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KEY DETERMINANTS OF SOCIOECONOMIC TERRITORIAL DEVELOPMENT: THE INNOVATIVE ASPECT *

The paper presents a correlation analysis of the innovative environment factors, which have a decisive influence on territorial development according to the year 2012 data. The study reveals the key determinants of territorial socioeconomic development and, particularly, improving living standards. These factors include the development of science, improvement of specific innovative infrastructure and innovative businesses, as well as the development of innovative economy in general. A dynamic analysis was also carried out on the data for the period of 2012–2014 in the group of Russian Federation regions called "Generators of Innovations". The positive impact of the selected key determinants on the socioeconomic situation in these regions.

Keywords: socioeconomic development; innovative environment; living standards; correlation analysis; regional economy.

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КЛЮЧОВІ ЧИННИКИ СОЦІАЛЬНО-ЕКОНОМІЧНОГО РОЗВИТКУ РЕГІОНУ: ІННОВАЦІЙНА СКЛАДОВА

У статті проведено аналіз чинників інноваційного середовища, що мають суттєве значення для розвитку територій. У результаті кореляційного аналізу даних за 2012 р. визначено основні детермінанти соціально-економічного розвитку території, зокрема, підвищення рівня та якості життя населення. Ці фактори включають в себе розвиток науки, покращення специфічної інноваційної інфраструктури, а також розвиток інноваційного підприємництва та інноваційної економіки в цілому. Також проведено динамічний аналіз даних за 2012–2014 рр. по групі суб'єктів Російської Федерації «Генератори інновацій», доведено існування позитивного впливу обраних ключових показників на соціально-економічний стан регіонів.

Ключові слова: соціально-економічний розвиток; інноваційне середовище; якість життя; кореляційний аналіз; регіональна економіка.

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КЛЮЧЕВЫЕ ФАКТОРЫ СОЦИАЛЬНО-ЭКОНОМИЧЕСКОГО РАЗВИТИЯ РЕГИОНА: ИННОВАЦИОННАЯ СОСТАВЛЯЮЩАЯ

В статье проведен анализ факторов инновационной среды, которые имеют определяющее значение для развития территорий. В результате корреляционного анализа данных за 2012 г. определены основные детерминанты социально-экономического развития территории и, в частности, повышения уровня и качества жизни населения. Эти факторы включают в себя развитие науки, улучшение специфической инновационной инфраструктуры, а также развитие инновационного предпринимательства и инновационной экономики в целом. Также проведен динамический анализ данных за 2012–2014 гг. по группе субъектов Российской Федерации «Генераторы инноваций» и подтверждено положительное влияние выбранных ключевых показателей на социально-экономическое положение регионов.

Ключевые слова: социально-экономическое развитие; инновационная среда; качество жизни; корреляционный анализ; региональная экономика.

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Introduction. Economic slowdown and deepening differentiation of Russian regions in terms of socioeconomic development raises the problem of identifying and implementing territorial development factors. New Economic Geography focuses on two groups of factors that affect the development of regions in various combinations and in varying degrees, and include primary and secondary factors (Krugman, 1991).

The key feature of regional development in Russian Federation is the dominant role of the first group of factors, in particular, availability of mineral resources. At the same time capacity factors of the second group are not used, or in most cases, act as barriers for regional development. Such barriers are fragmentariness and irregularity of innovative development of regions, the absence of control mechanisms for the development of innovation systems in regions, wherein there is an actual lack of governance arrangements of the region's innovative system development.

Complexity and ambiguity of this process led to the formation of many concepts. The growing interest of theorists and practitioners to the development of regional innovation systems initiates a lot of empirical evidence that such critical elements of the innovation process as generation of innovations, technology transfer etc., as a rule, are geographically localized, and thus put forward the regional aspect to the forefront.

Innovative development of economic systems becomes the factor of sustainable growth and territories' competitiveness under globalized conditions of the world economic relations. Appreciating the importance of the available scientific results in the field of regional innovative development management, it should be recognized that a number of conceptual and methodological issues have not received their solution yet, including the interdependence and mutual influence of innovative environment in a region and its socioeconomic environment.

