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Innovative Dynamics of Socio-Economic Systems in the Knowledge Economy

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Abstract: The Russian economy faces an imperative to enhance national competitiveness as a prerequisite for maintaining socio-economic security. The Strategy for Scientific and Technological Development of the Russian Federation (STR Strategy) is conceived as a long-term framework aimed at ensuring the country's sustainable, dynamic, and balanced advancement toward global competitiveness. Although the strategic directions articulated within the STR formally reflect the conceptual principles of the knowledge economy, they lack concrete mechanisms for stakeholder interaction, the realization of which is essential for achieving the strategic objectives of socio-economic development across all levels of governance. Since the inception of the STR Strategy, the conceptual model for managing the economic development of the Russian Federation within the paradigm of a knowledge-based economy has remained insufficiently defined. In this regard, the primary objective of the present study is to substantiate a methodological framework for constructing an evaluation system that measures the effectiveness of managing the economic development of socio-economic systems in the context of a knowledge economy. The research methodology is grounded in the dialectical, systemic, deductive, indicative, and synergetic approaches, which together provide a comprehensive analytical basis for examining the dynamic interrelations among innovation, competitiveness, and socio-economic stability. The scientific novelty of the study lies in the development of theoretical propositions, methodological guidelines, and practical instruments for the organization of monitoring systems aimed at evaluating the innovative potential of socio-economic systems at multiple hierarchical levels. The study synthesizes interdisciplinary theoretical foundations concerning the nature and mechanisms of ensuring national competitiveness within a knowledge-based economy. The research design employs a deductive approach encompassing four analytical levels: cross-country comparison, national scale, regional level, and organizational level. Using R. Solow's model of economic growth as an analytical framework, the paper examines key determinants of global economic development and establishes that the total factor productivity (TFP) exerts a decisive influence on Russia's economic performance. The analysis identifies regions of the Russian Federation exhibiting structural weaknesses in socio-economic development and empirically confirms the dependence of regional socio-economic security on the degree of innovative activity within organizations. The proposed analytical toolkit provides a foundation for information and analytical support in assessing the contribution of organizational innovation to the effectiveness of socio-economic systems at various levels of aggregation. Future research should focus on elaborating a comprehensive mechanism for

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managing national socio-economic security within the institutional framework of the knowledge economy, thereby enhancing the strategic resilience and global competitiveness of the Russian Federation.

1 INTRODUCTION

The relevance of this research stems from the scientific and practical necessity of identifying the key determinants that enhance the innovative activity of organizations, which constitute the fundamental structural components of the national socio-economic system and represent the primary source of its dynamism within the framework of the knowledge economy. The knowledge-based economy prioritizes intellectual resources, expertise, and other forms of human capital over tangible production factors. As non-renewable material resources continue to diminish, the achievement of sustainable competitive advantage increasingly depends on the creation of intellectual products—innovation—and the transformation of existing institutional and organizational structures (Boggs, 2016; Švarc, Dabić, 2017).

The conceptualization of innovative activity as a defining characteristic of organizational performance is essential for the development of effective mechanisms and analytical tools capable of projecting the outcomes of socio-economic development across all hierarchical levels in accordance with national strategic objectives. By its nature, the innovative activity of organizations exhibits a dual character: first, it demonstrates the relationship between the intended content of innovation processes and their actual outcomes; second, it reflects the specific behavioral patterns of organizations in the implementation of planned innovative strategies.

The growing importance of examining the effectiveness of innovation activity at the microeconomic level is largely determined by contemporary economic policy priorities. Within this context, micro-level data mining serves as a particularly effective analytical tool for uncovering causal relationships within the broader hierarchy of socio-economic systems. Nevertheless, despite increasing demand among policymakers and academic institutions for comprehensive assessments of organizational competitiveness and performance, cross-country comparative studies using a unified system of indicators remain methodologically complex. From the standpoint of advancing the analytical rigor of economic research, the establishment of an adaptive system of micro-level indicators that characterize innovation activity possesses substantial practical value. Such a system would enable the qualitative analysis of socio-economic processes across the meso-, macro-, and mega-levels, thereby strengthening methodological coherence and enhancing the validity of cross-level research.

Despite the expanding body of literature devoted to the factors driving economic development and competitiveness of socio-economic systems, scholarly consensus has yet to be achieved regarding the conceptual framework and methodological approaches for assessing the influence of innovation activity at the micro level on the development trajectories of higher-order systems. This gap is particularly evident within the theoretical paradigm of the knowledge economy, where the absence of a unified methodological platform complicates systematic analysis. Addressing this deficiency requires the development of an integrative analytical framework capable of linking innovation processes at the organizational level with macroeconomic outcomes in knowledge-driven economies.

At the same time, the global transition toward a knowledge economy—driven by rapid technological advancement and digital transformation—has generated both progressive developments and profound contradictions in socio-economic relations. Increasing imbalances have emerged between the global and national capacities of socio-economic systems, on the one hand, and the existing institutional conditions and expected future prospects, on the other. In his address at the World Economic Forum (Davos, 2021), President of the Russian Federation Vladimir Putin emphasized that the COVID-19 pandemic had sharply revealed pre-existing systemic imbalances and vulnerabilities within the global economy. He cautioned that the risks associated with the escalation of these contradictions continue to grow, manifesting across virtually all domains of socio-economic life. The underlying cause of these risks lies in the crisis of traditional models and instruments of economic development. Consequently, there is an urgent need to construct an algorithmic framework that enables both global and national economies to recover from the effects of the pandemic while simultaneously restructuring their economic systems toward a new qualitative state capable of mitigating deep-rooted social and structural disparities.

