ISSN 0798 1015

REVISTA ESPACIOS

HOME Revista ESPACIOS ÍNDICES A LOS AUTORES

GERENCIA • GESTÃO • MANAGEMENT Vol. 39 (N°22) Year 2018. Page 6

Integral technique for analyzing of national innovation systems development

La metodología integral para analizar el nivel de desarrollo de los sistemas nacionales de innovación

Alexey I. SHINKEVICH 1; Svetlana S. KUDRYAVTSEVA 2; Marina V. RAJSKAYA 3; Irina V. ZIMINA 4; Alena N. DYRDONOVA 5; Chulpan A. MISBAKHOVA 6

Received: 02/03/2018 • Approved: 02/04/2018

Contents

ABSTRACT:
The urgency of the problem stated in the paper is conditioned by the fact that the rapid acceleration of changes in existing economic and institutional conditions leads to business entities confrontation with new problems that require new approaches and methods for their solution, which will further accelerate innovations and modernization reforms. The purpose of the paper is to develop a comparative assessment of innovative development level in the countries of the European Union and Russia. In the paper, based on the data of the European Innovation Scoreboard (EIS) technique, a comparative description of innovation processes' development level in the countries of the European Union and Russia is given. An integral indicator of costs and results of innovation activity is proposed. The method of dynamic matrix positioning reveals the trends of innovative development on integrated indicators of innovation activity in the countries of the world. The materials of the paper represent theoretical and practical significance for the development of innovation management models, as well as in the development of the strategy of state innovation policy.
Keywords: Innovation, innovation processes,

RESUMEN:
La relevancia del artículo se debe a que la rápida aceleración de los cambios en las condiciones económicas e institucionales existentes genera para las entidades económicas nuevos retos que requieren nuevos enfoques y formas de resolverlos, lo cual contribuirá a la aceleración de las innovaciones y otras transformaciones de modernización. El propósito del artículo consiste en desarrollar una evaluación comparativa del nivel de desarrollo innovador de los países miembros de la UE y Rusia. El estudio presenta una característica comparativa del nivel de desarrollo de los procesos innovadores en la UE y Rusia a base de la metodología del Marcador de la Innovación Europea (European Innovation Scoreboard (EIS), 2017). Se propone un indicador integral de costos y resultados de la actividad de innovación. Una matriz de posicionamiento dinámico ha sido empleada para revelar las tendencias del desarrollo innovador según indicadores integrales de la actividad innovadora de los países. Los materiales del estudio presentan gran importancia teórica y práctica para el desarrollo de los modelos de gestión de la innovación, así como para el desarrollo de la estrategia de la política estatal innovadora.
Palabras clave: innovación, procesos de innovación,

national innovation system, European Innovation Scoreboard, costs and results of innovation activity, matrix positioning	sistema nacional de innovación, Marcador de la Innovación Europea, costes y resultados de la actividad innovadora, matriz de posicionamiento

1. The Relevance of Study

The main direction in the realization and support of innovation activity in the knowledge economy is the formation of a national innovation system that should implement innovative development through the building of intellectual resources and innovative competencies, the creation of an innovative infrastructure and their subsequent use in the production of innovative goods.

Many scientists have been involved in the study of national innovation systems: W. Kingston (1984), P. Patel & K. Pavitt (1994), S. Metcalfe (1995), Y.V. Yakovec (2004), B.A. Lundvall, P. Intaracumnerd & J. Vang (2006).

W. Kingston (1984) notes that innovation is "the process of transforming a new idea or invention into social significant product, having fundamentally new technical and economic indicators or transforming ideas in specific objects".

According to the point of view of B.A. Lundvall, P. Intaracumnerd & J. Vang (2006) "the national innovation system is formed by elements and relationships within the boundaries of the state, which provide interaction in the creation, diffusion and application of new and creative knowledge".

P. Patel and K. Pavitt (1994) define the national innovation system as "a system of stimuli and competencies of national institutions, on the basis of which the main trajectories of technology education in a particular country are determined".

Institutional approach to the definition of the national innovation system is traced by S. Metcalfe (1995) - "it is a set of institutions that contribute to the creation and use of new technologies and create conditional boundaries within which the state authorities carry out national scientifically- technical and innovation policies".

B. Kuzyk points to the unity of the hierarchical, functional and providing structure within the national innovation system. To the hierarchical structure, the researcher attributes the levels of innovation activity - from local to global; to functional subsystems - forecasting and selection of priorities, strategic planning and programming, assessment and selection of innovative ideas and inventions, innovative transformation of inter-industry complexes and territories, integration innovative projects; to providing subsystems - legal, financial, personnel, information support, management and organizational structures (Yakovec, 2004).