Recent studies and publications analysis. Topics of national and regional innovation systems' development are reflected in the researches of M.A. Afonasova (2009), B.A. Lundvall (1992), D. Niosi et al. (1993), Ch. Edquist et al. (1997) and other scientists. Structural transformation of the economy and its orientation on innovative development requires solving new problems in management, including those at the strategic level. Research problems of scientifically-based strategic management of socioeconomic systems are presented in the works of A.I. Tatarkin and S.N. Kotlyarova (2013). Institutional aspects of territorial economic systems development were researched by foreign and domestic scientists, such as D. North (1997), R. Nelson (1993), R. Coase (2007), Yu.K. Persky and Y.V. Dubrovskaya (2011). Systematization of the factors causing the competitive advantages' development of a territory was carried out in the framework of the "New Economic Geography" by P. Krugman (1991). Linkage and interdependence of innovations and economic growth were investigated by J. Schumpeter (1982). Features of innovative potential estimation of a region are considered by I.M. Bortnik et al. (2012), I.V. Grishina et al. (2012), L.M. Gohbert et al. (2012), K. Freeman (1995) and others.

The analysis of theoretical studies' results shows that management issues related to regional innovation systems within socioeconomic environment have not been reflected fully in scientific literature yet, and a number of important aspects are left without adequate attention and theoretical grounding. There is no scientific management mechanism for regional innovative system development based on mutual influ-

ence assessment of socioeconomic and innovative environments. In particular, the development of regional economy that requires detailed work, includes the identification of key determinants of its functioning and development, the elaboration of methods for mutual influence assessment of socioeconomic and innovative environments. This raises the need for development and testing of appropriate research and methodological tools.

Problem statement and research objective. Innovative activity in Russia is just gaining momentum. There is a limited number of tools for the innovative potential assessment which are universal. The purpose of this research is to develop a methodology for assessing the level of innovative potential of regions, which would confirm or reject the existence of interdependence between innovative development of a region and its socioeconomic development. This will allow assessing the influence of certain factors on innovative development of a specific region and propose directions for the state policy development in the innovative sphere at different levels of management.

Next, we need to identify the factors that have their significant impact on regional development, and to consider a change of key factors in dynamics on the example of Russian regions.

Key results. Let us assume that a change in one environment does not entail change in another. In other words, what basic living standards do not change under the influence of innovations and science development and innovative economy does not depend on the income level of population in this region, life safety, social and institutional support, doing business on a given territory etc. For testing this hypothesis we need to prove the existence and importance of such mutual influence.

As a result of synthesis of the most common integrated methodologies (Bortnik et al., 2012; Gazda, 2010; Grishina et al., 2012; Gohbert et al., 2012; Freeman, 1995) we managed to develop author's own method of innovative potential estimation for regions, which includes the indicators of socioeconomic environment development and innovative environment. Sequence in determination of key development determinants of a region includes 7 stages.

The first stage is to identify 3 indicators groups of the innovative environment development and 10 indicators groups for the development level of the socioeconomic environment (x_1-x_{28}).

In the first case the indicators groups were formed on the basis of the hypothesis, according to which in the socioeconomic environment a person has the opportunity to be born (demography), be healthy and educated (health and education), work and earn income (the income level; the development of entrepreneurial initiatives; the level of economic development), live in comfortable conditions (housing conditions; environmental conditions; security of residence; transport infrastructure and the level of territorial development), rest and have access to social services (social infrastructure). These conditions directly affect economic and innovative activity of a person as a consumer, student, specialist, scientific researcher, entrepreneur, expert and innovator (Schumpeter, 1982).

The development level of regional innovative environment is characterized by 3 groups of indicators as the development of science and education (generation of human and research resources, development of innovation infrastructure (provision

of processes for innovative production), innovative economy development (income generation) which best describes the innovative activity in a region (Z_1-Z_{20}).

Selection of indicators is based on the following requirements as representativeness, accessibility, objectivity and consideration of regional peculiarities (Grishina et al., 2012).

Next we need to obtain statistical indicators to measure the development level of socioeconomic environment in a region and the development level of innovative environment in the same region.

The second stage is data collection and verification of statistical information according to set requirements, confirmed by data availability for each region.

The third stage is indicators normalization by the reduction of indicators of all regions to the maximum or minimum value as the standard for each of the regions. In contrast to several existing researches, parameters normalization was not implemented by the method of linear scaling (Ershov et al., 2012). It was realized through the reference value of the index across all the regions, as the development task for each region is to maximize the level of socioeconomic and innovative activity, which has been already achieved by at least one region. This method of normalization is sometimes used in some methods of regional development evaluation. The normalized value of the indicator for each region ranges from 0 to 1. Considering such indicators as the unemployment rate, the number of registered crimes per 100,000 population, the death toll per 10 thousand vehicles and the number of accidents per 100,000 population standard is the minimum result.