In light of these challenges, the purpose of this study is to substantiate a methodological approach to the formation of a comprehensive system for evaluating the effectiveness of managing the economic development of socio-economic systems within the conditions of the knowledge economy.

To achieve this purpose, the study addresses the following objectives:

1. To analyze the methodological and theoretical foundations that define the directions of economic development of socio-economic systems within the paradigm of the knowledge economy;
2. To substantiate the author's methodological approach to analyzing and evaluating the factors that determine the outcomes of breakthrough scientific, technological, and socio-economic development;
3. To interpret the obtained evaluation results and identify promising avenues for their application in the activities of key stakeholders.

The problem field of this study spans multiple interrelated scientific domains, including socio-economic security, economic development, scientific and technological advancement, complex systems theory, and synergetics. The interdisciplinary nature of this research provides a foundation for developing a coherent methodological framework that integrates these domains in the analysis of innovation-driven socio-economic transformations.

The first direction - research in the field of theory and methodology of the socio-economic security of the country and regions was reflected in the works of A.A. Miku (Miku, 2009), E.S. Mityakova, V.K. Senchagov (Mityakov, Mityakov, Ladynin, Nazarova, 2023) and others. Positioning the socio-economic security of the state as a certain state of its socio-economic system and government institutions, which is able to provide the country with economic independence, guarantee the social welfare of its citizens, create conditions for the sustainable and efficient functioning of business entities based on the balanced development of industries and sectors of the economy, maintaining the spatial integrity of the country, we consider it justified, of strategic importance, to identify objective factors that determine the emergence of threats to the socio-economic security of the country.

The second direction is connected with the studies of the problems of economic development of socio-economic systems in the conditions of the knowledge economy, which were studied by such Russian scientists as S.D. Bodrunov (Bodrunov, 2023), G.B. Kleiner (Kleiner, 2020), V.L. Makarov (Makarov, 2003), B.Z. Milner (Milner, 2003), N.V. Shashlo and Petruk (Shashlo, Petruk, Korostelev, 2018), V.S. Uskov (Uskov, 2020), O.E. Kalenov (Kukushkin, Kalenov, 2019). Among Western researchers, R. Solow paid great attention to these issues (Solow, 1957; Solow, 1956), M. Abramowitz (Abramovitz, 1986), C. Lall (Lall, 2001), M. Bell and C. Pavitt (Bell, Pavitt, 1993) and others. In the context of the presented theories, we understand the economic development of a socio-economic system as such a complex of transformations that transform the totality of the system's qualities, which is able to increase the viability and efficiency of the socio-economic system, as well as its socio-economic security. As a result of such transformations, new opportunities should open up for the system in the implementation of targets in relation to scientific and technological support for the implementation of the tasks and national priorities of the country. In the Russian Federation, the system of these priorities is defined in strategic planning documents developed as part of goal setting at the federal level.

Changes in the vector of development of the world economy after the Second World War, associated primarily with transformations in material production based on knowledge, occurred simultaneously with the formation of a wide range of economic theories that basically combine science, technology and economics. From this standpoint, the neoclassical theory of economic growth, the theory of catch-up development by M. Abramowitz, the theory of technological possibilities by S. Lall and the theory of technological accumulation by M. Bell and C. Pavitt, as well as many others, are of particular importance. The study of the theoretical and methodological approaches presented above allows us to conclude that they position scientific research, which resulted in the emergence of commercially viable innovations and technological achievements, as the main driving forces of technological change, which stimulates technological progress, and it, in turn, generates economic growth.

A significant breakthrough in economics in research into the factors of balanced economic growth occurred with the advent of R. Solow's model of exogenous growth, which received the Nobel Prize (Solow, 1957; Solow, 1956). In 1957, R. Solow formed a methodological basis for analyzing economic growth based on the decomposition of a generalizing indicator of GDP growth rates into contributions from changes in a number of factors:

capital, labor costs, and an aggregate factor of an unknown nature that accumulates an exogenous impact on economic growth. This model was called the "R. Solow growth accounting" model and has been widely used in economic science and political analysis: the IMF, OECD and the European Commission widely use this model to analyze the development of technological progress, the dependence of production on capital investment in different countries. World Bank researchers note that labor productivity is never random. Based on extensive global analytical research, they conclude that total factor productivity (TFP) can be a measure of the efficiency with which society builds the process of using resources and tools to develop the economy by combining people and their culture. However, many scientists criticize the model, noting that the "residual R. Solow", represented by the factor of exogenous influence, can consist of a very large number of factors that can enter into specific relationships with the factors included in the model, and at the same time change its results. Further research led to the emergence of a number of modifications of the R. Solow model, partially eliminating the above disadvantages.

