
Research and Development Intensity in Business: Russia and EU

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Abstract:

The present study is devoted to the investigation of the intensity of research and development importance in Russian Federation and EU. The authors selected economics of EU and Russian Federation countries as the object of the study.

The subject of research is the intensity of research and development in Russian Federation and EU in the context of the priority sectors: state sector, scientific sector, business sector. In the given article the authors consider the semantic definition of «the intensity of research and development», the dynamics of research intensity indicators and development in Russia and EU, the authors' assessment of the choice of priorities for research and development sectors is also given.

According to the results of the study authors indicated the problem zone, discussion points and priorities for the further research. The authors also give recommendations for the Russian practice.

Key Words: *Intensity, research and development, GDP, EU, Russia, state sector, business sector, science and education sphere*

JEL Classification Codes: *F60, F63, O35, O44*

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Introduction

The strategy of European development till the year of 2020 determines research and development as the key objective of country's development, with the key indicator of efficiency set to ensure the strategic goal of 3% of GDP. In order to ensure the growth of the intensity of research and development, EU is planning the formation of a common scientific space, in which the free interaction on the model «researcher-knowledge-technologies» will take place. In the given context, there appear a number of questions: what is the state of things on the specified direction in Russia and how to relate the strategic priorities in this field across countries (Akopova and Przhedetskaya, 2016; Dasanayaka and Sardana, 2015; Ryzhkova and Prosvirkin, 2015).

Based on the said above, the purpose of the study is defined by the authors as the study of trends and strategic priorities for the financing of research and development in the cross-country perspective. Consideration of the issues of research and development intensity is a hard task, since the area of the objective study is the following:

- firstly, in understanding the definition of «intensity of research and development» itself;
 - secondly, research and development intensity index is the key indicator of the effectiveness of strategic development for many countries and plays a significant role in the assessment of cross-country competitiveness, which determines its complexity and diversity, requires the application of interdisciplinary approaches for the research and actualizes a comparative retrospective analysis on the example of the actual index values in Russian Federation and some of EU countries.
- Thus, this is the context and logics of the given study.

Theoretical, Informational and Empirical, and Methodological Grounds of the Research

«The intensity of research and development» is a complex category. In order to determine its semantics, it would be useful to consider a system of concepts - «intensity - research - development» and later on, taking into account its peculiarity, to give the definition «the intensity of research and development». We are going to carry out the study of semantic influence of the definition «R & D intensity» with the help of content analysis technology.

US National Science Fund defines the intensity of research and development as the ratio of research experimental work and GDP.

Efremova T. in her dictionary defines «intensity» as high voltage or force that can give the highest performance. The electronic encyclopedia «Grandaras» defines

«intensity» as a relative indicator, expressed through the degree the extent of one phenomenon among other phenomena.

Research and Development (R&D) is the term which is commonly used to describe the activities done by firms and other entities such as individual entrepreneurs in order to create new or improved products and processes. The widest meaning of the term presupposes activities from basic scientific research performed in universities and laboratories all the way to testing and refining products before commercial sale or use. The performance of, incentives for and the contributions of R&D are topics that are widely studied in management, economics, and other social science disciplines. Total spending on R&D activities is also one of the most widely used indicators of the innovative performance of firms, industries, and countries (Dmitrishina and Uskov, 2015; Epifanove *et al.*, 2015; Frank *et al.*, 2016; Havlíček *et al.*, 2013; Tsvetkov *et al.*, 2015).

Definition Research and development (R&D) comprise creative work undertaken on a systematic basis in order to increase the stock of knowledge (including knowledge of man, culture and society) and the use of this knowledge to devise new applications. The Frascati Manual of the Organization for Economic Cooperation and Development (OECD), first published in 1963, created an international standard for surveys of spending on R&D. This manual defines R&D.

R&D covers three activities: basic research, applied research, and experimental development. Basic research is experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundation of phenomena and observable facts, without any particular application or use in view. Applied research is also original investigation undertaken in order to acquire new knowledge; it is, however, directed primarily towards a specific practical aim or objective.