At the fourth stage all normalized indicators are added. Calculation of the integral indicators of the development level of innovative environment Y_1 and the development level of socioeconomic environment Y_2 is made according to the formulae 1 and 2 (Gohbert et al., 2012):

$$Y_{1n} = \sum_{i=1}^{20} Z_{in}; \quad (1)$$

$$Y_{2n} = \sum_{i=1}^{28} X_{in}, \quad (2)$$

where n – a particular region (from 1 to 83); Y_1 and Y_2 – the integral indicator of the innovative and socioeconomic environment level of n region respectively; X_{1n} and X_{in} – the normalized value of the i -indicator (x or z) on the n region, respectively.

The integral indicator of the socioeconomic development level can be set according to the number of indicators from 0 to 28, and the integral indicator of the development level of the innovation environment can be fixed from 0 to 20. The calculation is made using the method of integral region estimation for each development factor. Interpretation of the obtained integral indicators (Y_1 , Y_2) in the graphical form make it possible to study the features of development of regions which are different in terms of their socioeconomic and innovative development. Figure 1 presents the type of scatter plot which reflects the regions' location based on the measure of innovative potential level. This graph is based on the integral indices of 81 Russian regions. It does not reflect the data of Moscow city and St. Petersburg city, as the level of innovation potential of these territories significantly exceeds the national average.

Figure 1 clearly shows significant differentiation of Russian regions. A number of regions have abnormally high levels of socioeconomic development and low level of innovative development. At the same time we can observe regions where both indicators are low. Of course, without appropriate management tools this divergence will progress and regional differences will grow, preventing further a stable development of the national economy.

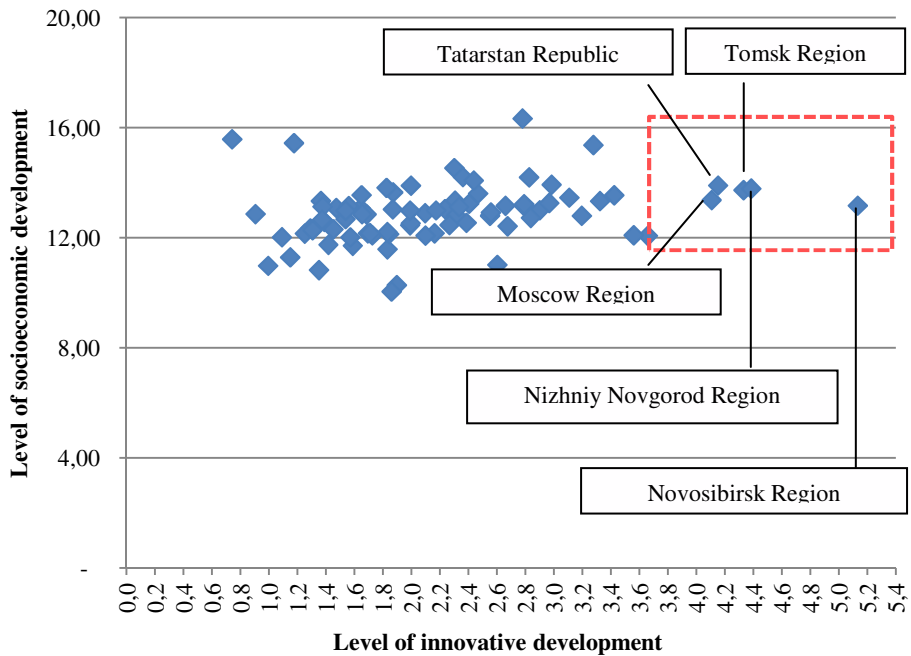


Figure 1. The scatter plot of Russian Federation regions by their levels of innovative and socioeconomic environment development (the data for 2014), author's

The greatest interest in the study is the area of balanced and moderately high socioeconomic and innovative environment (right upper area). This sector of "Generators of innovations" includes such regions as Moscow Region, Nizhniy Novgorod Region, Novosibirsk Region, Tatarstan Republic and Tomsk Region.

