
Knowledge-Based Engineering as a Driver of Economic Development of the Regions of Russia

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Abstract:

The main purpose of this paper is the study of the characteristics and the evaluation of the impact of knowledge-based engineering enterprises on the regional economy, where they act as a main driver, a catalyst for the development of a number of sectors of the economy, by enhancing and strengthening the competitive advantages of other industrial enterprises. The fundamental provisions and papers of the reputable scientists in the field of management of regional innovation systems and knowledge-based enterprises, as well as the authoring constitute the theoretical and methodological basis of this study.

The methods of empirical knowledge, the inductive and deductive methods are the basic methods used in this study. The reinterpretation of the importance of the knowledge-based engineering for the development of the regional economies is proposed, the principles of spatial distribution and the factors constraining the development of the enterprises in the industry are identified as a result of the work performed. The characteristics of the knowledge-based engineering in the context of increasing and intensifying crisis states of the economy are defined.

The necessity of improvement of the state support instruments aimed at addressing the challenges of sustainable development is substantiated. The guidelines related to the requirement to strengthen the innovation and investment sector and development of the export potential of the knowledge-based engineering enterprises and regions are given. The instruments for the development of the knowledge-based engineering enterprises, allowing to bring the regions on the path of sustainable economic growth, are given.

Keywords: *knowledge-based engineering, knowledge-based industry, innovation, regional economy.*

JEL Classification: *O18, O31*

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Introduction

The orientation of the market economy to meet the needs of consumers has a stimulating effect on the industrial enterprises and the territorial arrangement of production. The dynamism of the markets, the volatility of the market conditions and the turbulence of the macro-environment lead to a qualitative transformation of the regional economical systems. There appears a need to create a "medicine" from these negative phenomena and to establish the mechanisms to ensure the sustainable development of the regional economies.

The knowledge-based engineering enterprises are of exceptional importance in the spatial development of the regions. They provide high-speed generation of the breakthrough innovations, the assimilation of the fundamental developments, and the production of competitive products, increase the immunity and neutrality of the meso-environment to the "market failures". Acting as the driver of the economic development, the knowledge-based engineering reformats the market environment of the region through rapid modernization, radical transformations of the market space, and acceleration of the assimilation of new technological paradigms. The pulse of the regional development is enhanced by deepening their interaction with the "anchor enterprises", the "point of growth"-enterprises, the small and medium businesses and the establishment of the regional technology platforms, based on science and high technology.

Russian knowledge-based enterprises, operating in the post-transformational period and in the conditions of the change in the type of the economic management, require the implementation of the unity of the processes of modernization of the equipment and the expansion of the range of competitive products, and require to reconsider the views on the problems of the organization of production, research and design base, technical and technological and organizational training, development of competitive products and improvement of their R & D intensity. The reduction of the cycle of creation and development of the knowledge-based products are of particular importance for the enterprises. This problem comes to the fore, and it can be solved purely using the modern most advanced production techniques, the organization of a system for development and assimilation of new technologies and techniques as well as by the radical reorientation to production of the innovative products of new technological paradigms. (Garina *et al.*, 2015; Akopova and Przhedetskaya, 2016; Albekov *et al.*, 2017; Borovin *et al.*, 2015; Dzhukha *et al.*, 2017; Frank *et al.*, 2016; Okunev *et al.*, 2016; Shekhovtsov *et al.*, 2017; Sibirskaya *et al.*, 2016).

The problems of development of the knowledge-based engineering enterprises are very significant in the scientific field, since, on the one hand, they are the driver of development of Russian regions due to acceleration of the development of other branches of engineering and industry, and, on the other hand, they give impetus at the macro level to redirect the resource-export economy of Russia to the path of

innovative development. This sector of economy experiences a number of problems. (Okunev *et al.*, 2016; Garina *et al.*, 2015; Gerasimov and Prosvirkin, 2015).

The most acute are the shortage of skilled labor, the inefficiency of management, the lack of regional support programs for knowledge-based enterprises. The reinterpretation of their importance to the regional economy and the country as a whole and the development of the instruments for their promotion and support are required (Gerasimov and Prosvirkin, 2015; Ovchinnikov *et al.*, 2016; Meskhi *et al.*, 2016).

Methods

The fundamental and applied works of domestic and foreign scientists in the field of innovative development, high technology business management, regional economics, management, the results of several studies on the operation of the knowledge-based engineering enterprises and industry, the dynamics of the development of the innovative products and possibilities of their planning and forecasting are the methodological basis of this study.

The methods of empirical cognition were used by the authors during the study aimed at the identification of the problems of development of the knowledge-based engineering enterprises. They served as a means of collection of the scientific evidence. Three large knowledge-based enterprises located in the Moscow region in the largest Russian space science city, the city of Korolev, act as the objects of the study. The resulting factual material and the information obtained from these enterprises were subjected to theoretical analysis, which involves the allocation and consideration of the individual aspects, features, features of functioning and development of the knowledge-based engineering enterprises. The individual facts were analyzed, grouped, and systematized by the authors. Their general patterns were identified. The analysis was followed by synthesis, which allowed to penetrate the essence of the knowledge-based industries, innovations and their impact on the economy of the region and the country as a whole. The theoretical significance of this work is due to the novelty of the subjects of the studies performed. The statistics obtained from Rosstat, the materials of the collective monograph featuring the authors of the study "Entrepreneurship and business: financial, economic, administrative and legal aspects of sustainable development", public reports and analytical materials on the knowledge based enterprises of Korolev, as well as the reports and the empirical research data of the Russian and foreign scientists were used in this work. The study also contains the logical methods: inductive and deductive. They allowed making a generalization of the theoretical data obtained empirically in the field of the influence of the science and technology

progress, the R & D costs, and the technological paradigms on the growth of regional economies and the economy of the country.

