International Business Management 9 (6): 1112-1118, 2015
ISSN: 1993-5250

Evaluation of the Innovation Potential of the Regions of the Central Federal District of the Russian Federation

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Abstract: The present article analyzes the current approaches to the evaluation of innovation potential of the individual territories of the Russian Federation. The technique of evaluation of the innovation potential on the example of the Central Federal District regions by means of the functional model of evaluation is given consideration to. The algorithm of the innovation potential evaluation proposed by the authors includes six groups of indexes integrating twenty-eight individual indicators. The main advantages of this technique are studied. The authors' approbation of the proposed technique on the example of the Central Federal District has been carried out.

Keywords: innovation potential, innovation potential evaluation, group integrated indexes, generalized integrated index.

INTRODUCTION

In the current conditions, the innovation pr ocesses are the priority areas of socio-economic development of the country and its regions. The ambitious goals to ensure a high level of population's well-being, the securing of the geopolitical role of the country as one of the world leaders are set as a strategy of the innovation development of the Russian Federation for the period up to 2020. The only possible way to achieve these goals is the transition of the economy from the raw materials exporting to the innovation community-oriented model of development (O Strategii..., 2011). At that, the uneven development of the Russian innovation system in branches of economy and regions of the country should be noted. Therefore, the study and evaluation of innovation potential of the region will allow determining the direction of their development, improving the justification of the choice of forms and methods for the innovation processes in the economic entities activation.

At the present time, the issue of forming the innovation potential is the focus of the Russian economic literature (Dorokhova et al., 2014; P'yankova et al., 2013), but the existing information is often of fragmentary and contradictory character and has no unambiguous interpretation.

Thus, in some cases the innovation potential is identified with the scientific and technical one. The innovation potential is represented as an "certain amount of accumulated information on the results of scientific and technical works, inventions, design and engineering developments, samples of new equipment and products" (Dan'ko, 1999), or interpreted as a "system of factors and conditions necessary for the implementation of the innovation process" (Nikolaev, 2001), which significantly simplifies the reality and narrows the scope of this important category. The authors, who uphold the resource approach in the definition of innovation potential, consider innovation as a collection of resources (material, financial, intellectual, scientific and technical) that enable the innovative activity and creation of innovative technologies, products, services.

The definition "innovation potential contains the unimproved, hidden opportunities of the accumulated resources that can be brought into action to achieve the goals of the economic entities" (Kokurin, 2001) also indicates the presence of ambiguity in understanding of the essence of the innovation potential.

This circumstance complicates the development of practical recommendations for the formation and effective use of the innovation capacity to a great extent, and, consequently, has an adverse effect on the final results of the innovation activity.

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As far as the innovation potential evaluation is concerned, it should be noted that international organizations have developed a system of indicators, designed to determine the level of the innovation potential of the country (region):

- the International Innovation Index – is a composite to measure the level of innovation in the country;
- the Global Competitiveness Index - (World Economic Forum – WEF) – is a composite to measure the level of innovation and competitiveness evaluation in the country;
- the Knowledge Assessment Methodology (World Bank)– the Knowledge Assessment Methodology (World Bank) – is a composite to measure the level of knowledge economy and innovation in the country;
- the system of indicators of the Commission of the European Communities (CEC) for the innovation activity evaluation - is used for the comparative analysis of the level of development of the innovation activity in the countries of the European Union (EU), and also for the comparison of the latter with the indicators of the US, Japan (European Innovation Scoreboard);
- the Oslo Manual – indicators characterizing the level and dynamics of development of innovation economy of developed and developing countries used in the method of the Organization for Economic Cooperation and Development (OECD) and others (Rukovodstvo Oslo, 2010).

In the twenty-first century methodologies, called the innovation benchmarking, have gained the preferential currency: European Innovation Scoreboard (EIS); Exploratory Approach to Innovation Scoreboards (EXIS) (EIS, 2013; Moskovkin et al., 2004; Moskovkin, 2009).

The existing systems of indicators are primarily focused on the evaluation of the innovation potential of the developed countries. In this regard, they do not take into account a number of factors that are typical for the emerging markets. The latter impose restrictions on the promotion of the innovation activity (for instance, the level of innovation legislation development, the priorities of the state authorities concerning the issues of the innovation development, etc.). In this case, in addition to the traditional indicators, it is appropriate to calculate a number of indicators evaluating the effectiveness of the innovation processes, affecting the socio-economic development of the country (individual regions). For example, such indicators as the share of innovation activity in the regional economy, the indicator of socio-economic utility of the innovation, the share of innovations in the budget of the region (country), etc.

