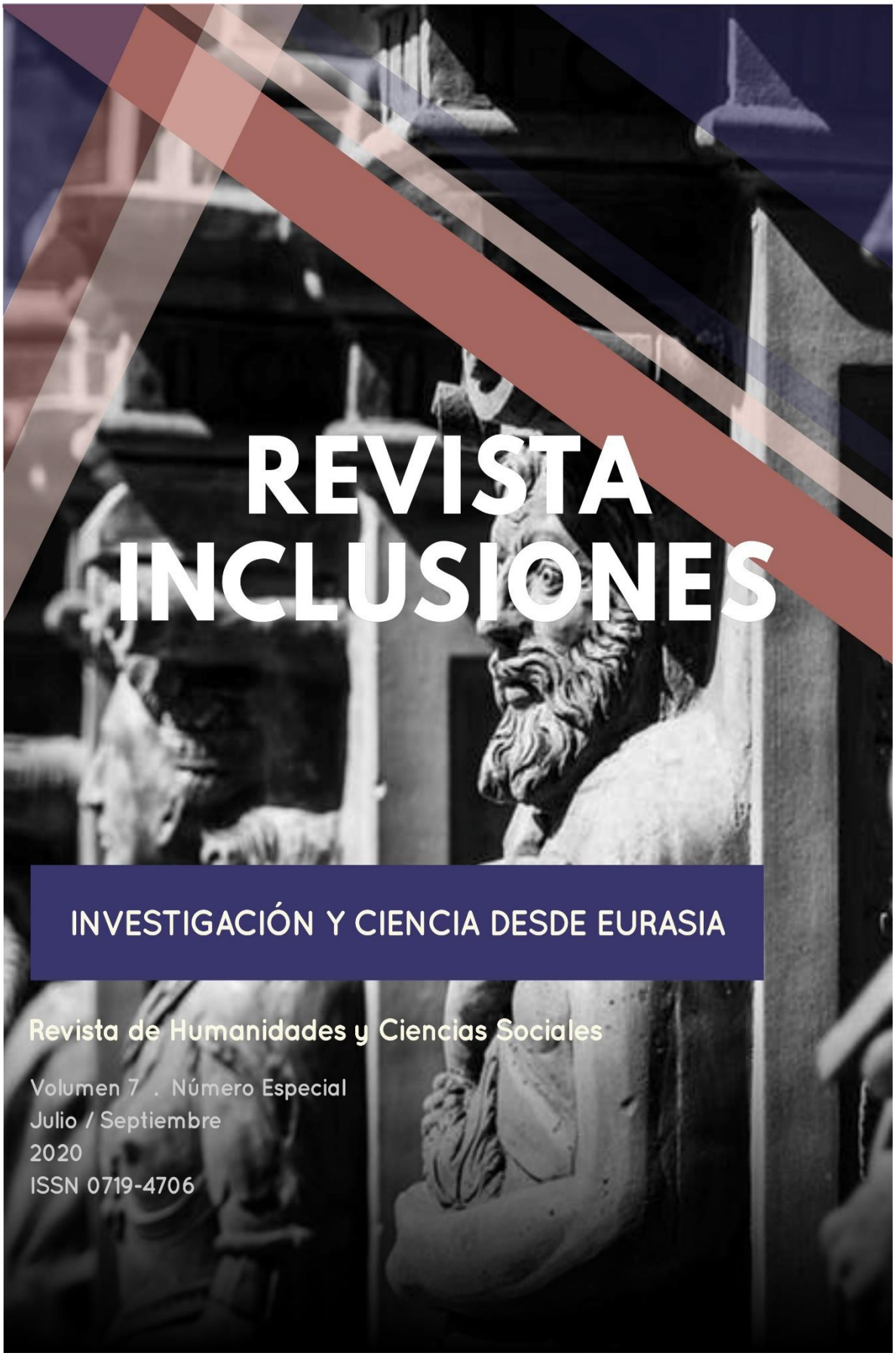

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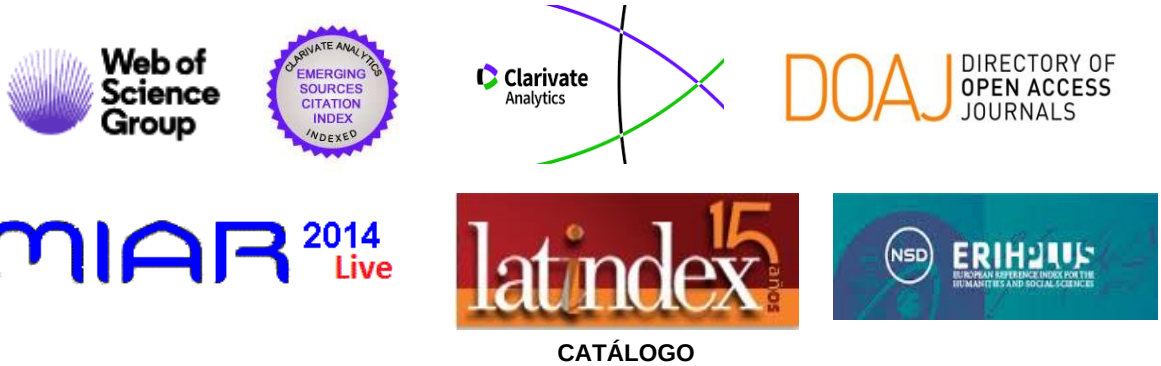

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ABOUT THE NEED TO DEVELOP INNOVATIVE DECOMPOSITION METHODOLOGICAL ASPECTS AS A WAY TO INCREASE EFFECTIVENESS IN CREATING HIGH-TECH PRODUCTS

Lic. Sergey E. Tsybulevsky
Joint Stock Company "Organization "Agat", Russia
https://orcid.org/0000-0001-7165-0906
tsybulevsky@mail.ru

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Abstract

This article's methodological basis is the work of domestic and foreign authors in the Research and Development (R&D) economic results analysis field in the high-tech products development. The proposed methodological approaches, taking into account the practice of implementing the results obtained in the R&D field, are focused primarily on the existing scientific potential rational use and ensuring scientific developments cost reduction. This study's purpose is to confirm the hypothesis of the interdependence presence in achieving potentially high results when performing R&D, provided that the previously obtained results of scientific and technical activity are decomposed. This article examines the issue's current state of the methodological approaches topics development in the R&D results analysis field in the high-tech products development, as an integral part of the management system tool in the innovative development field and the subsequent formation of a new technological economic paradigm. The methodological aspects of the innovative decomposition and subsequent analysis in the R&D field are based on the need for a comprehensive and critical assessment of the obtained results' economic effect based on retrospective and prospective studies, the results of which will subsequently form the basis for evaluating the program planning documents effectiveness and rational resources allocation.

Keywords

High-tech industries – Scientific and technical activities results decomposition – Competitiveness

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Introduction

This study analyzes the domestic costs volume for financing research and development in the R&D field in Russia's gross domestic product (GDP) based on a qualitative method for describing processes and results' subsequent interpretation. The research methods choice is determined by the direct study area, which is interdisciplinary in nature at the economic, financial and innovative issues junction.