Methodological approaches to assessing the contributions of various factors of economic growth expand the search horizon for an optimal model of economic growth, taking into account the specifics of different countries and regions. The economic downturn of the late 1970s led to the formation of the evolutionary theory of technological change by R. Nelson and S. Winter (Nelson, 1959). The contribution of these scientists is to develop an evolutionary model of the behavior of the firm, according to which the factor that has a multiplier effect on the volume of innovative activity of the firm is the cost of R&D. Later, the practical significance of this model was proved for the conditions of various social institutions, including education, the social community, state and municipal government, and others. Evolutionary economists view innovation as an interactive process that paves the way for a non-linear interactive model of innovation. This innovation model was described by S. J. Kline and N. Rosenberg as a chain model that traditionally begins with the identification of an unfilled market need, then forms complex feedback loops between all stakeholders at each stage of innovation activity (Kline, Rosenberg, 2010).

An important basis for the theoretical platform for researching the problems of economic development of socio-economic systems in a knowledge economy is the concept of a triple partnership of universities (science), business and government, known as the Triple Helix Model, which appeared in the mid-1990s. century (Itskowitz, 2010). The interaction of government, science and business, according to this model, appears as a hybrid social structure that has the advantages of a DNA molecule, that is, its increased adaptability to changes in the external environment. In the 2000s, this construction began to be introduced into the economies of the developed countries of the world as a foundation for the formation of regional clusters and the generation of innovations. In essence, the concept of the triple helix is based on an evolutionary theory that explains the transformations in the course of the development of socio-economic systems by the trajectory of technological development. In the course of these transformations, the forms of interaction between government, business and science have always undergone evolutionary changes, since it became clear that at each next stage of technology formation, the activity of each of the three elements of the innovation process model did not bring an effective result to society. And the point is that only when each of the three elements of the innovation process contributes to an increase in the effectiveness of other elements, and the very model of the triple helix is born.

The theory of the triple helix quite specifically puts forward the thesis that representatives of science occupy a dominant position in the system of innovative development. At the same time, as a rule, this happens at the regional level, where a certain specificity of relations between industrialists and scientific associations is formed, and the absence or presence of state regulation of this interaction already affects the very configuration of the triple helix model, which is formed in each specific case. It is clear that the transfer and preservation of knowledge remains a key task for universities. Even when universities join some of the functions of business and government, they continue to retain their classical focus on the dissemination of knowledge and the socialization of young people. It is natural that the same situation develops with the state, which acts as a guarantor of social foundations, as well as with business organizations, primarily interested in the production of goods and services. In essence, business continues to provide services and produce goods, but at the same time, it is stimulated to engage in research in order to increase its competitiveness. Through the process of training and upgrading their employees, business companies can "create their own universities" in their area of specialization. The triple helix concept works not only in the standard case of consumption of scientific research results, which are in the interests of industrial specialists, but also considers the possibility of assessing the structure of enterprises in the region and their readiness to apply the results of scientific research. The authors of the triple helix model are convinced that the result achieved in the socio-economic system built according to such a model, which contributes to the development of science and technology, can also contribute to public well-being (Leydesdorff, Perevodchikov, Uvarov, 2015; Kinouchi, 2014).

The practice of competitive allocation of research resources in countries with developed science stimulates the diversification of scientific research and makes it possible to expand opportunities for the free choice of directions for scientific research. At the same time, the established strong connection with practice through the definition of priorities adjusts this process to achieve useful results that are significant for the whole society. Scientometric tools are in such systems a means of improving the quality of decisions, but they are not perceived as the only, and even more so, exclusive criteria. If it works otherwise, scientists in such socio-economic systems pursue the goal of achieving measurable indicators, violating the logic of the triple helix model, leveling any of its positive effects on society. The state, of course, should set the rules of the game, but at the same time, it should provide access to obtaining venture capital for the development of new companies. At the same time, the main results of the commercialization of innovations should be an increase in the speed of creating new products or an increase in labor productivity.

The shortcomings of the triple helix concept were eliminated in the structure of the four- and five- fold innovation helix, which was jointly developed by E. Karayiannis and D. Campbell (Akoev, Markusova, Moskaleva, Pislyakov, 2021). The structure of the four- and five-fold innovation spiral describes the interactions of a larger number of elements, where, in addition to the classical university, industry and government, the public and the environment are also included in the interaction within the framework of the knowledge economy. The main component of the spiral system in such models is knowledge circulating between the subsystems of society, which is transformed in the process of such circulation into innovations and know-how in society (knowledge society) and for the economy (knowledge economy).

Thus, productivity as an indicator is a key indicator for analyzing the economic growth of socio-economic systems. Note that there are many different approaches to measuring performance, but the choice of an appropriate performance indicator should be made by researchers in accordance with the goals they are pursuing.

The third direction is interdisciplinary research in the field of complex systems theory and synergetics, associated with the names of A.A. Bogdanova, L. von Bertalanffy, N. Wiener (Carayannis, Campbell, 2010). Also noteworthy are the works of scientists who developed the systemic paradigm in the economy of the twentieth century: B.G. Kleiner (Kleiner, 2020), B.L. Kuznetsov (Anohin, 1980), I.R. Prigogine (Prigogine, 1989), G.A. Simon (Simon, 1993), G. Haken (Haken, 1980), K. Schwab (Schwab, 2017) and others. The works of these researchers confirm that in Industry 4.0, systems intelligence plays a priority role in shaping the competitiveness of systems as a property of various socio- economic and socio-technical structures to recognize and realize emerging problems and find ways to solve them. Knowledge here acts as one of the resources of intellectual activity.

