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## Article

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# Theoretical and Methodological Aspects of Innovation Development in Modern Economic Systems

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## ABSTRACT

The purpose of this article is to classify existing approaches to analyzing theoretical and methodological aspects of innovation development in modern economic systems. We also present a new approach based on existing ones that combines advantages, eliminates drawbacks, and offers means of analyzing innovation development in modern economic systems and that presents optimal models of innovation development in modern economic systems.

The authors develop and appraise – based on the case of present-day Russia – proprietary methodologies for examining innovation development in modern economic systems. It involves the calculation of an index of innovation development that reflects current levels of innovation development in economic systems and possibilities and perspectives related to innovation development in economic systems in the near future.

The authors classify approaches to the analysis of theoretical and methodological aspects of innovation development in modern economic systems as criteria on innovation development in economic systems. Within this classification, the authors distinguish between and conduct comparative analyses of the following three main approaches: plan-factual, ranking, and indexing, which involve making various theoretical assumptions on innovation development in modern economic systems and on the use of various methodologies.

The authors present a new approach to the analysis of theoretical and methodological aspects of innovation development in modern economic systems that eliminate drawbacks of existing approaches and that present unique advantages (simple calculations and universal use). In turn, an optimal model of innovation development in modern economic systems is offered.

**KEY WORDS:** innovation development, modern economic system, human capital, economic growth

**JEL Classification:** O110, O320

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## Introduction

A priority of any modern economic system and global economy is to improve the population living standards.

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This first involves increasing rates of economic growth and GDP per capita, in turn improving the set of goods and services accessible to each consumer. Second, it involves the creation of innovations that satisfy public needs even while preserving rates of economic growth and creating a stable set of goods and services accessible to consumers. Both processes involve innovation development.

Absolute and relative increases in GDP occur through scientific research and the development of human resources enterprises, which increase intellectual capital, which promote capabilities for the development of innovations, and which promote adaptations to new technologies and equipment and their application through the creation of innovative technologies of production. Such technologies increase labor efficiency, and the modernization of equipment expands enterprise production capacities. This, in turn, facilitates innovation development within existing spheres of the economy and the refinement of existing products, technologies, and equipment.

The creation of innovations occurs through scientific and educational development in economic systems; through the financing of economic research at corporate and state levels for the development of new products, technologies, and equipment that satisfy consumer needs or existing needs more efficiently; and through the creation of new economic spheres. As a result, scientific revolutions occur, and technological modes change one another.

When taking into account capacities for innovation development in modern economic systems, the efforts of multiple representatives of scientific societies are aimed at theoretical considerations and instrumental developments for the provision of innovation development in modern economic systems. However, the results of previous studies often contradict one another, and accumulated knowledge in this sphere is scattered. This complicates the selection of optimal criteria and of practical applications of existing analysis methodologies focused on innovation development in modern economic systems, predetermining the necessity for their reconsideration and systematization.

The purpose of this article is to classify existing approaches to the analysis of theoretical and methodological aspects of innovation development in modern economic systems and to present a new approach based on existing methods that applies their advantages, eliminates their drawbacks, and includes means for analyzing of innovation development in modern economic systems and optimal models of innovation development in modern economic systems.

## Literature review

Issues of innovation development have been thoroughly studied by scientists in recent years. Various organizational-, production-, and marketing-focused innovation activities employed in enterprises in various countries and economic spheres have been explored at the local scale to support or increase firm competitiveness while preserving or improving firm positions in the market (Allan, Crouchley, & Robertson 2012; Bayev & Podshivalova, 2013; Morozova & Vladimirovna, 2014; Nechaev & Antipina, 2015; Ryapukhina, Suprun, Doroshenko, Bukhonova, & Somina, 2015). Enterprise innovation activities are conducted through organizational, production, and marketing activities (Tovt, 2014) to support or increase competitiveness (Belkin & Belkina, 2013) while also preserving or improving firm market positioning (Imanbekova, 2014).

Other scientists have analyzed basic characteristics, essential peculiarities, and generalized features of innovation development processes at the macro level to determine the role of innovation in the provision of national economic growth and have studied ways of provisioning country competitiveness in the global economy through the creation and application of innovations into national production and through the stimulation of business innovation activities through state policies (Coccia, 2015; Donate, Peña, & Sánchez de Pablo, 2016; Kolychev & Prokhorov, 2015; Rumyantsev, 2015; Vasin & Gamidullaeva, 2015). Innovations play a key role in the provisioning of national economic growth (Ng, Kanagasundram, Wong, & Chandran, 2015). Increased state competitiveness in the global economy is largely achieved through the creation and application of innovations in national production (Filinova, Filinov, Pogodina, Lunev, & Luneva, 2015) and through the stimulation of innovative business activities through state policies (Turriago-Hoyos, Thoene, Bernal-Torres, & Alfonso-Lizarazo, 2015).