The theoretical methods were required for determination of the knowledge-based engineering enterprises as the main drivers of the regional development, wording of the main working hypotheses and evaluation of the empirical material used in this field. These methods are also associated with the study of the narrow specialized literature and the normative-legal acts, which allowed to determine the sides and the aspects which have been already studied in the designated area, as well as the ones under the scientific discussion and therefore not relevant, and the problems pending the solution.

The purpose implies the recognition and the substantiation of the influence of the knowledge-based engineering on the regional economy and other industries and drawing-up of the recommendations on the development of this industry sector.

Results

The knowledge-based engineering as the "poles of growth" of the regional economy

The expanded reproduction and gradual positive qualitative and structural changes in the economy and productive forces of the regions are a major determinant of sustainable development of the entire national economy. The complex geopolitical situation is developing in relation to our country initiating the search for a new vector of political and economic development of the country (Idilov *et al.*, 2015; Izmailova *et al.*, 2016). The negative political and sanction trends of recent years have strengthened the representations on the part of the scientists and practitioners on the need for the fundamental reorientation of the structure of the Gross Regional Product (GRP) from the "export of raw materials to the production of knowledge-based products" (Gnezdova *et al.*, 2016). While in the 1990s the "innovation allowed to obtain the monopoly super-profit, currently the innovation is primarily a means of survival" (Sekerin *et al.*, 2016). The implementation of the strategic regional development initiatives is possible only by improving the spatial organization of the economy and support of the most desirable dynamically developing industries such as the industries of the knowledge-based engineering.

The role and the importance of engineering in the national economy are quite significant, especially given the prevailing geopolitical crisis and the strengthening of the economic security of the country (Polgar *et al.*, 2016). This industry is closely related to other sectors of the economy and ensures their stable functioning and the capacity of the market; it is the foundation of the technological development of the

industry, the impulse for formation of the national innovation system. "The economic growth of the country is largely determined by the rate of propagation of the innovation" (Drucker, 1981) and its implementation in the sphere of material production. Knowledge-based engineering is the catalyst for assimilation of the innovation; it is, on the one hand, the consumer of the most advanced technologies and R & D, and, on the other hand, the generator of its propagation.

The attribution of the knowledge-based engineering to a separate group occurred relatively recently. The basis of the "knowledge-based" category can be defined as the capacity, the inclusiveness of the scientific activity into any object or process, while its main purpose is not the production and systematization of objective knowledge on reality, but the obtaining of any new product or technology based on them, their subsequent commercialization. This definition is closely related to the concept of innovation activity in terms of goal-setting and absence of criteria for the minimization of the costs, but there are some differences between them also. The knowledge content brings to the fore the volume, the cost of the scientific activities and can act as one of the characteristics of the process of consumption of the technological innovation, which "is the incentive for the economic growth" (Lerner, 2013).

The knowledge content acts as a cost measure, allowing revealing the unity of quality and quantity indicators of a certain object, to generalize the methods and the results of its measurements, the period of preservation of some of its qualities. These objects may be the reified objects-results of the economic activity (products), the transformation of the expenditures of funds and the objects of labor for the production of new products (production), the methods for their production (technology), the organizational and separate business entities involved in their production (enterprises, organizations) and their associations (industries, sectors). In contrast to the high-tech industries, "characterized by the increased competitive environment and a very short life cycles of the technologies" (Lee, & Kang, 2015) the knowledge-based ones are focused on R & D consumption, generation and diffusion of innovation, development of innovation in other industries. Thus, a knowledge-based engineering can be recognized as a group of engineering industries producing the precision machines, appliances, instruments, with the highest share of the innovative products manufactured and high research and development costs.

The knowledge-based engineering as the "poles of growth" gives the impetus to the development of the regional economy, which is transmitted to the "peripheral secondary industries through the market relations among the enterprises" (Lasuen, 2010). This conclusion may be supplemented by the fact that the engineering industries "not only grow fast, but also generate a chain reaction of the emergence

and growth of the industrial centers (Perroux, 2007). Acting as a driver of these processes, it contributes to the overall post-industrial development of the country and makes closer the release of the product of new technological paradigms. Given the fact that "the formation of the technological platforms bridges the gap between the scientific base and the development of the technology" (Tassej, 2016), the knowledge-based enterprises are the central link of these meso associations, due to consumption of the research and development and implementation of the processes of continuous generation of the innovation in the organizations, which is "one of the key features of the business environment" (Makimattila *et al.*, 2014). "The innovation is the important means of competitive advantage" (Eurich *et al.*, 2014). The accumulation of them at the enterprises of regional business systems pushes to the reorientation toward the new technological paradigm.