Y.V. Yakovec (2004) defines innovation as the introduction of new elements into various types of human activity, which increase the effectiveness of this activity. It is noted that the concept of innovation is multifaceted and its understanding is not as simple as it seems. The author singles out "faces", or incarnations of innovations (Yakovec, 2004).

1. Motivation for innovation. Yu.V. Yakovets notes that one should not reduce everything only to an enterprising nature of a person, to the desire to break the established routine. According to the author, the main motive for innovation is growing human needs and competition for their best satisfaction. Yu.V. Yakovets concludes that innovation is "a general sociological pattern, an engine and an incentive motive for the progress of society in all its many facets."

2. Sources and initiators of innovation. The initiators are:

- Scientists who discover new laws for the development of nature, society, technology and suggest ways of using new knowledge;

- Inventors offering innovations, methods of using it in practice and protecting their intellectual property through patents;

- Entrepreneurs, managers, investors, bankers, who develop new forms of company management or investing in innovation;

- People of creative professions, who develop the spiritual sphere of society, - musicians,

writers, filmmakers, educators, etc.;

- Political and state figures, creating new forms of organizing the political life of the society, political parties, legal norms, interstate relations;

- Military leaders, who offer more effective methods of conducting military operations, use of weapons.

3. The level of novelty of innovations. Under the general term "innovations", phenomena completely different in nature, level of novelty and scale of consequences of implementation are concealed: epochal, basic, improving, micro-innovations, pseudo-innovations, anti-innovation.

4. Types of innovation. The classification according to the sphere of application is proposed: technological, ecological, economic, socio-political, state-legal, innovations in the spiritual sphere, military one and legal order.

5. Spatial sphere of innovations. Depending on the level of novelty, innovations have different territorial distribution. Epochal and basic innovations, spreading from the epicenter, gradually cover the entire territory inhabited by people. The field of action of improving innovations can be limited to the territory of the country, region or city. Micro-innovations (the author uses the term "pointed" here) is limited to the enterprise, collective (Yakovec, 2004).

---

2. Methodological Framework

2.1. Methods of the study

During the research, the following methods were used: analysis, synthesis, system analysis, systematization and generalization of facts, modeling, comparison method, descriptions, analogies, correlation regression analysis, index method, dynamic matrix positioning.

2.2. Theoretical basis of the study

The theoretical basis of the research is the fundamental and applied studies of foreign and domestic scientists exploring the innovative development of national innovation systems engaged in the development of management tools for innovative and modern economic development.

2.3. Stages of the study

The study was conducted in three stages:

- At the first stage - the preparatory stage - the current state of the investigated problem was analyzed in the theory and practice of innovation management; a program of research technique was developed;

- At the second stage - the main stage - based on the statistical data of the European Innovation Scoreboard and Russtat technique, the countries were analyzed on the level of innovative development, an integral technique for estimating the costs and results of innovation activities was proposed, and on its basis a dynamic matrix positioning of national innovation systems was performed;

- At the third stage - the final stage - the systematization, comprehension and generalization of the research results were carried out; theoretical conclusions were refined; processing and registration of the research results were carried out.

---

3. Results and Discussions

3.1. International techniques of National Systems Innovative Development

At present, the economic literature discusses a wide range of issues related to determining the level of development of NIS. However, insufficient attention has been paid to the problems of determining comparable country assessments. The question of which system of statistical indicators reflects to the greatest extent the development of the "new" economy and corresponds to the tasks of the scientific, technical, economic and social policies of states arose in the mid-1950s of the twentieth century. To coordinate the efforts of countries in 1957, within the framework of the Organization for Economic Cooperation and Development, a group of national experts on science and technology indicators (NESTI) was established, which in 1963 in Frascati discussed and adopted a unified technique for conducting statistical surveys of research and development - "The Frascati Manual" (Center for Research and Statistics of Science, 1995). Taking into account the need to develop special standardized recommendations on the issues of the relevant aspects' statistical study in the development of science, technologies, their impact on economic growth, a series of methodological guidelines that formed the "Frascati family" was prepared by OECD (Organization for Economic Co-operation and Development) experts. These include: recommendations for measuring the balance of payments for technology, the use of patent statistics, measuring human resources, collecting and interpreting data on technological innovation, the standard practice of research and development surveys.