Experimental development is systematic work, drawing on existing knowledge gained from research and/or practical experience, which is directed to producing new materials, products or devices, to installing new processes, systems and services, or to improving substantially those already produced or installed (Theriou, 2015; Theriou *et al.*, 2014; Zachariadis, 2013). The main aggregate used for international comparisons is gross domestic expenditure on R&D (GERD).

This consists of the total expenditure (current and capital) on R&D carried out by all resident companies, research institutes, university and government laboratories, etc. It includes R&D funded from abroad but excludes domestic funds for R&D performed outside the domestic economy. GERD is here expressed in constant 2005 dollars (adjusted for purchasing power parity) and as a share of GDP (R&D intensity).

In International Accounting Standards determination of R&D is presented in the form of two separate definitions, namely «research» is original and planned investigation, undertaken with the prospect of gaining new scientific or technical knowledge and understanding and «development» is the application of research findings or other knowledge to a plan or design for the production of new or substantially improved materials, devices, products, processes, systems, or services, before the start of commercial production or use (Carstina *et al.*, 2015; Liapis *et al.*, 2013).

Research is planned search or critical investigation aimed at discovery of new knowledge with the hope that such knowledge will be useful in developing a new product or service (hereinafter "product") or a new process or technique (hereinafter "process") or in bringing about a significant improvement to an existing product or process. b. Development is the translation of research findings or other knowledge into a plan or design for a new product or process or for a significant improvement to an existing product or process whether intended for sale or use. It includes the conceptual formulation, design, and testing of product alternatives, construction of prototypes, and operation of pilot plants. It does not include routine or periodic alterations to existing products, production lines, manufacturing processes, and other on-going operations even though those alterations may represent improvements and it does not include market research or market testing activities.

Research and development—Basic and applied research in the sciences and engineering and the design and development of prototypes and processes. This definition excludes quality control, routine product testing, market research, sales promotion, and sales service, research in the social sciences or psychology, and other non technological activities or technical services.

R&D is defined as the collection of efforts directed toward gaining greater knowledge or understanding and applying knowledge toward the production of useful materials, devices, and methods. R&D investments can be characterized as basic research, applied research, development, R&D equipment, or R&D facilities.

It's necessary to outline the following types of work: fundamental and applied research and development. Fundamental research is aimed at obtaining new knowledge (without any objective to use this knowledge). The result of fundamental research can be hypotheses, theories, methods, etc. They are completed, as a rule, by the recommendations of the applied research, scientific publications, etc.

Applied research is aimed at obtaining new knowledge with the objective of exact practical application. Applied research determines all possible ways of using the results of fundamental research, new methods to solve the problems stated before.

Developing works are based on existing knowledge gained from research and (or) experience aimed at creating new materials, products, processes, devices, services, systems, or methods.

From the point of the study we define «the intensity of research and development» as the magnitude of the ratio of gross domestic spending (current and capital), carried out by resident organization (including research institutions, non-commercial organizations, etc.) aimed at financing fundamental, applied research and experimental development activities as a percentage of GDP within the borders of the state. From the author's point of view, the given indicator should be calculated per capita of the working population, as it will allow neutralizing the effect of the large-scaled state and making more adequate assessment. This comparative assessment must be carried out not on the basis of the value actually received in the current period, but based on an assessment of the dynamics of data changes of indicators based on the methodology or basis of chain indexes. Since that is exactly the thing, which will allow to consider the peculiarity of the process intensity.

Current trends analysis of the research intensity and development in Russia and EU

In Russian Federation the study of research and development intensity issues are studied both at the state level and in the scientific field. In particular:

- Unified information and analytical portal of the state support for innovative business development deals with the study of research intensity and developments in Russian state-owned companies and foreign partner companies, while as mechanism tools of innovative development programs are used and the mechanism of financing of research and development at the expense of state-owned companies;
- National Research University «Higher School of Economics» publishes its report on the monitoring of the index of industrial production intensity;
- Agency of Strategic Initiatives studies the issue of effective mechanisms for attracting investments, the development of standards of executive power of subjects of Russian Federation to ensure favorable investment climate in Russian Federation, provide the evaluation of the investment portal quality of RF subjects.