The necessity of formation of new technological paradigm is an important condition for the progressivity of the economy and its transition to a new level by simultaneous development of the aggregate of the conjugate productions of a uniform technical level. The knowledge-based engineering includes the profession equipment engineering, the radio, electronic and electric industries, as well as the production of the automatic, biotechnical and interactive robots. It is the most innovative sector of the manufacturing industry, which produces the means of production and is an integral part of a unified economic complex of the country, its products are used in many sectors of the economy, and it has a high level of expenditures on innovation and R & D, it may be fairly recognized as the regional driver of the economic development. The state of the knowledge-based engineering determines the vector of development of the national economy in general and its regional components, which is caused by several factors.

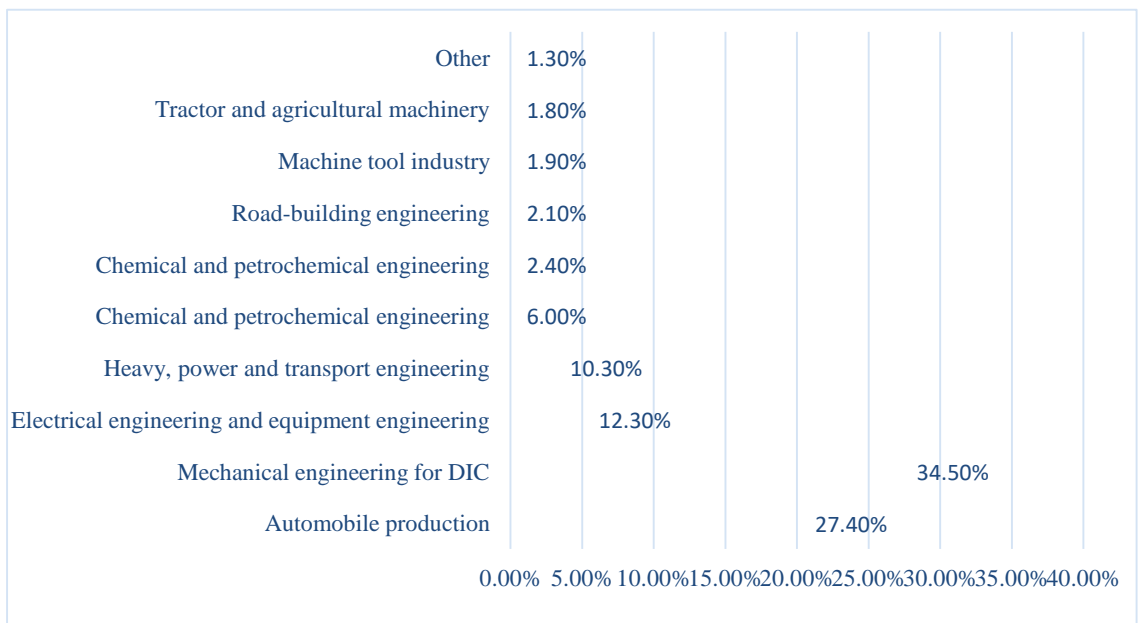
First, the machinery, equipment and robots created by the knowledge-based enterprises are used in other fields. Due to this, they provide the foundation for development of other sectors of industry. The enterprises that use the products of the knowledge-based engineering industries may expect the increase in the productivity, in the rationalization of the production, the minimization of the human factor, etc., which ultimately leads to the reduction of the costs and improvement of the competitiveness of the production.

Secondly, the knowledge-based engineering acts as the geographically-forming factor. Due to the enterprises of these sectors, the city-service sphere develops, the level of human development and employment increases, as well as the activity of the business environment, the investment potential grows, ultimately forming the growth of the added value of the regional economy and improvement of the social sphere. They increase the level of the economic assimilation of the territory and the degree of utilization of the surplus resources; flatten the uneven distribution of the main socio-economic parameters by tax on units of the country and the macro-imbances of the development of the territories.

Third, it is the impedance of the development of the innovation and advanced technologies. The knowledge-based enterprises strengthen the scientific and technical environment, promote the diffusion of the innovation, and improve the investment climate in the region.

The knowledge based engineering has the greatest impact directly on the development of other sectors of engineering. The largest share in the gross output of the engineering products accounts for the automotive industry, where the indicator amounts to 27.4%, and the DIC where the indicator amounts to 34.5% (Figure 1).

Figure 1: *The structure of the gross output of the mechanical engineering by sub-sectors*



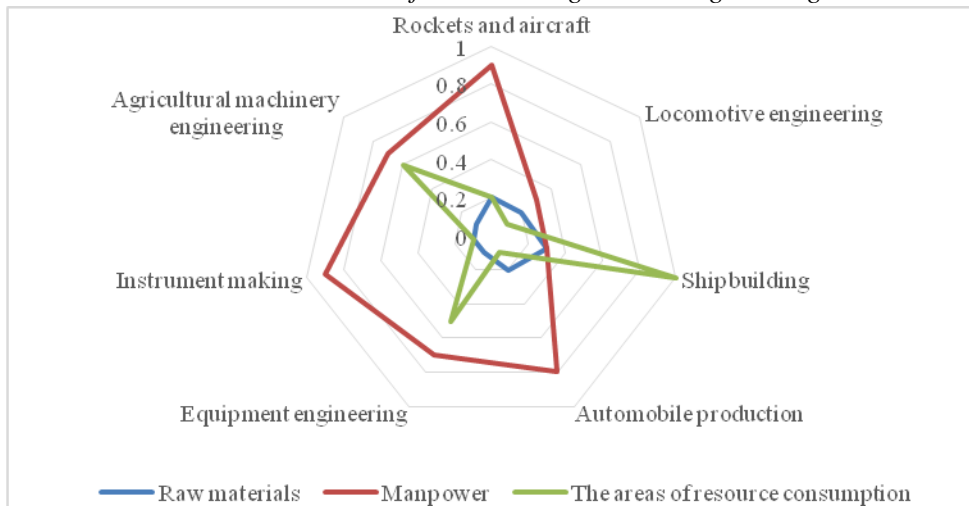
Source: Rosstat RF (Federal State Statistics Service of the Russian Federation, 2016).