In Russia a series of studies on the evaluation of the innovation potential were conducted in recent years, including those using the innovation benchmarking methodologies of the European Union: "The analysis of the prospects of technological development of Russian regions under realization of the scientific and technological foresight of the Russian Federation" (draft CSD "North-West"); "A comparative analysis innovation activity of Russia and Ukraine by means of the methodology of the European innovation scoreboard" (project BRUIT), etc.

Various methodological approaches to the evaluation of the innovation potential of Russian regions are considered in the works of such Russian scientists as E.P. Maskajkin, T.V. Artser (2009), N.P. Sovetova (2014), V.N. Yakimets, I.L. Balezina, A.N. Val'vashov, A.A. Shirobokova (2012), A.A. Alekseev, E.S. Dyatlova, N.E. Fomina (2012) and others.

The work of the team of authors under the guidance of A. A. Maltseva (Maltseva et al., 2014) in which a comparative analysis of ten different techniques, developed by the Russian authors in the field of innovation, deserves a special note. The authors showed that the methodological approaches to the rating of regions in the innovation sphere need to be modified for the purposes of the operational analysis.

In foreign and Russian practice the indicator or index methods based on the evaluation of the variables, interpreting qualitative and quantitative characteristics to evaluate the innovation potential are used. However, the calculation and analysis of such indicators in the domestic practice is limited because of the lack of adequate information (especially on the regional level), and absence of a proper methodology for their calculation in the context of the main components of the innovation potential. There is also no scientific foundation for the necessary and sufficient number and composition of indicators, evaluating the innovation potential.

The use of score method or expert one for evaluating each variable is preferred in a large number of the proposed techniques. Practice shows that, the use of the expert method implies a subjective factor, and it is often difficult to find the competent experts. There is no possibility of the mathematical evaluation of the test result reliability (Potaev, 2012).

Therefore, the modern domestic methodology does not always objectively reflects the innovation processes, which means that it is problematic to use it to make grounded management decisions.

In order to improve the approaches to the innovation potential evaluation we have proposed the method of integrated evaluation of the innovation potential of the territory on the example of the Central Federal District (CFD) of the Russian Federation.

METHODOLOGY

Integrated evaluation of the innovation potential of the region requires, firstly, the existence of the reasonable and scientifically verified system of indicators. Secondly, the existence of the statistical database is necessary. Thirdly, the indicators calculated separately by the regions, can be used to evaluate the total potential of the country. Particular attention should be paid to the specific nature of the innovation development of the individual regions. The regional innovation systems totality, united by a common purpose (sustainable development of the country), and operating under the government's economic policies and legislation will form the innovation potential of the country on the whole.

To implement the innovation activities an object (country, region, industry, enterprise) must have a sufficient quantity of the innovation potential. In turn, for the effective management of the innovation potential monitoring and evaluation are required.

The proposed method of innovation potential of the region evaluation includes the following algorithm of the sequential actions (Figure 1).

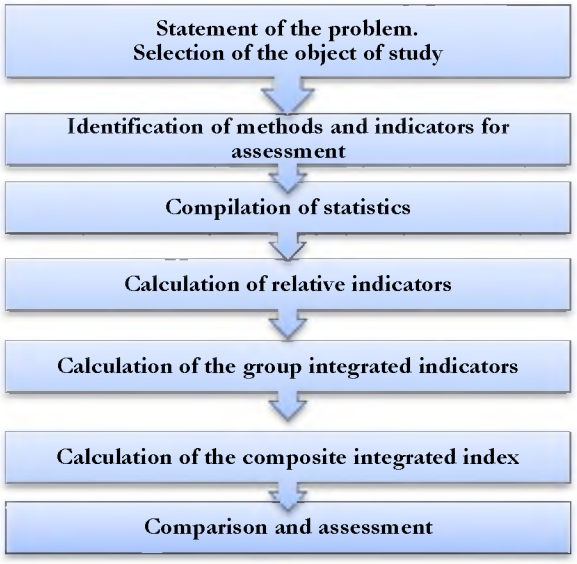

Fig. 1: Algorithm of the innovation potential evaluation

The main advantage of this method is its simplicity, universality and comprehensiveness: it can be used for evaluating the groups of the regions, as well as the Federal District, moreover, variants with the inclusion of the additional indicators, specific to the certain regions or industries, are possible.