Currently, the EU assesses the level of innovation economy development in the group of indicators and provides a comparative assessment of its development's effectiveness across countries. To compile an annual European Innovation Scoreboard (EIS), both regular statistical data and sample surveys (from EIS) are used.

The number of indicators reflecting the level of the innovation economy development is 25; they are divided into three units:

- The "Costs" unit includes the main external "engines" of innovation development and is divided into three sub-units – "Human Resources", "Openness and Attractiveness of the National Research System" and "Finance and Public Support", covering 8 indicators;
- The unit "Activity of firms" consists of three subunits ("Investments of the firm", "Cooperation and entrepreneurship", "Intellectual assets"), containing 9 indicators;
- The unit "Output (results)" characterizes the results of innovative activity of firms and consists of two sub-units using 8 indicators: "Innovators" (number of firms using technological and non-technological innovations) and "Economic effects" (employment, exports, and sales).

The presented indicators allow us to identify the main directions of national innovation processes, and to some extent take into account such social and economic factors as the role of the state, the market, demand - the supply of innovations. In this regard, it is advisable to assess the level of development of NIS on the basis of the "cost-output" principle.

3.2. Comparative Characteristics of Innovative Development of National Innovation Systems

The Russian innovation system cannot at present be characterized by a full list of EIS indicators, since not all indicators can be comparable with European ones. In this regard, the analysis of the level of NIS development by the EIS technique is proposed to conduct for two units - "Costs" and "Output", referring to the integral indices for them. Russian statistics has an extensive information base and methodological developments in the field of science, education and innovation statistics, which makes it possible to adapt the existing indicators to the EIS methodology and the subsequent comparison of Russia in terms of the level of NIS development with the EU countries (Federal State of Statistics Service, 2017).

Comparative characteristics of innovation development's indicators in Russia and the European Union countries allow us to conclude that practically all the indicators of the "Human Resources" unit are lagging behind the countries of Europe. The only exception is the "share of the population with a completed tertiary education aged 30-34 years," where

the indicator for Russia was 62% compared to 33.6% in the EU (from gks).

Russia significantly inferior to other countries on the indicators "Openness, prospects and attractiveness of the national research system": the number of publications indexed in the web of science for 1 million people is 189 (in the EU countries it is an average of 301). The share of Russia in the global number of publications in scientific journals indexed in the web of science is about 4.5 times less than the average European level.

Public expenditure on research and development is 0.46% of GDP (on average in the European Union - 0.76%), which corresponds to the level of Turkey (0.51%), Luxembourg (0.48%), Hungary (0.44%), Croatia (0.41%). Venture capital (0.01% of GDP) is similar in its relative value to Bulgaria (0.015%), the Czech Republic (0.011%), Greece (0.007%).

The resultant unit "Innovators" also shows a significant lag of Russia from the EU member states: the share of organizations that carry out technological innovation is 3.7 times lower than the average European level, marketing and organizational innovations - 6.6 times.

Employment in science-intensive activities is approximately at the level of European countries - 11.6% and 13.5%, respectively. However, if in the EU countries medium- and high-tech exports and exports of science-intensive services make up about 48% of the total volume of export and services' export, respectively, in Russia the value of these indicators is 23.5% and 7.4%, respectively. A significant gap of Russia from the European Union is noted in the development of "new for the market" products and "new for the company" products - 2.5% against 13.3%.

3.3. Dynamic Matrix Positioning of National Innovation Systems

To compare the level of NIS development, we will use the matrix positioning method. This method is widely used in strategic management to determine the position of a strategic economic unit relative to competitors and is very useful in obtaining analytical estimates in the management of innovation. To do this, we define a two-dimensional space of coordinates, whose axes will determine the costs and results of innovative activity in national economies.

Because costs and results are described by several parameters, one need to convert them so that to get one integral value. These values can be calculated on the basis of regression models, where the resulting variable is the growth rate of national economies, and the input variables are indicators for the "costs" and "results", respectively.

To construct a regression model of the economy growth rates' dependence on the costs and results of innovation activity, at the first stage, the individual correlation coefficients and their significance level for the units were calculated: human resources; openness, perspectives and attractiveness of the national research system; finance and state support, innovators, economic effects. In order to assess adequately the indicators presented, the presence of multi-collinear phenomenon (a close relationship between the factor signs) was identified, which could substantially distort the results of the study. One of the indicators for determining the presence of multi-collinear phenomenon between the factor signs is the exceeding of the paired correlation coefficient value of 0.8.