The needs in manpower of the knowledge-based engineering are met by many technical and technological universities, institutions of secondary vocational education and thousands of other social organizations throughout the country.

The efficiency of the knowledge-based engineering industry is largely dependent on the direct distribution of production in the regions. The factors influencing the accommodation of the knowledge-based engineering in the Russian Federation were analyzed by the authors. The biggest impact in terms of development of the enterprises, involved in production of spaceships and aircraft, automotive and instrumentation factors, has the availability of the labor resources. The shipbuilding

and the manufacture of agricultural machinery gravitates to the areas of product consumption (Figure 2).

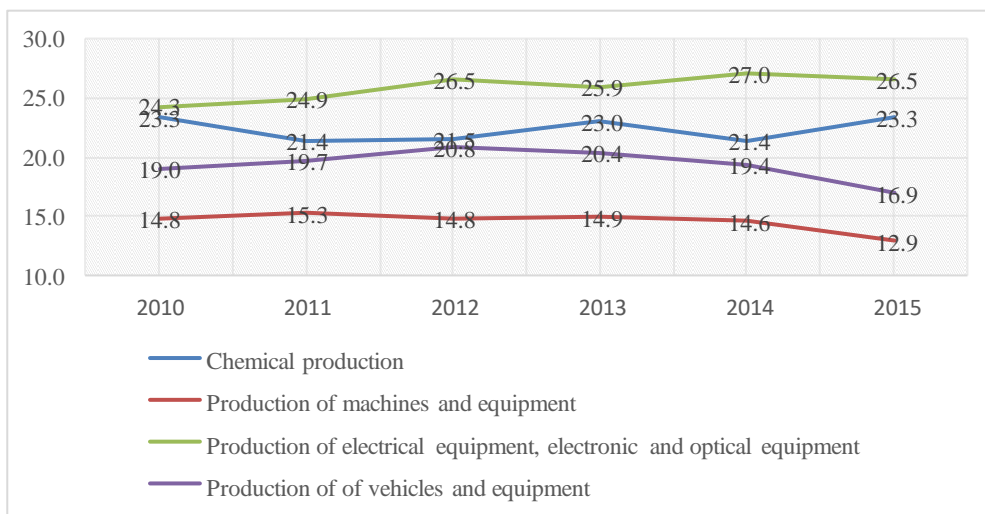
Figure 2: The degree of influence of the main factors on the placement of the individual sectors of the knowledge-based engineering.



The role and the importance of the knowledge based engineering in social and economic regional development at the current stage and prospects can easily be underestimated. Being the backbone sector of the economy, it determines the level of production and human resource capacity, and also acts as the major factor of sustainable development of all industries; it is the foundation for construction of a new economy of Russia and is aimed at the innovative growth. The ability of many regions and countries to get rid of the hydrocarbons export dependence depends on the degree of development of the knowledge-based engineering industry.

Currently, the technological innovation is implemented by few engineering enterprises (Figure 3). Therefore, only a certain part of them can be attributed to the category of knowledge-based enterprises.

Figure 3. The share of the enterprises, implementing the technological innovation in the total number of surveyed enterprises



Source: The calculation is made according to the Russian Federal State Statistics Service (Federal State Statistics Service of the Russian Federation, 2016).

Taking into account the need to assess the generation of the innovation, the list of the Russian engineering sectors was ranked by the authors by the share volume of the innovative goods, works services in their gross volume (Figure 4). Mostly the production accounts for the industries, supported by the state or owned by the state.

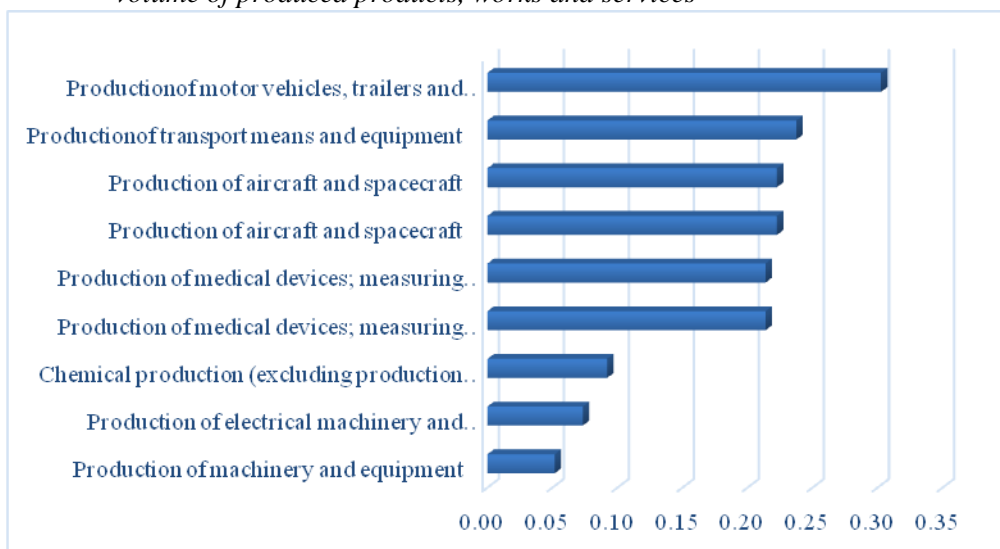
Russia has adopted the RF Development Strategy until 2020, which sets out a number of objectives, including those related to the innovative development and joining the world's technological powers, the GDP growth, and the improvement of the quality of life of the population, ensuring the country's security. The solving of the designated problems is not possible without the reorientation of the views and solving the current engineering problems. Thus, the extent of development of the economy of the country and its regions depends on the effectiveness of the development of the knowledge-based engineering, the formation of a new intensive post-industrial society, which would ensure its competitiveness.