Federal State Statistics Service keeps a record of statistic data on domestic expenditures on research and development in Russian Federation.

Republican Research Scientific-Consulting Centre of Expertise publishes information on the structure of domestic expenditures on research and development in Russian Federation and the sources of their financing.

It should be noted, that Federal Purpose-oriented Programs are used as one of the instruments to support research and development in Russian Federation, which

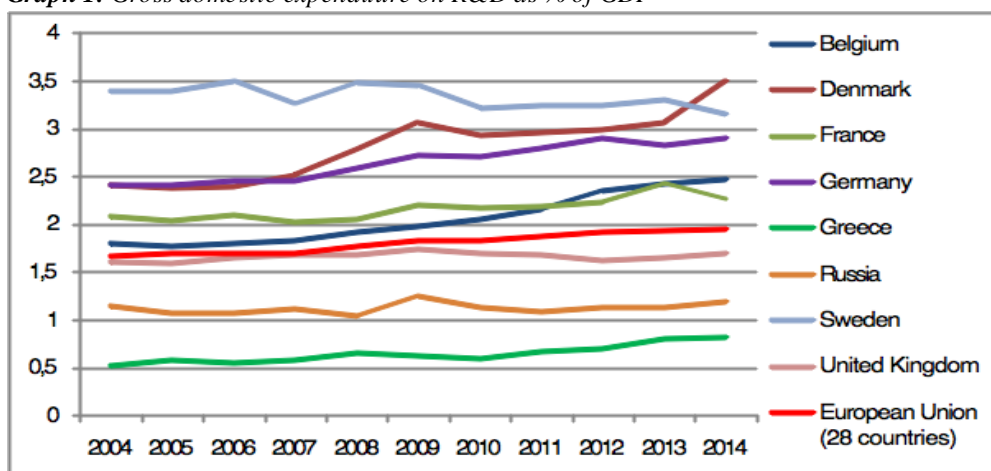
include 21 critical technologies and 6 priority areas of research and development in the Russian Federation till 2020.

In Germany, suchlike issues are the priority zone of the Expert Commission of Research and Innovation (EFI), which publishes research reports, innovation and technological activities in the country.

EFI focuses on R & D intensity in the following areas: pharmaceutical area, automobile industry, electrical engineering / electronics sector, chemical industry. In EFI reports it's stated that since 2009, research and development is oriented to meet short-term demand. The total amount of financing for research and development in Germany in 2014 made up to 83.6 billion Euro, which is 2.87% of GDP and 79.7 billion Euro or 2.83% of GDP in 2013. It should also be noted, that EFI monitors the intensity of research and development both as in the federal states, and at global scale. In Germany, to assess the intensity of research and development as one of the indicators used «indicator of internal research and development intensity», which is defined as the proportion of domestic expenditure on R & D as a percentage of sales of its own production. In Russia, State Statistics Committee also monitors domestic spending on research and development in the following aspects: totally throughout Russian Federation, separately in all subjects of Russian Federation, according to economic activity. Graph 1 shows the dynamics of the intensity of research and development, expressed in terms of domestic expenditures on research and development as a percentage of gross domestic product on the example of different countries.

It can be visibly seen on Graph 1 from the analyzed list of countries, the total amount of financing on the intensity of research and development in Russian Federation has nearly the minimum figure, and is significantly lower than the average amount for other 28 EU countries.