The results of the correlation analysis allow us to conclude that the multi-collinear phenomenon between the factors attributes in the unit "human resources", "openness, perspectives and attractiveness of the national research system", "finance and state support", "economic effects" is absent. In the unit "innovators" there is a close positive relationship between the parameters "organizations that carry out technological innovations - organizations that carry out organizational and marketing innovations" - the coefficient of pair correlation was 0.8272 and is statistically significant. Since the indicator "organizations that implement organizational and marketing innovations" with the output parameter is associated less (the coefficient of pair correlation with the growth rate of the national economy was 0.1095), then the model will have the indicator "organizations that carry out technological innovations" (coefficient of pair correlation with the rate growth of the national

economy - 0, 1182).

At the second stage, according to the regression model, the weights of the corresponding indicators were obtained for costs and results. The presence of negative coefficients is explained by the delay effect of innovation activity costs and results and the growth rates of the economy. For our study, when calculating the integral indicators for costs and results, it seems appropriate to use the values of the weighting coefficients modulo.

As a result, the formulas for calculating the integrated assessment of costs and the results of innovation have taken the following form:

Integral cost index:

$$(0{,}45529\times X1.1.1+0{,}02936\times X1.1.2+0{,}06754\times X1.1.3+0{,}00068\times X1.2.1 +0{,}34200\times X1.2.2+0{,}01726\times X1.2.3+5{,}61280\times X1.3.1+11{,}16652\times X1.3.2) / 16{,}9487$$

Integral index by results:

$$(0{,}0804\times X3.1.1+0{,}2128\times X3.2.1+0{,}0757\times X3.2.2+0{,}0024\times X3.2.3+0{,}2049\times X3.2.4+0{,}9254\times X3.2.5) / 0{,}6663,$$

Where X1.1.1, X1.1.2,…X3.2.5 – indicators in the technique of the European Innovation Scoreboard.

After the calculations, the integrated estimates of innovation activities' costs and results in the countries of the European Union and Russia took the values presented in Table 1.

Table 1
Integral indices on the costs and results of innovation in the countries of the European Union and in Russia in 2016.

Country	Integral cost index	Rating	Integral index based on results	Rating
Belgium	1,0364	7	8,5014	13
Bulgaria	0,5665	30	5,6521	30
Czech Republic	0,7287	20	9,3145	6
Denmark	1,1152	4	8,4211	15
Germany	0,9706	12	10,9590	2
Estonia	0,8314	16	6,9994	25
Ireland	0,9153	13	8,7772	9
Greece	0,7271	21	7,6313	23
Spain	0,7962	18	7,8355	18
France	1,0153	8	8,7387	11
Italy	0,7723	19	8,2139	16
Cyprus	0,7270	22	8,6131	12
Latvia	0,5372	32	4,7077	34

Lithuania	0,7266	23	5,3472	32
Luxembourg	0,8363	14	9,3913	5
Hungary	0,6588	25	8,9074	8
Malta	0,4257	34	9,6140	3
Netherlands	1,1146	5	8,2058	17
Austria	0,9867	10	8,4795	14
Poland	0,6972	24	6,3028	28
Portugal	0,8146	17	7,8053	21
Romania	0,5691	29	6,6511	26
Slovenia	0,8348	15	8,7433	10
Slovakia	0,6483	26	7,8245	20
Finland	1,2070	3	9,4441	4
Sweden	1,2678	1	9,1759	7
United Kingdom	1,1018	6	7,8287	19
Croatia	0,6289	27	7,3913	24
Turkey	0,5214	33	6,3949	27
Iceland	0,9801	11	5,7189	29
Norway	1,0076	9	5,1096	33
Switzerland	1,2194	2	12,8127	1
Serbia	0,6236	28	5,5413	31
Macedonia	0,4050	35	7,7295	22
Russia	0,5421	31	3,6793	35

Having integral estimations of innovative activity’s costs and results in national economic systems, we will construct a matrix of positioning of the countries. A similar study was conducted for EU countries and Russia on the basis of innovation results for 2008 (Shinkevich et al., 2017), which allowed dynamic matrix positioning of the studied economies. In 2016 in comparison with 2008, the relative location of national economies in the theoretical space by integrated indicators of innovation activity’s costs and results in general has not undergone significant changes.

3.4. Evaluation of Simulation Results

All countries are divided into four quadrants, each of which characterizes, on the one hand - the costs of innovation activity, on the other hand, its results. Let us consider them in more detail.