However, at present, the issues of analysis and assessment of the level of influence of individual factors on the results of the economic development of socio-economic systems in the context of a knowledge economy remain insufficiently studied. Until now, a unified list of key indicators reflecting the impact of science and technology on the economic development of different levels of socio-economic systems has not been developed, which makes it possible to quickly identify and assess emerging risks and threats in the socio-economic system. The subject of monitoring in our study is the innovative potential of socio-economic systems, which, as a set of resources, should be used to achieve the goal of the Strategy for Scientific and Technological Development of the Russian Federation, which guarantees the provision of the required level of socio-economic security of the country. Our analysis of the implemented Strategy and programs (projects) for the socio-economic development of multi-level systems showed that strategic decisions do not include modern mechanisms, tools and methods for determining the nature of the impact for the subsequent clarification of the list of factors that threaten the socio-economic security of the country.

2 METHODS AND MATERIALS

When conducting research, a set of methodological approaches was used to ensure the necessary complexity of assessing the influence of factors on the breakthrough scientific, technological and socio-economic development of the country.

The assessment was carried out on the basis of an array of statistical information, covering, firstly, the actual data of international statistics and the forecast of potential rates and structure of economic growth, made according to the IMEMO RAS model for 15 leading economies of the world; secondly, Russian statistical data characterizing the indicators of socio-economic development of the constituent entities of the Russian Federation; thirdly, information characterizing the innovative activity of organizations and their contribution to the implementation of the national project "Labor Productivity".

The methods of scientific knowledge in the study were dialectical, systemic, indicative and synergistic approaches, comparative analysis, establishing cause-and-effect relationships, methods of economic and statistical analysis and generalization, ranking and sampling.

The scientific novelty of the study lies in the development of theoretical provisions, methodological recommendations and practical provisions for organizing monitoring of the factors of the innovative potential of socio-economic systems at various levels.

3 RESULTS AND DISCUSSION

The research methodology was built on the principles of a deductive approach: by building a chain of "cross-country research - national scale - regional level - level of organizations".

A comparative analysis of the dynamics of socio-economic development indicators at the cross-country level was made on the basis of a modified production function by R. Solow. According to this function, GDP as a result of socio-economic development was broken down into three factors: capital, labor resources and total factor productivity (TFP). The capital factor is calculated based on the forecast of the investment rate modeled for an array of countries using a regression model. The volume of labor resources was determined according to the demographic model, which included indicators of population, labor force participation, and unemployment. The TFP factor was determined by the authors of the IMEMO RAS model for a wide array of countries through the construction of panel regressions (Table 1)

Table 1: Factors of economic growth of the world economy and leading economies of the world.

Object	Factors	2000-2015 (fact)		2016-2035 (forecast)	
		Average annualgrowth rate, %	The level of influenceof factors, %	Average annualgrowth rate, %	The level of influence offactors, %
World	Labor	0.301	9.9	0.043	1.5
	Capital	1.517	49.9	1.174	39.7
	TFP	**1.219**	**40.2**	**1.738**	**58.8**
	GDP	3.038	100	2.955	100
USA	Labor	0.323	16.5	0.356	18.8
	Capital	1.152	58.8	0.646	34.1
	TFP	**0.484**	**24.7**	**0.892**	**47.1**
	GDP	1.959	100	1.894	100
China	Labor	0.431	4.5	- 0.176	- 3.2
	Capital	4.391	46.2	2.083	38.2
	TFP	**4.678**	**49.3**	**3.549**	**65**
	GDP	9.500	100	5.457	100
Japan	Labor	- 0,152	-18.5	- 0.365	- 31.6
	Capital	0.370	45.1	0.637	55
	TFP	**0.602**	**73.4**	**0.886**	**76.6**
	GDP	0.820	100	1.157	100

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Germany	Labor	0.274	21.7	- 0.599	- 73.1
	Capital	0.609	48.2	0.433	52.8
	TFP	**0.380**	**30.1**	**0.986**	**120.3**
	GDP	1.263	100	0.820	100
Great Britain	Labor	0.331	18.1	0.112	6.7
	Capital	0.904	49.5	0.344	20.7
	TFP	**0.593**	**32.4**	**1.210**	**72.6**
	GDP	1.828	100	1.666	100
France	Labor	0.528	43.7	0.056	3.3
	Capital	0.873	72.3	0.574	33.9
	TFP	**- 0.194**	**- 16**	**1.061**	**62.8**
	GDP	1.207	100	1.691	100
Italy	Labor	0.449	190.2	- 0.390	- 32.9
	Capital	0.554	234.7	0.413	34,2
	TFP	**- 0.767**	**- 324.2**	**1.184**	**98.7**
	GDP	0.236	100	1.208	100
India	Labor	0.943	13.6	0.731	13
	Capital	3.286	47.3	1.971	35.2
	TFP	**2.716**	**39.1**	**2.901**	**51,8**
	GDP	6.945	100	5.603	100
Canada	Labor	0.834	39.1	0.233	13
	Capital	1.465	68.7	0.777	43.6
	TFP	**- 0.166**	**- 7.8**	**0.772**	**43.4**
	GDP	2.132	100	1.781	100
Brazil	Labor	1.165	43.3	0.357	14.7
	Capital	1.216	45.2	1.556	64
	TFP	**0.308**	**11.5**	**0.518**	**21.3**
	GDP	2.689	100	2.431	100
South Korea	Labor	0.775	19.2	- 0.053	- 2.3
	Capital	1.769	43.7	1.175	51.1
	TFP	**1.503**	**37.1**	**1.179**	**51.2**
	GDP	4.047	100	2.301	100
Spain	Labor	0.746	44.9	- 0.198	- 21
	Capital	1.132	68.1	0.558	59.3
	TFP	**- 0.215**	**- 13**	**0.581**	**61,7**
	GDP	1.663	100	0.941	100
Mexico	Labor	1.185	51.2	0.753	21.3
	Capital	1.561	67.5	1.825	51.5
	TFP	**- 0.434**	**- 18.7**	**0.964**	**27.2**
	GDP	2.313	100	3.542	100
Russia	Labor	0.495	12.4	- 0.431	- 18
	Capital	0.673	16.9	1.073	44.7
	TFP	**2.818**	**70.7**	**1.757**	**73.3**
	GDP	3.986	100	2.398	100
Australia	Labor	1.137	39.1	0.530	27.6