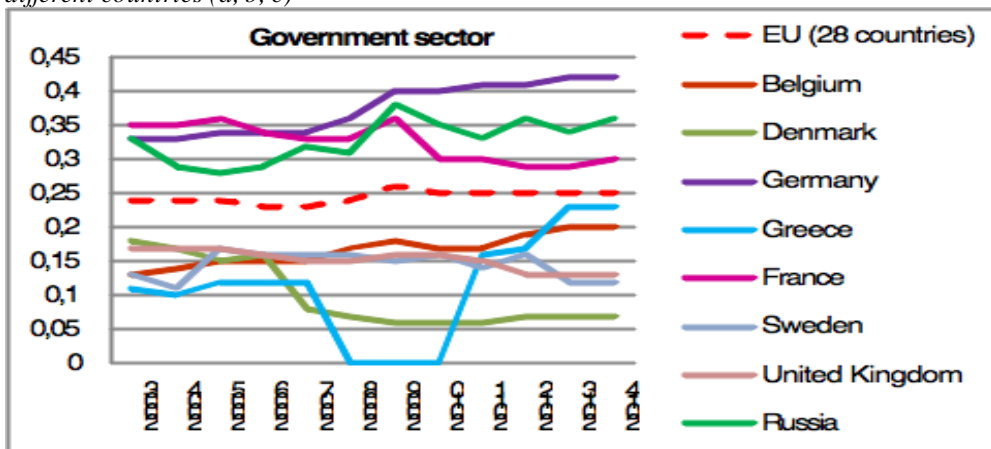
Graph 1. Gross domestic expenditure on R&D as % of GDP



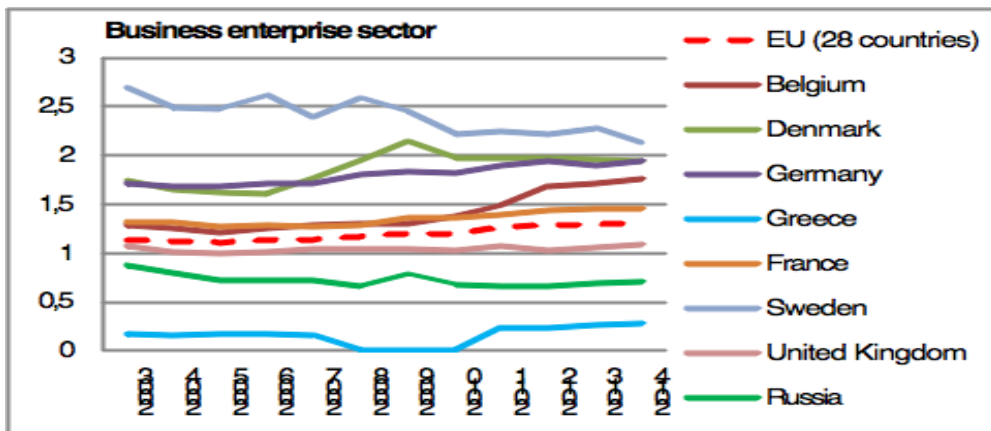
Source: Completed by the authors based on: Federal State Statistics Service. - Official site. - www.gks.ru - (date of the application September 17, 2016); OECD Data. - <https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm>

Further, it's necessary to consider the dynamics of expenditures on research and development in the context of three major sectors: the economy, higher education (universities), state sector (Graph 2). The Graph 2 shows that in Russia the expenditures on research and development in the state sector exceed the average indicator for EU countries, while indicators for two other sectors obtain almost insignificant level. Thus, we can say that the state sector is priority target for financing research and development in Russia, Germany and France, while for Denmark and Sweden priority target is financing research and development in the higher education sector. The concentration of target priorities in the Business enterprise sector is typical of countries such as Germany, Denmark and Sweden.

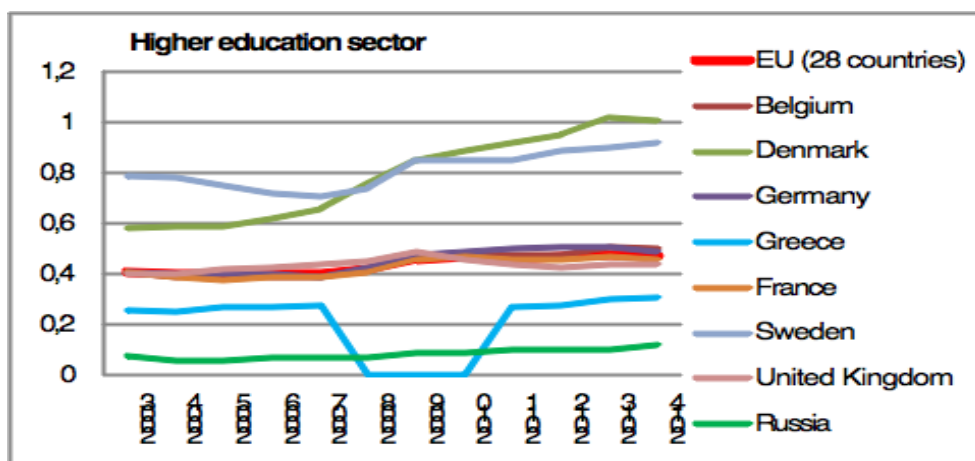
Graph 2. The expenditures on research and development in leading sectors in the context of different countries (a, b, c)