Problems of development of knowledge-based engineering

The problems emerged in the knowledge-based engineering in the course of transformation of the economy, preventing it from development, are usually not private and local in nature. They are the interdependent and interrelated systemic problems. The authors analyzed the activity of "Tactical Missiles Corporation" JSC, "Composite" JSC and "RKK Energy n.a. S.P. Korolev" JSC which are the largest knowledge-based engineering companies, located in the Moscow region, Russia. The above enterprises acted as the subject of study for the students, bachelors and masters, whose papers were written under the supervision of the members of the research team. The research results were systematized in a number of monographs.

The selection of the knowledge-based engineering enterprises for the study was representative, as according to the criteria of the number of employees, they had over two thousand people employed, and the high cost of research and development and the openness of the information constituted 19% of the total number of such enterprises of the Moscow region.

Figure 4: *The volume of the innovative products, works and services in the gross volume of produced products, works and services*



Source: *The calculation is made according to the Russian Federal State Statistics Service*

The problems hindering the development of the knowledge-based engineering enterprises at the macro and micro levels were identified as a result of the analysis and the study.

According to the authors, the main problems at the micro level are the following:

- the extreme obsolescence and depreciation of the fixed assets and technology;
- the shortage and the lack of influx of the young qualified personnel due to uncompetitive salaries, lowering of the prestige of the engineering professions and the aggravation of the social problems;
- the need for affordable working capital and investment funds, low interest rates on loans;
- the lack of funds for the implementation of the strategic transformation programs;
- the redundancy of production capacities, most of which are obsolete and have low technical and economic characteristics;
- the low efficiency of the management system in enterprises, the increased bureaucracy;
- the underdeveloped system of industrial cooperation, especially with small and medium-sized businesses;

- the quality management system is not fully compliant with the international quality standards;
- the shortage of the qualified human resources and management experience in the formation of the effective marketing strategy in the market of knowledge-based products;
- the absence of or the incomplete cycle of use of the service and support system of the knowledge-based products manufactured throughout their life cycle;
- the unequal competition conditions for the knowledge-based products on the world market.

The current large-scale systemic crisis in the domestic industry and, in particular, in the knowledge-based engineering, in addition to the above problems, is also enhanced by a number of other negative factors, which are closely linked and interdependent. The following factors may be attributed to the major negative macroeconomic factors leading to a systemic crisis in the knowledge-based engineering:

- the technological backwardness of Russia from the leading economic countries, especially in the machinery and robotics engineering;
- the shortage of the regional programs for the development of the innovation infrastructure of the knowledge-based sector;
- the degradation of the fixed assets of the domestic knowledge-based engineering, which is at the critical level;
- low technical and economic performance of products: the low quality of the knowledge-based products, high production costs due to high production expenditures and low profitability of production;
- inefficient or non-competitive HR policies aimed at attraction of the skilled personnel and scientists to production;
 - the gaps and imperfection of the legislation in terms of realization of the state industrial and innovation policy, technical regulation and supervision, the pricing policy for the knowledge-based engineering products, etc., leading to a higher tax base in international comparison (which ultimately reduces the working capital of the enterprise), the outstripping price growth for the products and services of natural monopolies in comparison with their dynamics in mechanical engineering, etc.;
- the gaps in the settlement of the problems of ownership for the land under the production facilities;
- the unfinished processes to bring to the international requirements of the standards for the products manufactured;
- the insufficient structure of many industries in the engineering complex;
- low competitiveness of domestic production of the engineering complex and its low investment attractiveness.

The current position of domestic knowledge-based engineering is hardly profitable. The developed countries tend to use technologies and innovations relevant to the 4th and 5th technological paradigms, but, if the fourth one is declining, the fifth one is

atop. There are some local manifestations of occurrences of the technologies of the 6th paradigm. The 4th technological paradigm is still the dominant paradigm in Russia, and, according to some experts, it will have reached its peak only by 2016. With regard to the domestic engineering industry, this fact suggests the need to overcome such a gap to the international level which is 1.5-2 technological generations (one technological generation is 1-1.5 decades) in parallel with formation and propagation of the most popular trends of the 5th and 6th technological paradigms in the long-term prospective (Polgar *et al.*, 2016). According to the authors, a large-scale economic and intellectual manoeuvre should be practically implemented to allow in the shortest time to recover and to develop the domestic engineering industry up to the high-tech level, currently thirty years lagging the developed countries in the technical condition. This requires providing a higher rate of development, taking into account the factor of growing complexity of the requirements for a modern knowledge-based engineering production according to the experience of foreign countries, where the number of production process performance indicators is constantly increasing, and the nature of their interaction becomes more and more dynamic.