	Capital	2.035	70	0.851	44.3
	TFP	**- 0.264**	**- 9.1**	**0.539**	**28.1**
	GDP	2.908	100	1.920	100

Source: Calculated by the authors based on the forecast model for the rates and factors of economic growth of the world's leading economies CEI Institute of World Economy and International Relations of the Russian Academy of Sciences.

An analysis of the economic growth factors of the world economy made it possible to establish that the level of influence of TFP on the resulting GDP indicator is within 40% in the reporting period and 59% in the forecast period. The change in the role of the factor in changing the resulting indicator at the level of the world economy is obvious: if in the reporting year the influence of the factor was assessed as significant, then in the forecast period the factor will be dominant. Studying the data in Table 1 makes it possible to single out countries with the traditionally predominant influence of the TFP factor on the result of economic growth: Japan (over 73%) and Russia (over 70%). All other countries demonstrate the dominant influence of material factors (labor and capital) on economic transformations at the beginning of the 20th century. Forecast values of rates and factors of economic growth in the period from 2016 to 2035 made it possible to distinguish the following groups of countries:

- countries focused on economic growth mainly due to TFP (USA, China, Japan, Germany, Great Britain, France, Italy, India, South Korea, Spain, Russia);
- countries invariably focused on economic growth mainly due to material factors (Canada, Brazil, Mexico, Australia).

Thus, the comparative analysis showed the importance of TFP as a subject of economic research in order to identify its structural composition and cause-and-effect relationships between the identified components and the resulting indicator, as well as with the main components of R. Solow's modified model.

To determine the patterns that take place in the socio-economic development of Russia and their impact on the country's innovative potential, which ensures the formation of conditions for scientific and technological development, we will group the regions of the Russian Federation in order to identify their properties and characteristics that ensure the adaptation of these regions to the conditions of a constantly changing environment. Traditionally, in economic studies, groups of developing, problematic and depressed regions are distinguished, however, in our study, we adhere to the approach adopted at the state level, which is the basis of project management (Schwab, 2017; Telyatnikova, Ryzhakov, Suvorova, Chekmakovskii, Khalyapina, 2020; Popkova, 2019).

In the course of the study, an approach was used to identify the so-called "regions with a weak economy", proposed in June 2019 by the Ministry of Economic Development of the Russian Federation, based on the following reasons: 1) the regions had the worst positions in four indicators: average per capita income of the inhabitants of the region, the share of the population with incomes below the subsistence level, unemployment and investment in fixed capital per capita; 2) there is a connection between the listed indicators and two factors in R. Solow's model: labor and capital.

To determine the degree of influence of economic development factors on the overall result of the efficiency of the national economy from the standpoint of scientific and technological development, we proposed the following changes to the chosen approach: subjects of the Russian Federation); 2) the period from 2017 to 2019 is taken as the billing period. (the period of the first stage of the implementation of the Strategy of the Scientific and Technical Revolution of the Russian Federation); 3) the assessment was performed not only by the absolute values of the indicators, but also by their dynamics over the 3 analyzed years in comparison with the average Russian level (Fig. 1). We propose in the process of analysis and evaluation to compare the values of indicators with the average Russian level as a threshold value from the position of socio-economic security.

At the next stage of the study, the regions were grouped according to the share of the number of indicators that do not correspond to the average Russian level, in percentage terms, which makes it possible to determine the level of socio-economic security of a particular region in comparison with the threshold (average Russian) for each indicator (Table 2). This, in turn, can be used to identify the most problematic regions (regions with a weak economy), the state of which reflects the level of socio-economic security in the region and the impact on socio-economic security at the macro level.

Table 2. Grouping of regions according to the share of the number of indicators that do not correspond to the average Russian level.