At the fifth stage, before the main analysis, it is necessary to verify the presence and assess the degree of the integral indicators' interaction of the development of innovative Y_1 and socioeconomic environment Y_2 for 83 integral indicators in accordance with the number of Russian Federation regions. The value of correlation coefficient is 0.65 indicating high degree of confidence in the assumptions of mutual influence. The calculated value of t-student criterion critical value is $t_{calculated} (11, 88) > t_{critical} (1, 99)$ therefore, the correlation coefficient is significant and the relationship can be considered significant. The critical value ($t = 1, 99$) was obtained using MS Excel "=TINV(0.05;81)", where 0.05 is the significance level, and 81 is the number of freedom degrees.

For further research we will denote the indices of the socioeconomic environment as x_1-x_{28} and the indicators of innovative environment as z_1-z_{20} . The data source for our research is based on the statistical observations throughout 83 regions of Russia for the year 2012 (Federal Service for State Statistics, 2013).

The seventh stage is the interpretation of the correlation analysis results. The obtained results demonstrate the presence of significant links between individual indicators of the innovative environment development level, and the development level of socioeconomic environment in general (Y_2).

The key factors in the region's socioeconomic development are represented through the following indicators:

1. The science and education development (z_1, z_3, z_5, z_7) as the number of national research universities, unit; the number of PhDs per 100,000 population, persons; the number of doctors per 100,000 population, persons; the number of organizations training postgraduates, unit; the number of organizations training doctoral students, units.

2. Innovative entrepreneurship and infrastructure development (z_{11}) as the number of organizations involved in R&D, units per 10,000 population.

3. Innovative economy development ($z_4, z_{17}, z_{18}, z_{20}$) as the share of technologies and services of technical nature in terms of revenues in Russian export, %; applications for patents (for inventions, utility models), units; granted patents (for inventions, useful models, industrial samples), units; the number of used advanced production technologies, units.

Next, we need to carry out a dynamic analysis of the key factors of socioeconomic development of Russian regions. The number of national research universities, the number of organizations training postgraduates, the number of organizations training doctoral students, the number of organizations involved in R&D are not additionally investigated, because they are constant over a long period of time. At the same time scientific and educational institutions, no doubt, are the attraction centers for innovatively active and creative young people and also highly qualified personnel in any region. These institutions are the foundation of innovative economy. It should be noted that of importance is not so much the quantitative side of the issue, and to a greater extent qualitative one, in particular, consistency and efficiency of education and science. It is necessary to maintain high level of technical and technological equipment of scientific and educational processes to ensure the competitiveness of this sector.

Let us consider the following most significant figures. The number of PhDs per 100,000 population and the number of doctors per 100,000 population reflect the level of human and research resources generation in a region. These parameters characterize not only the quantity but also the quality of this resource. At the same time national average of by number of PhDs per 100,000 population in 2014 is 32.78 persons, even taking into account Moscow city, which has the maximum level of 267.87 persons. The minimum level was records in Yamal-Nenets Autonomous Area – only 2.96 persons (Figure 2).

As we can see in Figure 3 the national average for the number of doctors per 100,000 population in 2014 is 9.91 persons, also taking into account Russian capital

(with its maximum level of 107.52 persons). The minimum level was again recorded in Yamal-Nenets Autonomous Area – only 0.56 persons.

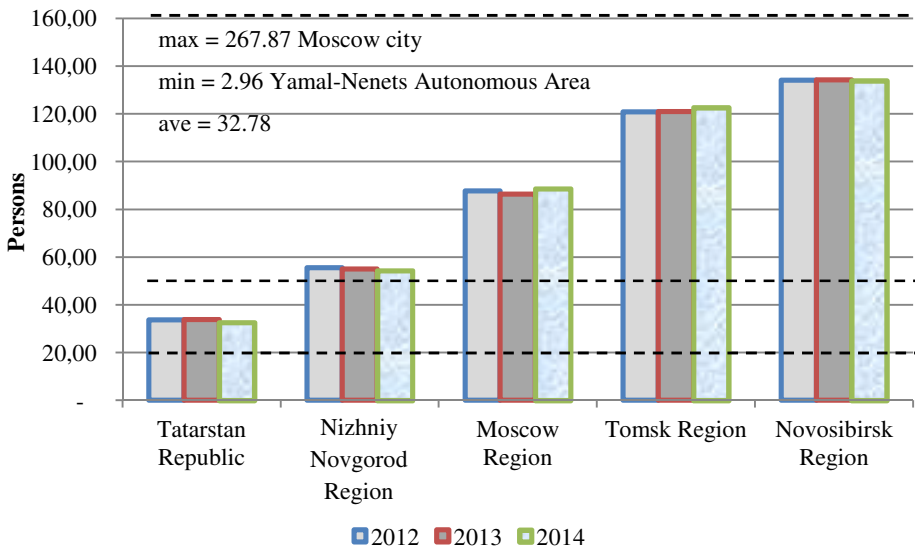


Figure 2. **Dynamic analysis of the number of PhDs per 100,000 population,** author's