Studies of the methodological aspects of decomposition and the subsequent R&D innovative results analysis are of a generalized popular scientific nature and are based on practical results and theoretical and conceptual approaches analysis, including in the R&D economic results effectiveness evaluating field and determine the directions for further more detailed study and proposals preparation to ensure a qualitative transition of high-tech industries to a new technological paradigm[1].

The methodological apparatus development for the scientific and technical activities results decomposition and the subsequent R&D results analysis in order to improve the project management system in the scientific research field is one of the possible key factors that can determine high-tech industries progressive development vector, in particular, identify innovation growth points, able to qualitatively change the reality nature[2]. The revealed interdependence between the potentially high economic results achievement during R&D is characterized by the need to develop an appropriate methodological apparatus that stipulates a retrospective analysis and subsequent qualitative innovative results decomposition in order to rationally use the resources and then obtain synergistic and multiplicative effects that contribute to bringing the industrial potential to a qualitatively different level of technological development. This need is dictated by factors such as:

- high-tech industries long-term development goals implementation, formed under the influence of policies in the relevant industry;
- existing and potential risks objective assessment that contribute to solving problems and achieving goals[3].

Russian experience analysis in the innovative high-tech industries evolution of industrialized countries

First, it should be noted that industrialized countries' industrial enterprises intense innovative activity was determined by serious state support measures for initiatives coming not only from large corporations, but also from multifunctional industrial enterprises specializing in individual projects in the innovation sphere and together forming the industrial innovation infrastructure basis of an economic sector, or a national economy sector[4].

[1] R. Nelson, National Systems of Innovation: A comparative analysis (New York: Oxford University Press, 1993).
[2] T. Foxon; P. Pearson; Z. Makuch & M. Mata, Transforming policy processes to promote sustainable innovation: some guiding principles (London: Imperial College, 2005).
[3] R. N. Zaripov, Features of Identification and Analysis of Risks of R&D of the Hi-Tech Industrial Enterprise. Proceedings of 2018 11th International Conference "Management of Large-Scale System Development". 2018.
[4] Chiang, M., Low, S. H., & Calderbank, A. R., & Doyle, J. C. Layering as optimization decomposition: A mathematical theory of network architectures. Proceedings of the IEEE. 2007.