The first quadrant is represented by countries, the high costs on innovation activity correspond to the high level of results -integral indices exceed the average value of indicators. Here there are countries with highly developed national innovation system (Switzerland, Germany, Sweden, Finland and others). A common characteristic of these countries is a balanced system of costs of intellectual, financial, investment resources and innovative activity results in the form of innovative benefits.

In the second quadrant, countries are located in which the costs on innovation exceed the average level for countries, and the results of innovation activity lag behind the median value (Iceland, Norway, and Estonia). The buildup of resource potential does not find expression in the form of innovative goods, services, technologies. There is a "gap" between science, education, investment, on the one hand, and economic effects, on the other. The state policy of these countries is focused on supporting the innovative sector of the economy, creating a system of knowledge-intensive industries that meet the criteria of the knowledge economy, although in general the economies of the countries of this quadrant are far from the leading positions.

In the third quadrant, countries with low integrated indices of innovative activity’s costs and results are combined: Latvia, Lithuania, Bulgaria, Croatia and others. The national innovation system of these states does not have adequate state support. Unlike the second quadrant, the state here does not make significant efforts to accelerate innovation development. There are following reasons for this situation. First, these countries are at relatively low levels of economic development. Some countries have not yet accepted the knowledge economy and models of open innovation. Secondly, a characteristic feature of these countries is the low level of development of education and research institution. Both of these factors hinder the development of national innovation systems, turning these countries into innovators-followers. In this quadrant, Russia is also represented. At the same time, despite obvious problems, in recent years Russia has been actively seeking to move to an innovative model of development-the formation of an innovative infrastructure, the creation of networks of sector educational clusters, and the adaptation of triple-helix mechanisms (the interaction of science, business and the state), but the results of this work are not manifested fully. In addition, the change in Russia's position on innovation development was influenced by crisis phenomena in the economy.

Finally, in the fourth quadrant, countries are presented in which the integrated indices of innovation activity’s costs and results are approximately at the level of median values or the integrated index of results is slightly above the average level: Hungary, Czech Republic, Cyprus, Malta and others. These countries occupy an unstable position in terms of innovative development. Active state policy in the field of supporting the national innovation system, strengthening the relationship of the scientific and educational sectors with the productive sector in the foreseeable future can help move the countries of this quadrant into the first quadrant along with the countries that are leaders in innovative development. The opposite situation - if the national innovation system is not recognized by the government of these states as a priority strategy for the development of the economy, it will lead to a weakening of innovative incentives and the movement of this quadrant’s countries to the third quadrant with low integral indices of innovation costs and results.

---

4. Discussion

However, the positioning matrix by representing a coordinate system divided into only four quadrants does not allow us to distinguish homogeneous groups, since countries that differ in the level of national innovation systems’ development can enter into one quadrant. The use of cluster analysis namely, the "tree of clusters" allows eliminating this disadvantage in

the technique of positioning. Using this analysis, countries were divided into relatively homogeneous groups, similar in composition.

When examining national innovation systems, identifying a country's position is of key importance. Using the positioning matrix, it is possible to determine the position of countries in terms of costs and results of innovation activity, as well as their conformity / inconsistency to each other. The definition of the country’s strategic position can serve as a basis for research and development in the field of state innovation policy. The combination of NIS into homogeneous groups allows for a better understanding of the logic and trends in their development, as well as the effectiveness of state innovation policy. This method is widely used for conducting a comparative analysis and a primary assessment of the level of NIS development.

As the analysis has shown, the leading countries are characterized by the correspondence of high costs and results to innovation activity. At the same time, countries that occupy key positions in the development of human and intellectual capital (Switzerland, Sweden, Finland, and Denmark) are among the leaders in the results of innovation activities. For the countries of the first quadrant (the countries-leaders of innovation activity), it seems expedient to estimate the level of innovation activity’s profitability, as the ratio of the integral index by results and the integral index by costs. The analysis of profitability was carried out exclusively for the countries-leaders of innovative development, since the knowledge economy is characterized by high costs and the corresponding results of innovation activity. At the same time, the highest level of profitability was registered in Germany (11.3), Switzerland (10.5) and Ireland (9.6). Noteworthy is the position of Russia: if the results of innovation activities for 2008 practically on all indicators of the "Human Resources" unit showed a fairly high level, exceeding in some indices the average European level, according to the results of innovation activity, Russia was among the outsiders. The disproportionate costs and results of innovation are one of the reasons that prevent the transition of the domestic economy to a new quality of economic growth. As a result of 2016, Russia is located in a group of countries with low values of indicators for costs and results of innovation, forming a cluster with Serbia, Latvia, Bulgaria, Turkey, Romania, and Croatia.