Graph. 2(a)



Graph. 2(b)



Graph. 2(c)

Source: Completed by the authors based on: Federal State Statistics Service. URL: www.gks.ru; Eurostat Database. URL: <http://ec.europa.eu/eurostat/data/database>; 20. *EFI, Forschung und Entwicklung C2, 2016.* URL: http://www.e-fi.de/fileadmin/Inhaltskapitel_2016/EFI_2016_C2.pdf

It should be noted that initially, concentration on domestic comparison between the subjects of the Russian Federation is typical of Russian specifics, but in recent years there is a growing trend of international comparison for the purpose of comparison with OECD countries, EU and CIS. For western and European countries it is typical to carry out both in-country and cross-countries comparison. Thus, «at the beginning of the year, the US National Science Foundation (NSF) released a report «Science and Engineering Indicators», where it's stated, that position of Chinese science and technology is gaining more prominent position in the world, China has already become the second powerful country in the world on the amount of R & D, scientific and experimental works.

The country takes the second place in the world on such indicators as investment in research and development, the release of publications, capacity of high-tech manufacturing, and etc., it has the first in the world in provision of scientific and engineering talents, and the first place in the global wind energy industry. From 2003 to 2013, expenditures in East and Southeast Asia for research and development are growing very fast, the most prominent is the rate of Chinese growth, which is one third of the amount of global growth of expenditures on research and development of scientific and experimental works, while European and American share has significantly decreased, the US share has declined from 35% to 27%, and Europe from 27% to 22%. At the same time, the share of countries and regions in East and South-East Asia has increased from 25% to 37%.

In the «Indicators» it's also pointed out that in different countries there is different degree of priorities on fundamental research, applied research and experimental

developments. In 2012, 5% of China's financing was spent on the support of fundamental research, the US share was 17%. On the other hand, China will provide 84% of financing on development, in the USA that share is 62% .

Analysis of research and development intensity in Russian economic entities indicates that today Russian economy has weaker position not only than leading industrial countries, but also the majority of Central and Eastern Europe countries, in many aspects of scientific, technological and innovation potential development. It should be noted that a special role in the revitalization of research and development in the private sector is given to the state regulation system of innovation sphere, which role is to create conditions (legal and institutional basis, financial tools) for its development and defining the requirements (priority directions of development, strict selection criteria of budget funds, which is explained by the need of targeted and efficient expenditure).

Since the possibility of direct state financing or subsidies to enterprises are limited, it is necessary to use indirect methods of state stimulation of research and development. First of all, we are talking about the tax regulation of the business sector in order to enhance its research and innovation potential. As an example, we can give measures of tax stimulation of special zones in Spain (cancellation of customs duties of imported equipment, which has no domestic analogues), France and Belgium (cancellation of tax payment on corporate income), Sweden (cancellation of tax payment in the amount of 10% from company's expenditures for research and others.).

France and Germany (writing-off of the current expenses on research and development, differentiated VAT rate), Austria, Hungary, Denmark and Belgium (additional tax credit). It should be noted that, despite the relatively wide range of tools of tax regulation, used by foreign countries, it is difficult to identify the most effective incentives for research and development (Nechaev and Antipina, 2016).