Priority government policy measures provide, first of all, the solution for removing administrative barriers and creating the most comfortable conditions for all business entities working in the R&D field aimed at achieving breakthrough, qualitatively new results of scientific and technical activities that are ahead of the technical and technological development existing level, as well as the industries creation that promote quality transition to a new level of technological paradigm[5].

Creating favorable conditions for the innovative high-tech industries development, the state forms an innovative landscape, which is an integral part of the overall macroeconomic development strategy in a given historical period.

The scientific and technological potential transformation into a key factor in the Russian Federation development is identified as one of the priority areas. Having passed the adaptation stage to the market economy conditions at the turn of 1991-2001, characterized by the country's existing scientific and technological potential preservation, Russia entered the transition stage to building an innovative economy, accompanied by a significant increase in funding both in basic science as a whole and in applied R&D.

The actual results achieved and the potential economic consequences of a number of governmental programs show that there is currently a need to develop uniform, unified methodological approaches to the scientific and technical activities' results use and further application with a focus on improving the public administration and strategic planning efficiency in this area[6].

This study's purpose is the interdependence in achieving potentially high economic results presence hypothesis when performing R&D, based on the need for a high-quality innovative decomposition of the results obtained[7] and their subsequent use as a resource potential element that determines the further economic entity's development involved in the high-tech production process and the search for an independent investment source[8]. The resource potential rational use in the form of the scientific and technical activity results is a poorly studied topic in the context of creating a post-industrial innovative economy based on the scientific progress achievements use[9].

[5] I. M. Murakaev & S. E. Tsybulevsky, "Prospects for the development of high-tech industries of the domestic industry, taking into account the technological structure of the Russian economy using the example of the rocket and space industry", Microeconomics num 2 (2017): 29-32.
[6] S. E. Tsybulevsky; I. M. Murakaev; P. E. Studnikov & A. V. Ryapukhin, "Approaches to the clustering methodology in the rocket and space industry as a factor in the formation of a universal production model for the economic development in the space industry", INCAS Bulletin num 11 (2019): 213-220.
[7] I. M. Murakaev & S. E. Tsybulevsky, On the application of the decomposition method of previously obtained R&D and process works results for the subsequent formation of tangible and intangible assets from them, used in the production activities of enterprises in high-tech industries", Periodic scientific collection Modern Trends in the Development of Science and Technology num 1 Vol: 5 (2017).
[8] S. E. Tsybulevsky, "Using the factor of the rocket and space industry new corporate image formation with the variability of the search for sources of domestic investment for space industry enterprises", Moscow Aviation Institute Bulletin, num 22 (2015).
[9] M. Yarime, Coevolution of Environmental Regulation and Innovation Network: The Development of Lead-Free Solders in the United States, Europe, and Japan. Fourth European Meeting on Applied Evolutionary Economics, Utrecht, The Netherlands, 2005.

The stated research topic's study involves the methodological foundations and approaches coverage to the formation and subsequent disclosure of provisions describing the tools for the economic reproduction of competitive products with intellectual labor high added value, including a number of states limited by sectorial sanctions from foreign industrialized countries. Under the current conditions, the search for a mechanism for the scientific and technological knowledge efficient reproduction as the basis for the high-tech industries competitiveness in world markets is one of the urgent tasks of these countries' economies further development, including Russia[10].

At present, at the governmental level, clear universal methodological approaches and tools have not been fully formed in the adapted methods forms for the implementation of qualitative economic assessment of scientific and technical activities results effectiveness, as well as qualitative consequences' assessment of the state R&D programs' previously carried out financing [11]. A corresponding assessment of the results obtained is given at the departments level that are, as a rule, state customers of a certain R&D subject area, or independent experts who use standard approaches to assessing results achieved without taking into account the tasks' multi-criteria factor and the results' effectiveness [12].

Developed for satisfying the decree's requirements of the Government of the Russian Federation the Typical methodology for evaluating scientific organizations performance carrying out civil purpose R&D and adopted relevant industry methods does not cover the issues' full range relating to a systematic analysis of the R&D results, inter-branch transfer of received results, rational use of available resources, etc.[13]. At the same time, the fact that at the first stage the search for a way to formulate a universal methodology, that allows standardly and unambiguously assess the obtained result, is unpromising due to the variety and complexity of work in the R&D field, and the existing need to describe technological outputs with accurate recording of the obtained economic results[14]. However, the R&D results analysis' methodological aspects should include a certain set of elements that are common to many economic consequences, namely:

- selection criteria, on the basis of which the solution for decomposition[15] and the R&D innovative results' subsequent analysis;
- hypothesis and scenario of the obtained economic results impact formulation;
- collection, processing and analysis of primary data on the results source determination;
- obtained analysis's results summarizing and preparing a final conclusion on the basis of guidelines for assessing the economic R&D government programs consequences[16].