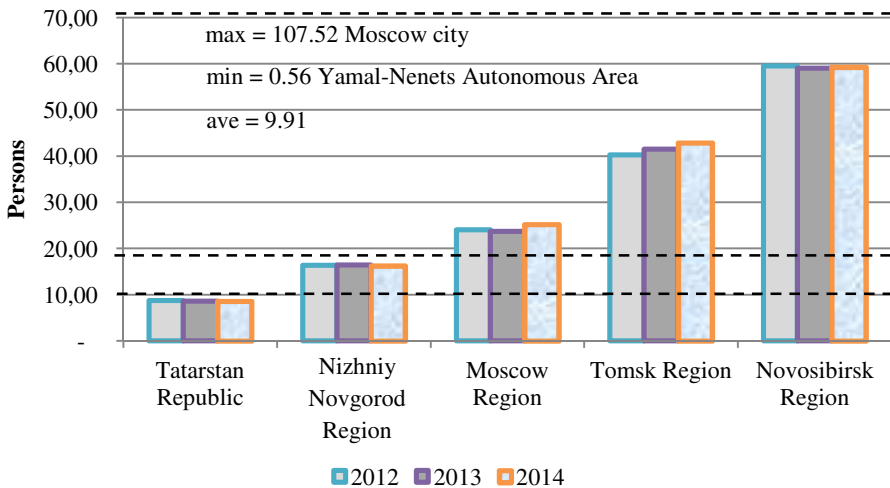


Figure 3. **Dynamic analysis of the number of doctors per 100,000 population,** author's

The performed dynamic analysis of the key indicators for the 2012–2014 revealed that in 5 Russian regions (Moscow Region, Nizhniy Novgorod Region, Novosibirsk Region, Tatarstan Republic and Tomsk Region) the number of PhDs and doctors per 100,000 population is at constant high level (Figures 2–3).

Continuing to study the dynamics of the key innovative determinants, which have a significant impact on socioeconomic development of Russian regions, let us consider the patents (for inventions, useful models, industrial samples).

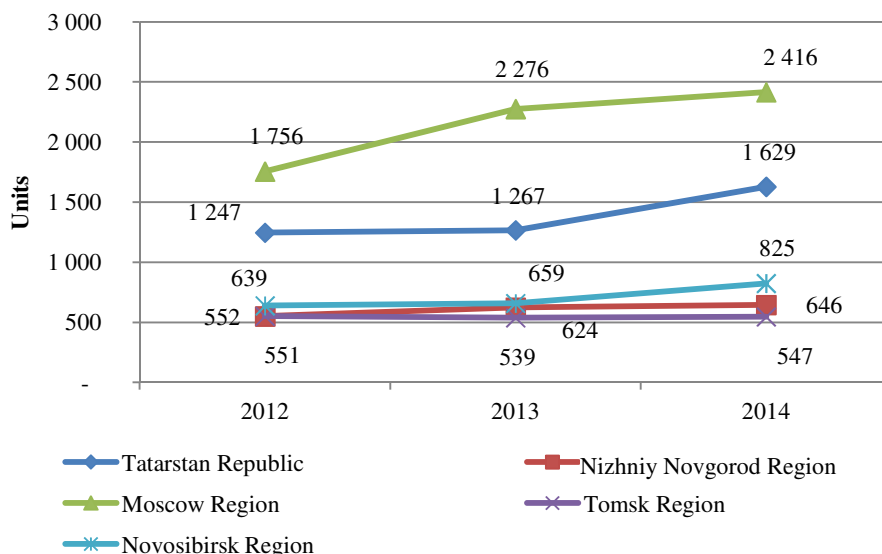


Figure 4. Dynamic analysis of the granted patents (for inventions, useful models, industrial samples), author's

Figure 4 reflects a positive trend in terms of granted patents for all 5 regions of Russia, it allows keeping a high level of innovative potential. A similar trend can be noted in terms of patents applications and the number of used advanced production technologies.