Group 1 - regions with 50% Discrepancy	Group 2 - regions with 75% discrepancy	Group 3 - regions with 100% discrepancy
Vladimir region, Voronezh region, Sevastopol, Ivanovo region, Kaliningrad region, Krasnodar region, Kurgan region, Penza region, Republic of Adygea, Republic of Kalmykia, Komi Republic, Republic of Crimea, Mari El Republic, The Republic of Khakassia, Ryazan Oblast, Smolensk region, Tambov Region, Chelyabinsk region, Chuvash Republic, Yaroslavl region	Altai region, Samara Region, Volgograd region, Zabaykalsky Krai, Kabardino-Balkarian Republic, Kirov region, Novgorod region, Orenburg region, Oryol Region, Altai Republic, The Republic of Buryatia, The Republic of Dagestan, The Republic of Mordovia, Republic of North Ossetia - Alania, Rostov region, Samara Region, Stavropol region, Tomsk region, Ulyanovsk region, Chechen Republic	Astrakhan region, Karachay-Cherkess Republic, The Republic of Ingushetia
20 regions	**20 regions**	**3 regions**

According to the performed grouping, it can be concluded that according to the values of the indicators characterizing the components "Labor" and "Capital" in R. Solow's model, more than half of the constituent entities of the Russian Federation can be determined as regions with signs of weak socio-economic development. Thus, this allows us to establish that the conditions for the scientific and technological development of these regions as a direction of the country's socio-economic development have not been formed.

Meso-level socio-economic systems, especially those at risk, have the ability to self-organize under certain conditions, which indicates that the system tends to self-organize using internal patterns of functioning and development, evolving from an unstable state to a more stable one. In the conditions of the knowledge economy, the innovative activity of organizations is an organizational factor in the effective transition to a state of sustainability in the interests of achieving the goals of national socio-economic security. On the way to conducting research, an obstacle to establishing causal relationships between the innovative activity of organizations and the effectiveness of the socio-economic development of the regions of the Russian Federation is the lack of a unified approach to determining the indicator "innovative activity of organizations" and its calculation.

In our study, to determine the essence and calculate the indicator "innovative activity of organizations", the approach of Rosstat of the Russian Federation was applied, which is based on the methodological principles of the statistical measurement of innovative activity, prepared by the OECD and Eurostat, recognized as an international standard in the field of innovation statistics. Another reason for our choice is the fact that this approach to calculating the indicator ‘innovative activity of organizations’ is the basis of one of the target indicators of the state program of the Russian Federation ‘Economic development and innovative economy’. In addition, only within the framework of this approach is it possible to carry out an interregional comparison of the innovative activity of organizations at the national level.

Analyzing the substantive part of the Strategy of the Scientific and Technical Revolution of the Russian Federation, the national project 'Labor Productivity' and the state program of the Russian Federation 'Economic Development and Innovative Economy', it should be noted: 1) the goal of implementing the Strategy of the Scientific and Technical Revolution is not disclosed for the purposes of the other two strategic documents; 2) one of the objectives of the STR Strategy is the formation of a knowledge economy, which is revealed by one of the objectives of the state program "Economic Development and Innovative Economy", among the goals of which is the increase in the innovative activity of business; 3) we noted the coincidence of the key indicators of the national project "Labor Productivity" and the state program "Economic Development and Innovative Economy" in terms of growth in labor productivity at medium and large enterprises in the basic non-primary sectors of the economy. It is obvious that there is no single methodological platform for the development of strategic documents, which does not contribute to the creation of an information and analytical space for assessing the results of the implementation of the STR Strategy. Such circumstances are caused by different levels of management, control and financing of innovation activities, at which documents were developed within the national space.

Table 3 attempts to investigate the mutual influence of the level of innovative activity of organizations on the innovative activity of the constituent entities of the Russian Federation within the framework of the national project "Labor Productivity". These tables confirm the earlier conclusion that the higher the level of innovative activity of organizations and their involvement in the implementation of the national project "Labor Productivity", the lower the level of manifestation of factors-threats to ensure the socio-economic security of the region, and vice versa. In the first group, the number of regions with innovative activity of organizations above the national average is 40, and only 1 region was not included in the implementation of the national project. In the second group, the number of regions with high innovative activity of organizations decreased to 25%, while organizations in 20% of the regions of the group were not included in the national project. The third group of regions is characterized by an absolute lag behind the average Russian level of innovative activity of organizations; organizations of the regions of this group were not included in the national project.

4 CONCLUSIONS

Summing up this study, we note that the achievement of national competitiveness based on the knowledge economy is a multidimensional, interdisciplinary and multi-level goal associated with the application of the methodology of socio-economic security of the country and regions, research on the problems of economic development of socio-economic systems in a knowledge economy and the theory of complex systems and synergy.

The author's research methodology is based on the use of the modified production function of R. Solow. R. Solow's model, in fact, is based on the principle of unity of economic, scientific and technological development, innovative business activity, on the basis of which the world's leading economies achieve success in solving the problems of the fourth industrial revolution in increasing national competitiveness in the global market.

The results of the study can be used to provide information and analytical support for the process of assessing the contribution of organizations' innovative activity to the effectiveness of socio-economic systems at different levels. Promising research should be the development of a mechanism for managing the country's socio-economic security based on the integrated regulation of development processes as part of the implementation of strategic documents.

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Table 3: Characteristics of innovative activity of organizations and their involvement in the implementation of the national project ‘Labor Productivity’.