This method of the innovation potential evaluation includes 28 basic indicators of statistic data. 24 indicators have been worked out by the Federal Service of the State Statistics of the Russian Federation (№№ K_{11}-K_{31}, K_{41}, K_{42}, K_{44}-K_{64}), and 4 indicators of the innovation activity have been presented by the National Research University of the Higher School of Economics in collaboration with the Ministry of Economic Development and the Federal Service of the State Statistics in accordance with the international standards of OECD and Eurostat (№№ K_{32}-K_{34}, K_{43}) (Sotsial'no-ehkonomicheskoe polozhenie CFO, 2013; Indikatory innovatsionnoi deyatelnosti, 2015).

The indicators are linked in six groups according to the types of the innovation potential:

- Intellectual and professional;
- Ecological;
- Organizational and managerial;
- Productive and technological;
- Financial and investment;
- Indicators of the effective output (Table 1).

When solving the various tasks to evaluate the innovation potential, the quantity and of the indicators composition may vary.

The next phase of the method involves the calculation of the relative values of the indicators according to the formula:

$$K_{rel} = \frac{K_{abs}}{K_{base}} \times 100, \quad (1)$$

where K_{rel} – the relative value of the indicator, %;

K_{abs} – the absolute value of the indicator;

K_{base} – the base of comparison.

In each case, various parameters (such as the GRP – gross regional product, etc.) can be taken as the base (K_{base}) aiming to bring the absolute value of the indicators used in a comparable form. Thus, we used the number of employed in the region, pers. as the base for indicators K_{11}, K_{12}, K_{13}; the total number of advanced production technologies in CFD, numb. – for K_{41}; GRP, rub. – for K_{52}, K_{54}, K_{55}, K_{56}, K_{57}; total number of patent applications in CFD, numb. – for K_{63}; GRP, rub. – for K_{64}.

To carry out the integrated estimation of the innovation potential of the region it seems appropriate to use the group integral indicator, defined as the n-th root of the product of all of its constituent n basic indicators (geometric mean).

$$N_i = \sqrt[n]{K_{i1} \times K_{i2} \times \ldots \times K_{in}}. \quad (2)$$

Integral estimation of the innovation potential allows us to reduce the set of miscellaneous indicators to a single generalized indicator and compare the innovation potentials of the regions. The innovation potential of the region is not just the sum of its constituent elements, but their complex, intricately and multifariously interrelated.

The advantage of the proposed integral indicator is that it covers all the basic innovation potentials and its constituents in a comparable form.

Table 1: Indicators of the innovation potential of the region

Innovation Potential Type (Group Indicator)	Conventional Symbol	Indicator	Conventional Symbol
intellectual and professional	N_1	1. The number of personnel engaged in research and development, pers.	K_{11}
		2. The number of researchers, pers.	K_{12}
		3. The number of PhD students, pers.	K_{13}
ecological	N_2	4. Ratio of organizations which carried out innovations contributing to the increased environmental safety as the result of use of the innovation goods, works, services by the consumer, %	K_{21}
		5. Ratio of organizations which carried out innovations contributing to the increased environmental safety in the process of production of the goods, works, services, %	K_{22}
		6. Ratio of organizations which carried out environmental innovations in the reporting year, in the total number of organizations surveyed, %	K_{23}
organizational and managerial	N_3	7. Ratio of organizations, which carried out organizational innovations in the reporting year, in the total number of organizations surveyed, %	K_{31}
		8. Ratio of organizations which took part in the co-projects on carrying out research and development in the total number of organizations, %	K_{32}
		9. Ratio of organizations which took part in the co-projects on carrying out research and development in the number of organizations involved in technological innovation, %	K_{33}
		10. Ratio of organizations which took part in the co-projects on carrying out research and development in the number of organizations not involved in technological innovation, %	K_{34}
productive and technological	N_4	11. Advanced manufacturing technologies being used by the regions of the Russian Federation, numb.	K_{41}
		12. Innovation activity of organizations (ratio of organizations which carried out technological, organizational and marketing innovations in the reporting year, in the total number of organizations surveyed), %	K_{42}
		13. Ratio of organizations which carried out individual types of innovation activity, in the total number of organizations involved in technological innovation, %	K_{43}
		14. Ratio of the small enterprises which carried out the technological innovations in the reporting year, in the total number of the small enterprises surveyed, %	K_{44}
		15. Ratio of organizations which carried out marketing innovations in the reporting year, in the total number of organizations surveyed, %	K_{45}
		16. Ratio of organizations which carried out technological innovation in the reporting year, in the total number of organizations surveyed, %	K_{46}
		17. Fixed assets suitability coefficient, %	K_{47}
financial and investment	N_5	18. Ratio of expenditure on technological innovation in the total volume of the goods dispatched, the works and services performed, %	K_{51}
		19. Special costs connected with environmental innovations, rub.	K_{52}
		20. Share of internal costs on research and development in the GRP, %	K_{53}
		21. Expenditure on technological innovations of the small enterprises, rub.	K_{54}
		22. Expenditure on technological innovations of organizations by the type of the innovation activity, rub.	K_{55}
		23. Expenditure on technological innovations of organizations, rub.	K_{56}
		24. Internal current expenses for research and development, rub.	K_{57}
indicators of the effective component	N_6	25. Ratio of innovation goods, works, services in the total volume of the goods dispatched, the works and services performed, %	K_{61}
		26. Ratio of innovation goods, works, services in the total volume of the dispatched goods, performed works and services of the small businesses, %	K_{62}
		27. Inflow of patent applications and granting the titles of protection in Russia, numb.	K_{63}
		28. Volume of innovation goods, works, services, rub.	K_{64}