The previous researches, which were made by W. Kingston (1984), P. Patel & K. Pavitt (1994), S. Metcalfe (1995), J. Swan et al. (1999), Y.V. Yakovec (2004), M.A. West (2004), B.A. Lundvall, P. Intaracumnerd & J. Vang (2006), N. V. Kalenskaya et al. (2017) and others are devoted to study of innovation systems.

However, the analysis of scientific papers on the problem of integrated techniques for assessing the level of national innovation systems’ development is not structured and is only of a debatable nature.

5. Conclusion

As a result of the study, it was shown that a comparative assessment of innovative development’s level of the European Union’s countries and Russia can be based on the technique of the European Innovation Scoreboard, using integrated cost indices (as innovation potential and innovative development resources) and results (as the economic and social effects obtained in the result of innovation). The method of national innovation systems’ matrix positioning based on integral indices of innovation costs and results is proposed: 1 quadrant - high costs of innovation correspond to high results of innovation activity; 2 quadrants - with high innovation costs and low results; 3 quadrant - with low innovation costs and results; 4 quadrant - integral indices of costs and results of innovation activity correspond to the median values or with a slight excess of the integrated index of results. On the basis of matrix positioning method and the "tree of clusters", the countries of the European Union are united in similar classification groups that allow developing trends of innovative development and more quickly and clearly identify inhibitors of innovation activity.

The materials of the paper are of theoretical and practical significance for the development of innovation management models, as well as in the development of state innovation policy

strategy.

Taking into account the obtained results of this research, it is possible to single out a number of scientific problems and promising directions that require further consideration: the deepening and expansion of certain provisions represented in the paper related to the assessment of national innovation systems development level.

Bibliographic references

Federal State of Statistics Service. (2017). Statistics. Retrieved from: http://www.gks.ru.

Kalenskaya, N. V., Shinkevich A. I., Salihov K. M. & Kudryavtseva S. S. (2017). Method of Institutionalization for Innovative Trajectory: Evidence from Russian. *International Journal of Economic Perspectives, 11*(3), 242-253.

Kingston, W. (1984). The Political Economy of Innovation. New York: Springer.

Lundvall, B. A., Intaracumnerd, P. & Vang, J. (2006). Asia'a innovation system in transition. New York: Edward Elgar.

Metcalfe, S. (1995). The Economic Foundations of Technology Policy. Cambridge: Cambridge University.

Patel, P. & Pavitt K. (1994). The Nature and Economic Importance of National Innovation Systems. Paris: OECD.

Rethinking the European Innovation Scoreboard. (2017). A new methodology. Retrieved from: http:/www.merit-unimass.nl.

Shinkevich, A. I., Kudryavtseva, S. S., Kozin, M. N., Shirev, D. A., Fedorova, I. A., Kharisova, R. R. & Zlobin, V. A. (2017). Economic Sectors Development Evaluation in Innovations TripleHelix Model. *Eurasian Journal of Analytical Chemistry, 12*(7b), 1399-1404.

Swan, J., Newell, S., Scarbrough, H. & Hislop, D. (1999). Knowledge management and innovation: networks and networking. *Journal of Knowledge, 4,* 262-275.

Center for Research and Statistics of Science. (1995). The Frascati Manual. Moscow: CRSS.

West, M. A. (2004). Creativity and Innovation in Organizations. *International Encyclopedia of the Social & Behavioral Sciences 3*(3), 2895-2900.

Yakovec, Y. V. (2004). Epochal innovations of the XXI century. Moscow: Economics.

1. Department of Logistics and Management, Kazan National Research Technological University, Kazan, Russia. *Contact e-mail: dlogscm@kstu.ru*

2. Department of Logistics and Management, Kazan National Research Technological University, Kazan, Russia

3. Department of Economics, Kazan National Research Technological University, Kazan, Russia.

4. Faculty of Secondary Professional Education, Kazan National Research Technological University, Kazan, Russia.

5. Nizhnekamsk Chemical Technology Institute (Branch), Kazan National Research Technological University, Nizhnekamsk, Russia

6. Department of Innovation in Chemical Technology, Kazan National Research Technological University, Kazan, Russia.

Revista ESPACIOS. ISSN 0798 1015
Vol. 39 (Nº 22) Year 2018

[Índice]

[In case you find any errors on this site, please send e-mail to webmaster]