	The level of innovative activity of organizations of the constituent entities of theRussian Federation in relation to the average Russian indicator, shares			The number of organizations in the region that became participants in thenational project ‘Labor Productivity’		
	2017	2018	2019	Total	Processing industry	Civil constructio n
Group 1 - regions with 50% discrepancy						
Vladimir region	1.30	1.26	1.26	34	31	-
Voronezh region	1.29	1.22	1.32	1	-	1
Sevastopol	0.53	1.11	0.51	2	1	-
Ivanovo region	0.65	0.66	1.20	40	35	-
Kaliningrad region	0.47	0.53	0.50	37	27	-
Krasnodar region	0.91	0.63	037	124	65	12
Kurgan region	0.84	1.06	1.36	14	14	-
Penza region	1.64	1.72	1.60	45	32	1
Republic of Adygea	1.12	0.90	0.75	4	4	-
Republic of Kalmykia	0.19	0.15	0	-	-	-
Komi Republic	0.41	048	0.70	1	1	-
Republic of Crimea	0.50	0.53	0.44	26	11	1
Mari El Republic	0.87	0.84	1.32	7	6	1
The Republic of Khakassia	0.50	0.52	0.39	2	-	1
Ryazan Oblast	1.39	1.45	1.46	58	45	1
Smolensk region	1.06	1.01	1.09	4	3	-
Tambov Region	1.03	0.99	0.99	32	23	1
Chelyabinsk region	1.44	1.58	1.59	67	55	1
Chuvash Republic	2.45	2.94	2.19	45	38	2
Yaroslavl region	1.41	1.21	1.41	48	39	1
Group 2 - regions with 75% discrepancy						
Altai region	1.20	1.37	1.10	60	43	4
Samara Region	0.48	0.70	1.02	108	84	7
Volgograd region	0.74	0.59	0.64	41	28	1
Zabaykalsky Krai	0.47	0.39	0.38	-	-	-
Kabardino-Balkarian Republic	0.28	0.20	0.21	-	-	-
Kirov region	0.93	1.01	1.66	8	5	-
Novgorod region	0.88	1.29	1.07	17	13	-
Orenburg region	0.57	0.40	0.50	19	14	1
Oryol Region	1.02	1.03	1.44	16	14	-
Altai Republic	0.91	0.49	0.31	-	-	-
The Republic of Buryatia	0.55	0.45	0.61	17	10	1
The Republic of Dagestan	0.76	0.23	0.09	5	3	-

The Republic of Mordovia	1.75	1.96	2.74	45	32	2
Republic of North Ossetia-Alania	0.28	0.20	0.21	-	-	-
Rostov region	1.21	1.21	1.72	73	54	4
Samara Region	0.48	0.70	1.02	108	84	7
Stavropol region	0.73	0.78	0.77	55	33	5
Tomsk region	1.09	1.09	1.38	32	22	3
Ulyanovsk region	0.54	0.75	1.15	12	8	-
Chechen Republic	0	0.04	0	-	-	-
Group 3 - regions with 100% discrepancy						
Astrakhan region	0.72	0.65	0.56	-	-	-
Karachay-Cherkess Republic	0.39	0.37	0.46	-	-	-
The Republic of Ingushetia	0	0.71	0	-	-	-
Compiled by the authors based on data from Rosstat and the Platform for Productivity Improvement of the National Project 'Labor Productivity'						

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APPENDIX

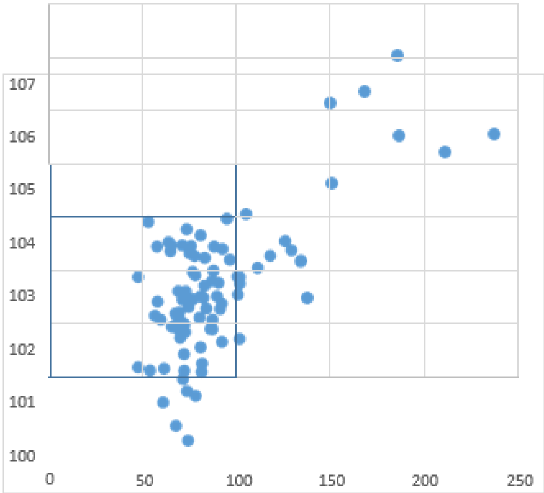


Fig.1. Distribution of regions according to the indicator "Average per capita monetary income of the population per month, rub." for 2017-2019