[10] N. I. Skrigan & N. N. Skrigan, "Stochastic wave trends – hierarchical approach application to market analysis", News of science and technology num 3 (2008): 42-50.
[11] UNCTAD, United Nations Conference on Trade and Development World investment report 2002 transnational corporations and export competitiveness (New York: United Nations, 2002).
[12] D. Stenholm; D. Corin Stig; L. Ivansen & D. Bergsjö, "A framework of practices supporting the reuse of technological knowledge", Environment Systems and Decisions num 39 (2019): 128–145.
[13] R. Calantone; K. Chan & A. S. Cui, "Decomposing Product Innovativeness and Its Effects on New Product Success", Journal of Product Innovation Management num 5 Vol: 23 (2006): 408 – 421.
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About the need to develop the government R&D programs' economic evaluation methodological aspects

The economic evaluation methodological aspects development is dictated primarily by the ever-increasing growth of global competition in world markets.

Structuring activities in the R&D results evaluating field should not be an episodic, uncontrolled process, but a systematic building an effective system process for creating high-tech innovative products that takes into account retrospective analysis[17].

The emerging need for evaluating R&D results is the result of ever-increasing competition in world markets and global interpenetration of the world economy[18].

The GDP analysis in Russia over the past decade (Figure 1) showed an increase in real terms of 398.16% (2005-2016). In the same period, the share of financing domestic R&D expenditures for research and development works increased by 0.03% (Figure 2) or about 715.25 billion rubles in real terms, which indicates an insufficient economy's technological paradigm's development level, the growth of which is offset the production extensiveness and, as a consequence, the further fixed assets obsolescence (retirement), instead of the corresponding thoughtful production intensification in the corresponding scientific and technological policy context.

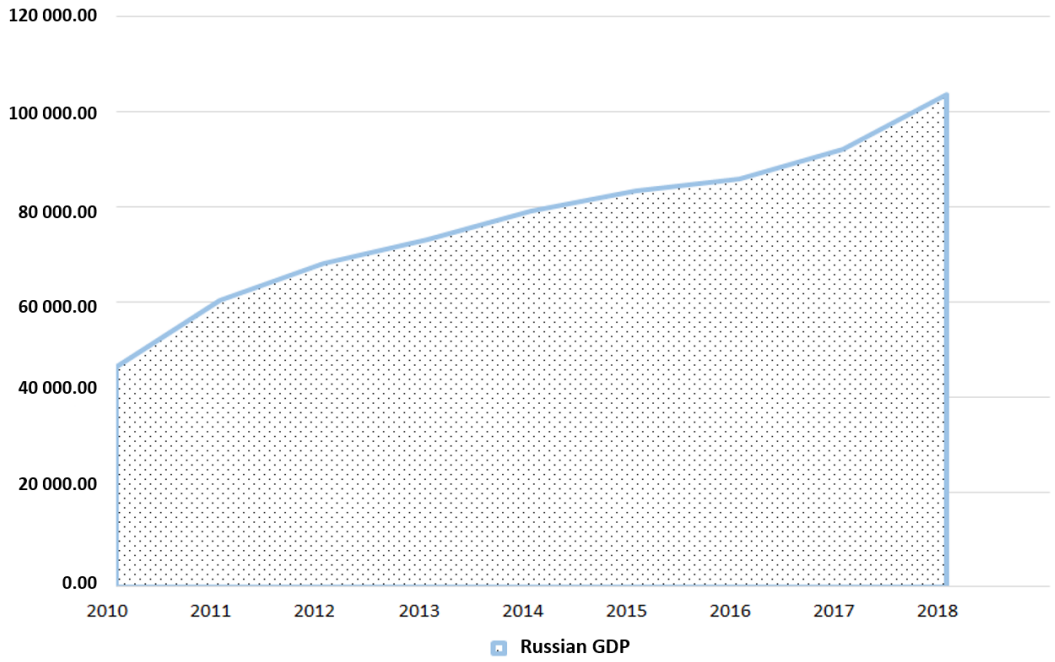

Figure 1
GDP analysis in Russia

[17] F. Hunt; C. J. Farrukh & R. Phaal, Technology re-use: developing a practical approach to making the most of your technological assets. 10th International Conference on Management of Technology (IAMOT 2001). 2001: 317-330.