We also noted that in the group of regions "Generators of Innovations" in 2012 the sample included the Sverdlovsk Region. But the innovative development index of this region in 2014 decreased by 26% as compared with 2012 (Figure 5). This lead to a slowdown in the economic development of this territory. From Figure 1, we can also conclude that the Sverdlovsk Region at the end of 2014 is not included in the group "Generators of Innovations" anymore.

Correlation and dynamic analyses show that science, education, innovation infrastructure and entrepreneurship development and the innovative economy development in general are the prerequisites for socioeconomic development of a territory, and in particular, for improving life standards of population in these regions. Therefore, the opportunity to use advanced technologies and carry out a research of applied nature is of critical importance to the formation of high-quality living environment. Acquisition of high-tech products abroad can temporarily compensate for the lack of domestic developments; however, it is necessary to intensify the development and implementation of Russian innovative products and technologies, as they according to the results of our research, have their significant impact on regional economies.

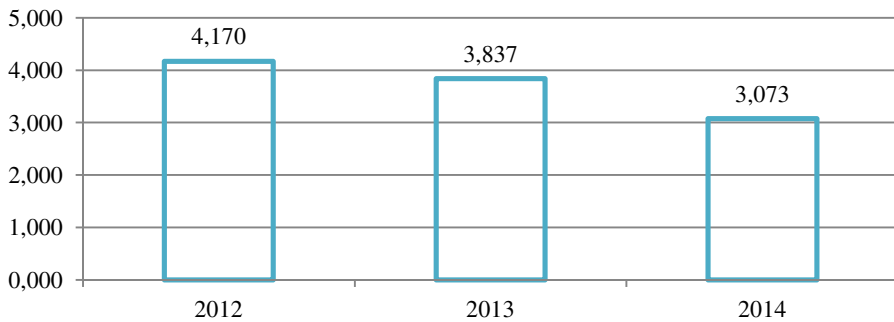


Figure 5. Innovative development index of the Sverdlovsk Region, author's

Conclusions. We can state that socioeconomic territorial development defines innovative development, on the one hand, and on the other, the factors of innovative environment have their significant impact on socioeconomic development of regions.

Currently the issues of sustainable economic growth and competitiveness of regions are important because the prospects of increased competitiveness are associated with increasing innovative activity.

Innovations determine the competitiveness of economy at all its levels. Competitiveness development in a region becomes possible only on the basis of developed innovative infrastructure, which can be considered the basic component of the system of measures for innovative development of a region, while another element to explore is the industrial development of a region, which is always accompanied by rising technical level.

Today the innovative development stage is characterized by the formation of scientific-technical complexes at enterprises which integrate research and production. Creation of holistic research-production-marketing systems is objectively natural, due to scientific and technological progress and market orientation needs.

For its high-quality innovative development the region must have sufficient quantity of intellectuals and professionals as well as relevant scientific and technical base. Innovative development based on intellectual property is recognized in the world and has proven its effectiveness. Innovation is the key element in this process and the base for efficient use of human intellectual potential. The role and importance of innovative activity in the economy increases, and this means that for more effective functioning of the society and its further development appropriate legal and economic support would be necessary ensuring the development of new sectors. Any region should seek transition from a consuming type to the generator type of new knowledge and ideas.

Using the tools of statistical analysis we here have identified the key determinants of functioning and development of regional innovative systems, namely, the factors of innovative environment that have their significant impact on socioeconomic development of regions. The obtained results allow using the effect of mutual reinforcement in the process of management innovative system development in the regions for the purposes of improving the level and life quality and further innovative development of the leading economic sectors.

Directions for further investigation. Our results can be used for testing further on the example of any territorial entity the suggested methodological tools for integrated mutual influence assessment of socioeconomic and innovative environment including the diagnostics of institutional, process and functional factors of innovation system development in a region. This tool will allow building the strategy for socioeconomic development, ensuring innovative development of regional economy and the balance taken by authorities in their administrative decisions. However, with regard to the subjects of the Russian Federation, the use of such comprehensive approach requires the consideration of specific features of a particular region, determined by the level of their development and the existing socioeconomic conditions (Akhmetova et al., 2014).

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