Everything of the said above can be explained by other factors (general state of the economics, demand for research and development, stage of the research and etc.), influencing the activation of research and development and effectiveness of the various state regulation tools. To prove the stated fact, it should be noted that there is a number of countries where there are practically no such targeted tax benefits, as a deduction of expenditures on research and development of taxable income, and tax research credit (Germany, Finland, Sweden), which occupy a middle position on direct state financing of research and development in private sector (8 percent in Germany and Sweden, and 4 percent in Finland in all private research expenditures), but are ahead of other countries in terms of R & D intensity in private sector.

There is quite low intensity of research and development in the countries with a fairly high rate of direct state financing for research and development: Spain and Portugal, Italy. Large countries with good index of private research and development

intensity (but less than in Sweden, Finland) - Great Britain, France - had a high level of state financing of private research and development (over 10 percent) and a significant attraction of tax stimulation. This proves that investment decisions in the sphere of business research and development are also determined by other factors, besides the state (both direct and indirect) subsidies of private research and development.

Analysis of tax tools of innovative processes that take place in Russia revealed a number of problems of tax incentives for private research and development because of poor experience to use this tool in the country. The usage of different tax benefits by Russian enterprises has some restrictions due to the imperfection of the legislation system, lack of experience to use these tools and other factors, all of that prevents the increase of research and development intensity in the country (Sibirskaya *et al.*, 2016).

The analysis of the theoretical foundations as well as data in the sphere of research and development, provided by the Federal State Statistics Service revealed a number of significant problems: low information transparency of research and development field, first of all, the lack of information about new technologies and potential markets; lack of own funds in the real sector of economy to implement the results of research and development, which have high cost and certain risks, long payback periods; low level of cooperation between scientific and research organizations, educational institutions and industrial enterprises, in terms of reproduction of scientific personnel, organizational maintenance of full cycle «generating knowledge - knowledge and technology transfer - the commercialization».

Discussion

Debatable point is the problem of considering the costs on research and development and approaches to assess their effectiveness, it is justified by the fact that the organization provide current financing, to get benefits in future, as a result there are two ways to consider the costs: classification the expenditures on research as spending or as intangible assets, but it is a problem of accounting and records, and it is not the field of the given research.

The second aspect that requires further study and discussion is the following, EU while forming statistical databases, are guided by the principles of Frascati standards, while Russian Federation is guided by the Federal Law № 282-FZ of November 29, 2007 (released July 23, 2013) «Official statistical accounting and state statistics system in Russian Federation», as a result there is a necessity of a single vector for the principles of formation operational databases, which is the background for a number of scientific and statistical reports.

The question for discussion is an indicator of research and development intensity, which presupposes disclosure of such aspects as:

- representation of a system of quantitative and qualitative indicators to measure the intensity of research and development;
- carrying out a comparative analysis on the set of intensity indicators of research and development in Russian and foreign practice, in order to form an adequate, flexible, integrated system of research and development intensity evaluation, containing a minimum set of relevant parameters and providing cognitive unity in carrying out cross-country comparisons.

Further research of the authors will be developed within the framework of the designated points of discussion.

Conclusions and recommendations

As a rule, the presentation of study results on research and development intensity in Russia and West European countries are considerably different. The formation of multi-page statistical books with a minimal text and maximum representation of tabular and graphic form is typical of Russia, while for European countries it is characteristic to have minimal information and substantial part of the text and a minimal number of tabular and graphic forms. In West European countries there is an opportunity to address primary data from the source, upload individual files in the form of Excel books, which allow comparative analysis without additional searching, in accordance with individual goals and objectives of researchers and analysts.

From the author's point of view, it is appropriate to recommend Russian organizations involved in the study of research and development intensity problems, to adopt West European experience in terms of structuring information in the forms of separate problematic units, its representation in the form of separate thematic documents, providing with subsequent discharge in the form of book-Excel with the original statistics.

We support the idea that Russia must have a unified server and website, which accumulate on the periods (one year as recommended period), statistically significant and important information on the problems of studying the research and development intensity.

There is a need to form some kind of common database platforms, similar to West European ones, which will not only organize and structure the problem statistically significant and important information, but also provide the opportunity to conduct a comparative analysis in retrospect, and will facilitate the implementation of the principle of openness and availability of a significant amount of high quality information for Russian researchers foreign scientists as well.

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