 0,98 | 1,04 | 1,04 | 1,04 | 1,04 | 1,04 | 1,03 |
| The growth rate of export licenses | 1,12 | 1,17 | 1,04 | 0,96 | 1,09 | 1,15 | 1,01 | 1,03 | 1,02 | 1,07 |
| The growth rate of output/ton of product | 1,15 | 1,00 | 1,01 | 0,60 | 1,10 | 1,00 | 1,02 | 1,00 | 1,05 | 0,99 |
| **Germany** | | | | | | | | | | |
| The growth rate of total R&D expenditure | 1,09 | 1,05 | 1,11 | 1,01 | 1,06 | 1,10 | 1,04 | 1,02 | 1,05 | 1,06 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| The growth rate of budgetary R&D expenditures | 1,06 | 1,05 | 1,14 | 1,06 | 1,08 | 1,08 | 1,02 | 1,01 | | 1,06 |
| The GDP growth rate | 1,05 | 1,15 | 1,09 | 0,91 | 1,00 | 1,10 | 0,94 | 1,06 | 1,03 | 1,04 |
| The growth rate of export licenses | 0,9 | 1,2 | 1,2 | 1,0 | 1,1 | 1,3 | 1,0 | 1,3 | 1,1 | 1,11 |
| The growth rate of output/ton of product | 1,11 | 0,94 | 1,04 | 0,88 | 1,13 | 1,16 | 1,00 | 1,05 | 1,03 | 1,04 |
| **The United Kingdom** | | | | | | | | | | |
| The growth rate of total R&D expenditure | 1,09 | 1,05 | 1,02 | 1,00 | 0,97 | 1,03 | 0,99 | 1,08 | 1,06 | 1,03 |
| The growth rate of budgetary R&D expenditures | 1,06 | 1,02 | 1,01 | 1,06 | 0,96 | 0,97 | 0,93 | 1,09 | 1,05 | 1,016 |
| The GDP growth rate | 1,07 | 1,15 | 0,94 | 0,83 | 1,04 | 1,08 | 1,01 | 1,03 | 1,10 | 1,03 |
| The growth rate of export licenses | 1,0 | 1,1 | 0,9 | 1,0 | 1,0 | 1,0 | 0,9 | 1,1 | 1,2 | 1,032 |
| The growth rate of output/ton of product | 1,45 | 0,48 | 1,05 | 0,79 | 1,26 | 1,16 | 0,97 | 1,02 | 1,02 | 1,02 |
| **Russia** | | | | | | | | | | |
| The growth rate of total R&D expenditure | 1,26 | 1,16 | 1,13 | 1,15 | 0,95 | 1,06 | 1,08 | 0,97 | 1,09 | 1,10 |
| The growth rate of budgetary R&D expenditures | 1,25 | 1,19 | 1,17 | 1,18 | 1,01 | 1,01 | 1,09 | 0,96 | 1,11 | 1,11 |
| The GDP growth rate | 1,30 | 1,31 | 1,28 | 0,74 | 1,25 | 1,25 | 1,06 | 1,03 | 0,89 | 1,12 |
| The growth rate of export licenses | 1,1 | 1,3 | 1,2 | 0,9 | 1,0 | 1,4 | 1,2 | 1,1 | 0,9 | 1,12 |
| The growth rate of output/ton of product | 1,01 | 1,06 | 1,23 | 0,89 | 1,12 | 1,07 | 1,30 | 1,22 | 1,14 | 1,01 |

Source: Authors' calculation

**Table 2.** R&D sector competitive sustainability trends in the United States, China, Japan, France, Italy and Russia

| Indicator | Years | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
| USA | | | | | | | |
| The average growth rate of expenditures on R&D, by progressive total | 1,05 | 1,07 | 1,07 | 1,06 | 1,05 | 1,04 | 1,03 |
| The average growth rate of licenses, by progressive total | 1,15 | 1,11 | 1,08 | 1,08 | 1,09 | 1,08 | 1,07 |
| China | | | | | | | |
| The average growth rate of expenditures on R&D, by progressive total | 1,16 | 1,15 | 1,17 | 1,18 | 1,15 | 1,16 | 1,15 |
| The average growth rate of licenses, by progressive total | 1,49 | 1,55 | 1,35 | 1,47 | 1,37 | 1,38 | 1,31 |
| Japan | | | | | | | |
| The average growth rate of expenditures on R&D, by progressive total | 1,03 | 1,03 | 1,03 | 1,02 | 1,02 | 1,03 | 1,03 |
| The average growth rate of licenses, by progressive total | 1,15 | 1,13 | 1,06 | 1,09 | 1,09 | 1,09 | 1,08 |
| France | | | | | | | |
| The average growth rate of expenditures on R&D, by progressive total | 1,05 | 1,06 | 1,06 | 1,05 | 1,04 | 1,04 | 1,04 |
| The average growth rate of licenses, by progressive total | 1,30 | 1,25 | 1,14 | 1,13 | 1,13 | 1,09 | 1,08 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Italy | | | | | | | |
| The average growth rate of expenditures on R&D, by progressive total | 1,04 | 1,04 | 1,03 | 1,03 | 1,03 | 1,03 | 1,03 |
| The average growth rate of licenses, by progressive total | 0,96 | 1,90 | 1,63 | 1,53 | 1,46 | 1,40 | 1,33 |
| Russia | | | | | | | |
| The average growth rate of expenditures on R&D, by progressive total | 1,22 | 1,20 | 1,20 | 1,16 | 1,14 | 1,13 | 1,11 |
| The average growth rate of licenses, by progressive total | 1,18 | 1,17 | 1,11 | 1,09 | 1,15 | 1,16 | 1,15 |