The international experience shows that the complexity of the machinery as an object of production has increased more than 5 times, and the accuracy requirements for manufacturing and assembly of parts have increased about 50 times during the past few decades. The increase in the range of products subject to reduction of the duration of the production cycle time within the same nomenclature group is also worth noting. The volume of production is within a fairly wide range, from a single item production to a mass production, but the small-scale and the medium-scale production remains the dominant. The increase of the efficiency of production is determined by the ever-increasing demands for productivity, the reduction of the production cycle time and the cost management efficiency (Meskhi *et al.*, 2016). In our opinion, the problem is also in the inefficiency of the management decisions taken by the state authorities, and at the level of the economic subjects.

Organizational and economical mechanism of development of the knowledge-based engineering industry

Despite a number of negative barriers and difficulties of functioning of the knowledge-based engineering enterprises, there are a number of backlogs, which are the impulses for its advancing development. First of all, they are: the own energy and raw materials, the advanced communication networks, as well as the scientific, HR, production and other potential, formed during the Soviet economy. One of the underlying reserves for the development of the knowledge-based engineering is the imperfection of the national legislation in the field of industry, such as a radical solution to a number of technological, social, economic, financial, human resources, innovation and other problems in mechanical engineering, the solution of which is possible by changing the federal and regional legislation and the budget-tax, customs regulation.

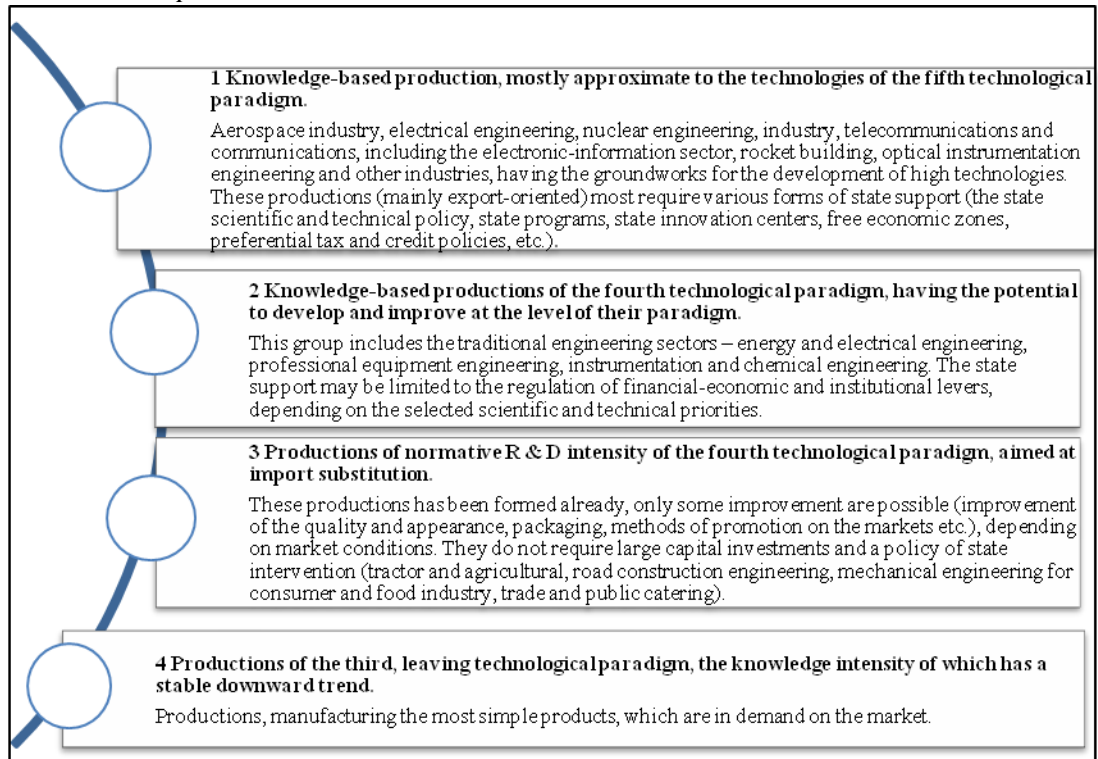
The federal government is required, mostly, to provide a financial support and the tax incentives. The experience obtained by the USA in the course of implementation of the program "Empowerment Zones" has proved convincingly that it is not poverty, but the regions in decline to be supported (Chatterji *et al.*, 2013). The reduction of the taxes can act as the impulse for development, as "the temporary reduction of the taxes in their size will ensure increase in the level of their collection in future due to the growth of business" (Chatterji *et al.*, 2013). However, two important points: "the quality of business support programs" and "the limitation of the opportunities for the friends or relatives of the creators of the laws on such a support, to participate in the support programs, should be taken into account in the course of support of a business and its financing" (Lerner, 2013), otherwise the low efficiency of the budget expenditures may be expected.

According to the authors, the degree of the state support should be based on its orientation and compliance of the enterprises with the technological paradigms. The experience of some countries shows that in the context of current globalization and development of the world economy, the transfer of some engineering sectors to the third world countries is possible, due to their participation in the over-country blocks. Such strategies, mostly associated with the loss of national sovereignty, are not acceptable for our country. Therefore, the entire engineering industry, its totality, including all sectors and sub-sectors, should serve as an object of state support with the definition of the priorities of the state support for any of them, should be based on the needs of the provision of the innovative development of the whole national economy.