In the methodology proposed, the groupintegral indicators are considered as equivalent. Therefore, the generalized integral indicator of the innovation potential of the region is determined by summing the m values of the group integral indicators N_i (m=6).

$$R = \sum_{i=1}^{m} N_i \,, \qquad (3)$$

where R – generalized integral indicator;

i – number of the group integral indicators.

At this it should be noted that this technique can be improved by means of identifying the significance of the group indicators with the use of the expert assessments on the basis of the sociological tools: questionnaires construction, groups of respondents identification – the key stakeholders of the innovation system of the region. the collection and processing of institutional data questionnaire and the calculation of the coefficients of the group indicators' significance. In the scientific literature, the coefficients of significance are also called weighing coefficients.

RESULTS AND DISCUSSION

Let us calculate the innovation potential of the regions of the Central Federal District (generalized integral indicator) for the period 2010-2013 by summing the values of the group integral indicators. The values of the 28 indicator are not given due to the space restrictions of the article. The calculation results are shown in Table 2.

Table 2: Distribution of the regions of the Central Federal District by the generalized integral indicator of the innovation potential

Regions	2010	2011	2012	2013
Moscow	4.61	7.09	7.55	6.59
Moscow region	4.13	4.55	5.43	5.18
Yaroslavl region	4.22	4.62	4.69	3.87
Kaluga region	2.77	3.33	4.00	3.67
Tula region	2.91	2.89	3.24	3.10
Ryazan region	2.31	2.70	2.61	2.93
Tver region	2.61	3.06	2.65	2.69
Vladimir region	2.46	2.98	2.83	2.63
Voronezh region	2.87	2.87	2.38	2.61
Lipetsk region	2.29	2.49	2.30	2.61
Kursk region	1.39	2.38	2.39	2.09
Belgorod region	1.90	2.09	1.65	1.62
Tambov region	1.77	1.92	1.35	1.56
Oryol region	2.11	2.00	1.17	1.34
Bryansk region	1.32	1.36	1.44	1.31
Smolensk region	1.31	0.95	1.41	1.06
Ivanovo region	1.23	1.12	0.93	1.03
Kostroma region	0.98	0.68	0.63	0.59

It is worth noting that the present system of parameters can not only analyze the innovation activity and determine the value of the innovation potential of the regions, but also identify the opportunities and potential for the growth of the regions, facilitating management decisions making and determining the direction of government policy in promoting the innovation development.

The dynamics of the innovation potential of the regions of the Central Federal District is more clearly visualized in the diagram (Figure 2).