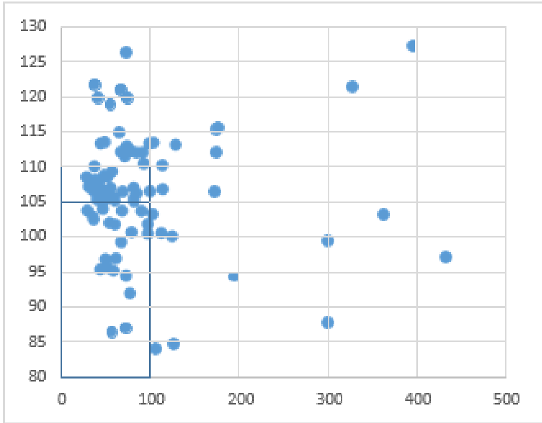
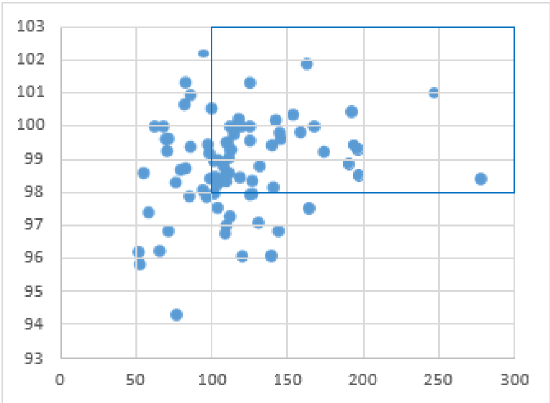
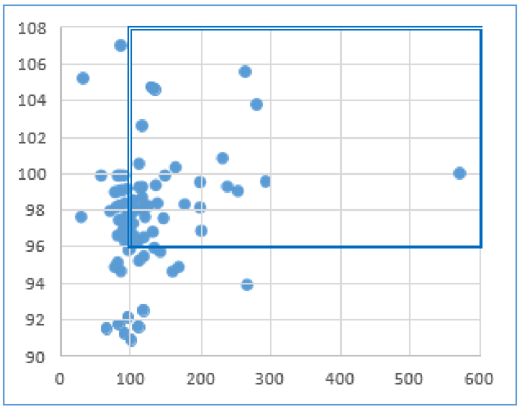


Fig.2. Distribution of regions by the indicator "Investment in fixed capital per capita, rub." for 2017-2019



Distribution of regions by the indicator "Population with cash incomes below the subsistence minimum, in % of the total population" for 2017-2019



Distribution of regions by the indicator "Unemployment rate, in %" for 2017-2019

where on the x-axis - the level of the indicator value in relation to the average Russian according to the data of 2019, expressed in%;
along the Y axis - the average growth rate of the indicator values for the period from 2017 to 2019, expressed in%.

Figure 1: Scatterplot of regions of the Russian Federation.

It should be noted that the position of the regions in terms of the indicators “Average per capita monetary income of the population per month, rubles.” and “Investment in fixed capital per capita, rub.” isassessed favorably if their values grow, then regions with a weak economy can be attributed to those in the lower left quadrant. Therefore, according to the other two indicators, the regions in the upper right quadrantshould be classified as such (Fig. 1). Based on the scatter diagram, the	According to the indicator "Investment in fixed capital per capita, rub."

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regions of the Russian Federation were grouped according to their assignment to the selected quadrants (Fig. 2).According to the indicator "Average per capita monetary income of the population per month, rub."			
Astrakhan regionAltai region Belgorod region Vladimir region Voronezh regionSevastopol Ivanovo region Kabardino-Balkarian Republic Karachay-Cherkess Republic Kirov region Kostroma regionKurgan region Leningrad region Novgorod region Omsk region Orenburg region Oryol RegionPenza region Perm region	Altai Republic Republic of Bashkortostan The Republic of Buryatia The Republic of Dagestan The Republic of Ingushetia Mari El Republic The Republic of Mordovia Republic of the North Ossetia - Alania Samara Region Stavropol region Tambov Region Tula region Tomsk region Udmurt republic Ulyanovsk region Chelyabinsk regionChechen Republic Yaroslavl region	Astrakhan region Volgograd region Voronezh region St. Petersburg Sevastopol Zabaykalsky Krai Kaliningrad region Karachay-Cherkess RepublicKrasnodar region Novgorod region The Republic of IngushetiaRepublic of Crimea Mari El Republic The Republic of MordoviaRostov region Ryazan Oblast Samara Region Tambov Region Tver region	Tomsk region Ulyanovsk region Yaroslavl region
According to the indicator "Population with cash incomesbelow the subsistence minimum, in % of the total population"		According to the indicator "Unemployment rate, in %"	
Altai region Arhangelsk region Astrakhan region Bryansk region Vladimir region Volgograd region Jewish Autonomous RegionTrans-Baikal Territory Ivanovo Region Irkutsk region Kabardino-Balkarian Republic Kaliningrad region Karachay-Cherkess RepublicKirov region Krasnoyarsk Territory Kurgan Region Novgorod Region Orenburg region Oryol Region Penza region Republic of Adygea	Republic of Altai Republicof Buryatia Republic of Dagestan The Republic of Ingushetia Republic of Kalmykia Republic of Karelia Komi Republic The Republic of Mordovia Republic of the North Ossetia - Alania Republic of Tyva Republicof Khakassia Rostov region Ryazan Oblast Samara Region Smolensk region Stavropol region Tomsk region Ulyanovsk region Chelyabinsk region Chechen Republic Chuvash Republic	Altai region Amur region Arhangelsk region Astrakhan region Volgograd region Zabaykalsky Krai Kabardino-Balkarian RepublicKarachay-Cherkess Republic Kemerovo region Kirov regionKrasnodar region Novosibirsk region Omsk region Orenburg region Oryol Region Primorsky Krai Pskov region Republic of AdygeaAltai Republic The Republic of Buryatia The Republic of DagestanRepublic of Ingushetia	Republic of Kalmykia Republic of Komi Republic of Crimea The Republic of Sakha (Yakutia) Republic of the North Ossetia - Alania Republic of Khakassia Rostov region Sakhalin region Smolensk region Stavropol region Chechen Republic Chuvash Republic

Figure 2: Grouping the regions of the Russian Federation on the basis of inconsistency of the values of indicators with the average Russian level.