Taking the above into account, it is expedient to allocate at the country-level the priority levels of the engineering enterprises, depending on the competitiveness and the knowledge content of their products. The way of support of the productions, presented in Figure 5, the priority in which is given to the knowledge-based productions of the highest technological paradigms, seems to be the most feasible.

The important role in the support of the knowledge-based engineering should be played by the regional authorities. Given the fact of "spatial innovation spillover the neighboring territories (Li, & Fu, 2015) the development of the regional spatial and economic relations should be supported and strengthened. Despite some scientists see the negative trends in the innovation, for example, the possible reduction of employment (Dachs *et al.*, 2016), the authors believe that the advantages prevail in number. And the decline in the employment of the population is a temporary phenomenon, as the effect of innovation leads eventually to the creation of new businesses and thus new jobs. Also, the implementation of the regional support policy for the knowledge-based engineering requires the focusing on their "competitive advantages, raising its competitiveness and contributing to its development" (Danko *et al.*, 2016).

Figure 5: The priority of the state support of the knowledge-based engineering production



Taking into account the available reserves of the knowledge-based engineering, the authors divided the regions into two groups by offering the means to improve their competitiveness to form the "poles of growth" of the regional economies. The mobilization of the discovered reserves of increase of the competitiveness of the region is associated with the formation of the competitive advantages of the knowledge-based engineering, and the identification of such reserves is the basis for the further development of the regional competitiveness management strategy.

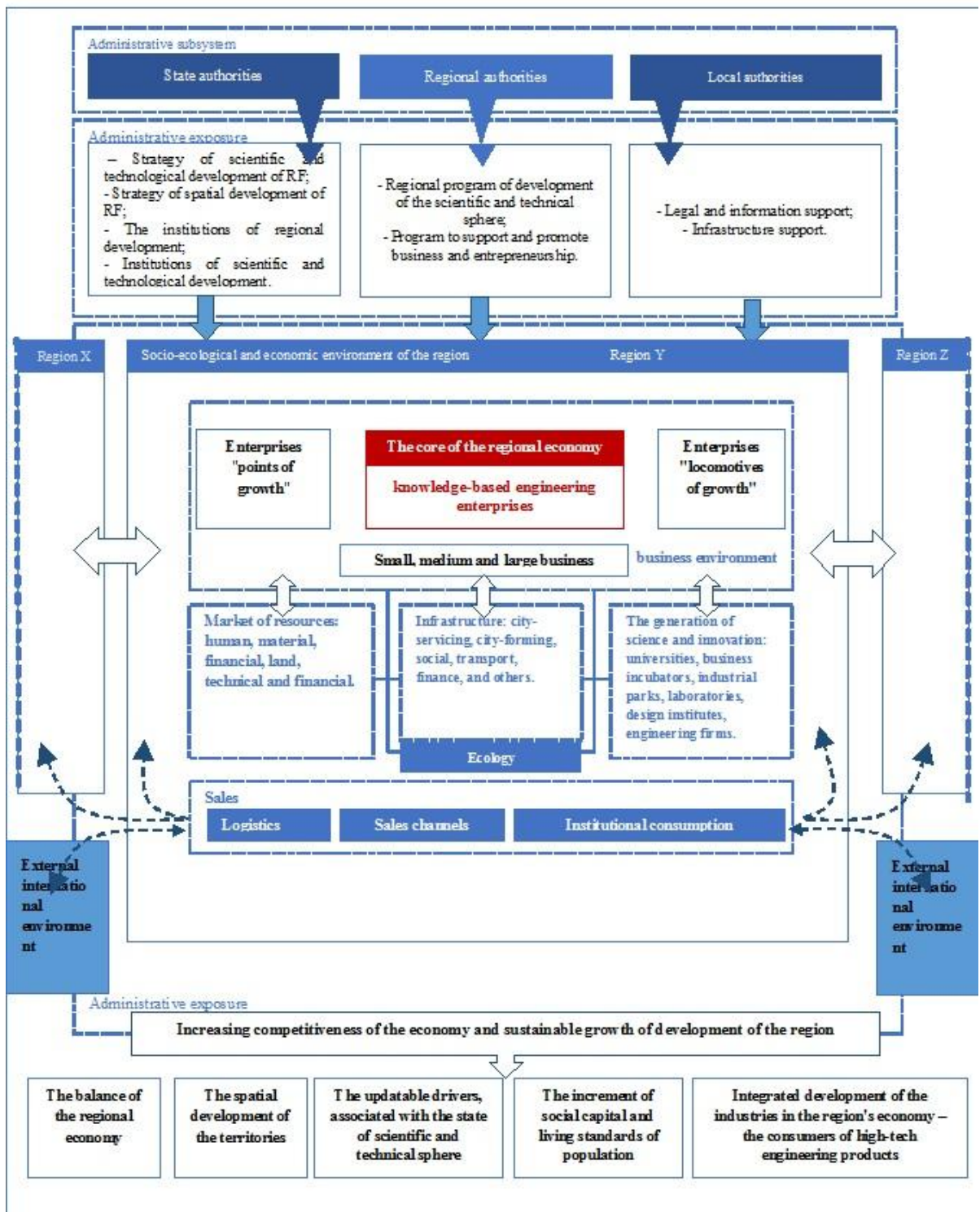
The first group of regions includes the disclosure of the provisions related to the condition of the engineering: the increase in GRP due to the growth of the knowledge-based engineering, the improvement of the economic security of the region in the field of production, the increase in the capacity of the market of the engineering products and the strengthening of the competitive advantages of the knowledge based engineering. The second group of regions includes the disclosure of the reserves, not associated with the state of the engineering, but determining the possibility of its development as a "pole of growth": the improvement of the functioning of commodity and financial markets and the labor market in the region with the engineering specialization, the increase in the innovation and entrepreneurial activity, the growth of the social and economic potential, the

acceleration of the adaptation of the region to the changes in its internal and external environment. The following trends in development of the knowledge-based engineering aimed at improvement of the competitiveness of the region are proposed by the authors:

- to design in the region the knowledge-based engineering facilities with the regional main engineering enterprises acting as the centers, and the global component manufacturers attracted in the available infrastructure industrial parks, and the generators of the innovation acting as the centres;
- to choose a group of knowledge-based engineering enterprises in the region to ensure the priority regional support of their development (based on the calculation of the group weighted average proposed in this paper);
- to attract the global manufacturers, producing the components for the knowledge-based engineering products, in the infrastructure industrial parks to work closely with the main enterprises of the region and the extra-regional consumers (due to the "points of growth" of the regional economic policy).

The conclusions derived met perfectly the model of organizational and economic mechanism of the regional development of the knowledge-based engineering (Figure 6), based on the model "Multi-element model of technology-based growth" (Tasty, 2016). As the important condition for the construction of the model is "the need for inclusive business models of development of the innovation" (Weiblen, 2014), as well as the necessity to address the needs of organizations for the acquisition of new and unfamiliar technology outside the organization (Janney, & Dess, 2004), the external international environment was included in this block by the authors.

Figure 6: *The organizational and economic mechanism of the regional development of the knowledge-based engineering*



Along with the proposed instruments, it is necessary to improve the regional economic policy related to the increase in the competitiveness of the region through the development of the knowledge-based engineering: the creation of the regional funds for development of the engineering at the expense of the regional budgets for the purposes of the preferential crediting of the priority engineering industries; the stimulation of the demand for the engineering products by limitation of the service life of the machines and mechanisms via the technical regulations and other legislative documents; the import substitution of the means of labor on the basis of formation of the machine tool cluster in the region with the engineering specialization; the development of the public-private partnerships in the field of knowledge-based engineering in the region, including R & D. It is shown that the formation of the competitive advantages is able to improve the competitiveness of the region as a whole and will have the greatest impact on its innovation and business components.

Discussion

This study is aimed at the evaluation of the influence of the knowledge-based engineering on the regional economy, as well as the elaboration of the appropriate mechanisms for the development of the economy sectors in terms of formation of the new technological paradigm. This work is based on the methods of theoretical and empirical cognition. The factual research base is based on the freely available information of "Tactical Missiles Corporation" JSC, "Composite" JSC and "RKK Energy n.a. S.P. Korolev" JSC. As a result of collection and analysis of the information on the activities of the knowledge-based engineering enterprises, the hypothesis of their high impact on the regional economy and the industrial sector, regardless of the industry specialization of the region, the need to form the appropriate support policies for these enterprises at the state level and the level of economy subjects of the Russian Federation, was confirmed. High reliability of the results is based on the papers of Lasuen, Perroux, Drucker, Lerner, Tassej and others.

The main feature of the study is the reinterpretation of the accumulated theoretical framework and the practice of assessment of the impact of the knowledge-based engineering on the economic growth of the regions, the allocation of this sector as a driver and the rooting for the technical and technological development, the catalyst and the guide for the development of other businesses and the economic growth. The main problems hampering the development of the knowledge-based engineering are defined and the organizational-economic mechanism of development is formed based on the analysis (Borovin *et al.*, 2015).

The findings on the priority of the support of certain knowledge-based engineering sectors in terms of transition to a new technological paradigm are given in this paper. This study meets the criteria of reliability. The monograph is based on certain

provisions of this study, which had been discussed with the scientists from the universities and business representatives in the largest Russian space science city, the city of Korolev. The reliability is also proved by the use of the official statistics, available on the website of the State Committee of Statistics of the Russian Federation, in the calculations.

Conclusion

Currently, a need for a reorientation of the approaches to regional management of the knowledge-intensive engineering, based on the improvement of their forms and through the formation of the self-organized and self-regulated structures to counter the turbulent environmental effects, the crisis in the economy, the market failures. The main conclusions derived from the study are the following:

1. The knowledge-based engineering is the driver of the regional economy, its "pole of growth".
2. The mobilization of the discovered reserves of increase in the competitiveness of the region is associated with the establishment of the competitive advantages of knowledge-based engineering and the identification of such reserves. It is the basis for the further development of a regional competitiveness management strategy.
3. The state and regional authorities in the model of scientific and technological development and economic growth are required to reinterpretate the mechanisms of support of the knowledge-based engineering, depending on the priorities of the products of the new technological paradigm.

The measures and the organizational and economic mechanism proposed by the authors will contribute to the creation of the effective regional support policy for the knowledge-based engineering, as well as to the improvement of materialization of the scientific and technological progress, the catalyst of the assimilation of the new technological paradigm, to the improvement of the investment climate in the entrepreneurial activity.

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