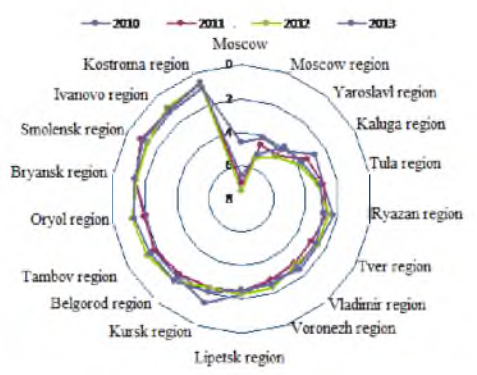

Fig. 2: Innovation potential of the administrative-territorial units of the Central Federal District of the RF

The present research has established that for the period 2010-2013 Moscow and Moscow region possessed the highest innovation potential among the subjects of the Central Federal District. The value of the generalized integral indicator in 2013 comprised of 6.59 and 5.18, respectively. If Moscow constantly supports the high level of the innovation potential at the expense of a high level of the science development, volume of the hi-tech productions with the use of innovation constituent whereas, Moscow region, only in recent years, has made the high-quality rise in the development of the innovation activity due to the significant increase of the costs on technological innovations of the organizations and in this regard increase of the quantity of the advanced manufacturing technologies used.

Yaroslavl and Kaluga regions are also worth noting. The value of generalized integral indicator as on 2013 comprises of 3.87 and 3.67, respectively. The high innovation potential of these regions is mainly provided by means of the innovation commodity output, and the value of the ratio of organizations carrying out marketing innovations.

Smolensk, Ivanovo and Kostroma regions possess the lowest innovative potential. Their value of the generalized integral indicator of the innovation potential is, respectively, 1.06; 1.03; 0.59 that is 3-5 times less than the indicators of the leading subjects of the CFD.

The general tendency in the development of the innovation potential of the subjects of the CFD is the recession of innovation activity in 2013. The majority of the regions underwent this recession. The greatest decrease in the innovation potential happened in the city of Moscow, Yaroslavl, Smolensk and Kursk regions, that of 12.5%, 16.0%, 22.9% and 11.2%, respectively. So, for instance, the rating downgrade in Moscow occurred, generally because of the decrease of the ratio of organizations carrying out the innovations: ratio of organizations providing the increase of ecological safety in the course of production of goods, works, services; the ratio of organizations carrying out ecological innovations in the reporting year, in the total number of the organizations surveyed; inflow of patent applications and granting the titles of protection, etc. In Yaroslavl region the rating downgrade happened because of decrease in the volume of the innovative goods, works, services, reduction of the special expenses connected with the ecological innovations, decrease of the ratio of organizations carrying out the technological innovations in the reporting year, in the total number of the organizations surveyed.

The most essential contribution to the generalized integral indicator of the innovation potential evaluation of the rating leaders was made by such indicators as – "the advanced production technologies used", "the ratio

of innovation goods, works, services in the total volume of the goods dispatched, the works and services performed", "the ratio of organizations carrying out technological innovations in the reporting year, in the total number of the organizations surveyed".

To evaluate the reliability and quality of the technique offered, let us compare the received results with the study results of the innovation activity of regions of the Russian Federation received by the National Association of Innovations and Development of Information Technologies (NAIDIT) for 2012 (Table 3).

Table 3: Rating of the innovation activity of the regions of the Central Federal District of the Russian Federation for 2012 following by the results NAIDIT calculation

Subject of the Russian Federation	Value of indicator
Moscow	0.8339
Moscow region	0.1075
Tver region	0.0913
Vladimir region	0.0869
Tula region	0.0845
Kaluga region	0.0558
Ivanovo region	0.0465
Voronezh region	0.0432
Belgorod region	0.0327
Yaroslavl region	0.0247
Kursk region	0.0203
Ryazan region	0.0197
Oryol region	0.0177
Tambov region	0.016
Kostroma region	0.0135
Lipetsk region	0.0124
Bryansk region	0.0122
Smolensk region	0.0122

Determination of the correlation ratio between the two data files has shown that the coefficient of correlation of R equals to 0.747 that is indicative of the close correlation ratio between the results of evaluation of the innovation potential carried out in the framework of two techniques. At the same time there is a certain element of originality in the technique offered by the authors. First of all it is connected with a choice of statistics data for the analysis of innovation potential.

CONCLUSION

Therefore, the evaluation of the level of the innovation potential development and the analysis of the innovation development specifics of the individual regions determines the formation and development of the innovation capacity of Russia in general. On the basis of the indicators of innovative potential evaluation the opportunity to identify the problems and reserves of the region's economy growth is provided. In the conditions of essentially new federal relations formation it is rational to develop the innovation environment, to conceptually determine the directions of the state policy in the field of innovation development for each region, considering its specific conditions of development, basing on the resources, work force, and infrastructure, available.

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