[18] A. Irnazarow & P. Heisig, Designed to Fail? Challenges in Sharing Engineering Knowledge Across a Global Company. European Conference on Knowledge Management. 2015: 375-382.

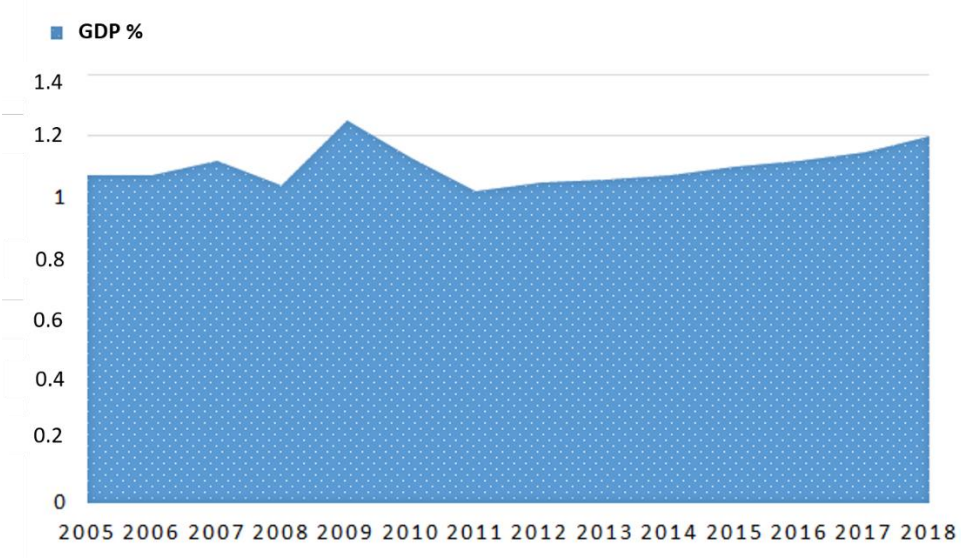

Figure 2
Domestic cost flow's financing share on research and development in the R&D field in Russia's GDP

Currently, in the global R&D financing practice, there are several general trends and patterns that have manifested in recent decades, namely:

- gradual increase in the innovation factor influence[19] of economic development as a fundamental element in building the entire public administration system both in the field of R&D and further macroeconomic development;
- financial costs burden redistribution in the direction of increasing the participation of non-state entities in investing in breakthrough technologies and focusing the state's role on supporting basic research and creating the appropriate infrastructure;
- emergence of new, dynamically developing countries represented by South Korea, China, India and others with a high level of high-tech production share, ready to compete with the recognized world economy leaders.

As a rule, high-tech industries research projects have long cycles, from development to the first prototypes and technologies testing, therefore, the planning horizon extends for more than one year and these projects' management should take into account both the intermediate economic effects and the final results, the economic consequences of which can be dispersed over time and generate new technical solutions types[20]. Therefore, work on a systematic analysis and assessment of the obtained R&D results impact suggests the presence of more detailed reporting, target indicators and methodological apparatus, contributing to the construction of a more effective system for managing investment processes in the basic and applied research field. It seems necessary to use an indicator reflecting the GDP's qualitative growth dynamics with high added value of the domestic high-tech industry intellectual labor as one of the criteria for such an assessment of the R&D effectiveness, taking into account the factor use the of R&D innovative decomposition.

[19] A. M. Pecea; O. E. Oros & S. F. Salisteanuc, "Innovation and Economic Growth: An Empirical Analysis for CEE Countries", Procedia Economics and Finance, num 26 (2015): 461-467.
[20] S. E. Tsybulevsky, "Ensuring the sustainable innovative development of the rocket and space industry through the formation of its new corporate identity", Bulletin of FSUE "TsNII Center" num 3 (2016): 104-115.

Conclusions

It seems advisable to differentiate the resource support distribution objectives for decomposed R&D results depending on the tasks being solved, highlighting such as: technologies' development that support social missions (in the field of health care, social welfare, etc.); maintenance and development of scientific and technological groundwork in the field of ensuring national defense and security; maintaining technical infrastructure that covers industry and requires significant financial resources. Summarizing the above mentioned, it can be claimed that the interdependence between the achievement of potentially high economic results during R&D, is characterized by the need to develop an appropriate methodological apparatus, which leads to retrospective analysis and subsequent qualitative innovative results decomposition in order to rationally use resources and then obtain a synergistic effect that contributes to finding industrial potential on the qualitatively different technological development level.

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