Numerous scientific studies have focused on global aspects of innovation development related to overcoming disproportionate economic growth in various countries through innovation and related to global economic growth not only through quantitative expression or an increase in GDP growth but also through qualitative expression through the applica-

tion of innovations (e.g., (Al-Sudairi & Bakry, 2014; Machado Arroio, 2012; Parrilli, Nadvi, & Yeung, 2013; Popkova, Zubakova, Bogdanov, Yakoleva, & Nebe-snay, 2013; Popkova, Yurev, Stepicheva, & Denisov, 2015; Voegtlin & Scherer, 2015). At the global scale, innovation involves overcoming disproportionate economic growth in various countries (Yakovleva, Azarova, & Titova, 2015) and ensuring global economic growth (Ryneiska, 2014) not only in quantitative terms through increases in GDP growth but also in qualitative terms (Voegtlin & Scherer, 2015).

Issues relating to the functioning and development of modern economic systems have been actively studied in the context of determining common features, unique possibilities, and key tendencies and in terms of identifying significant factors of development based on statistics of economic growth, dynamics of economic system change, models of current states and structures and forecasts of changes to occur in the near future (Hu, 2013; Mishra & Narayan, 2015; Oxensterna, 2015; Rommel, 2015; Saikевич, 2012; Zakharova, Prokhorova, Shutilov, & Klochko, 2015). Modern economic systems develop according to market types involved, and this supposes free competition and minimal interference with market processes (Batkovskiy, Konovalova, Semenova, Trofimets, & Fomina, 2015). This also assumes the occurrence of periods of crisis and economic growth (Loasby, 2015). Innovations are some of the most significant developmental factors affecting modern economic systems (Okrepilov, Markarov, Bakhtizin, & Kuzmina, 2015).

Nevertheless, despite the numerous studies conducted on this topic, theoretical and methodological aspects of innovation development in modern economic systems have not been studied in a consistent or systemic way. Research conducted in this sphere is thus fragmented, raising the necessity for a systematization of accumulated knowledge for the creation of nuanced and comprehensive understandings of problems, perspectives, and methods related to the activation of innovation activities in modern economic systems. This is examined in this article.

## Method

As methodological instruments, the authors apply induction, deduction, problem and systemic analysis, classification, formalization, economic modeling and

forecasting. In addition to the above methods, we use the proprietary method of innovation development analysis in modern economic systems. This approach involves the calculation of indexes of innovation development, which reflect current levels of innovation development in economic systems and perspectives on innovation development in economic systems to develop in the near future:

$$I_{\text{innov}} = (SE + SF + IT / CT) + (IE_5 / IE_1 + QP_5 / QP_1 + FS_5 / FS_1) \quad (1)$$

where

$I_{\text{innov}}$  – index of innovation development in an economic system;

SE – share of innovation enterprises to the total number of enterprises in an economic system;

SF – share of expenditures for financing science in the form of GDP;

CT – number of leading production technologies created in the current year;

IT – number of leading production technologies applied through enterprise activities in the current year;

IE – number of innovation enterprises (1 – in the first year, 5 – in 5 years)

QP – quantity of personnel focused on scientific research and development (1 – in the first year, 5 – in 5 years)

FS – financing of science from state budget assets (1 – in the first year, 5 – in 5 years).

Indicators of innovation development and generated innovation development index values are evaluated using a special scale (Tables 1 and 2). The index generates values of 6 to 30. The higher the index value, the higher the level and the more significant perspectives on innovation development are in an economic system.

## Results

In this study, the authors classify approaches to the analysis of theoretical and methodological aspects of innovation development in modern economic systems as criteria for innovation development in economic systems (Table 3). Within this classification, the following three main approaches are identified: plan-factual, ranking, and indexing approaches. These approaches involve applying various theoretical definitions of innovation development in modern economic systems and various methodologies.

**Table 1.** Scale for evaluating values of indicators of innovation development in modern economic systems

Indicators	Values assigned to indicators				
	1	2	3	4	5
SE	<1%	1%-9%	10%-24%	25%-50%	>50%
SF	<0.5%	0.5%-0.9%	1-2.9%	3%-5%	>5%
IT/CT	<0.50	>100	0.50-0.99	50-100	1-50
IE <sub>2</sub> /IE <sub>1</sub>	<0.80	0.80-0.99	1.00-1.19	1.20-1.49	>1.50
QP <sub>2</sub> /QP <sub>1</sub>	<0.80	0.80-0.99	1.00-1.19	1.20-1.49	>1.50
FS <sub>2</sub> /FS <sub>1</sub>	<0.80	0.80-0.99	1.00-1.19	1.20-1.49	>1.50

**Table 2.** Scale for evaluating values of indexes of innovation development in modern economic systems

linnov Values	Innovation development: current levels and perspectives
6-10	critical lack and absence of innovation development perspectives
11-14	limited or absent innovation development perspectives
15-20	limited but good innovation development perspectives
21-26	high-level but insignificant innovation development perspectives
27-30	high-level and significant innovation development perspectives

As Table 3 shows, when applying a plan-factual approach, innovation development in an economic system can be understood as the degree of plan realization. Rather, a model of innovation development in an economic system is created first and is then compared to reality. When applying a ranking approach, innovation development in an economic system is measured through rankings. While this allows one to compare economic systems, it hinders the determination of causal relations. Through the indexing approach, innovation development in an economic system is understood as the value of a certain index. This approach is limited due to challenges associated with procuring statistical data and calculating indices.

Existing approaches to the analysis of theoretical and methodological aspects of innovation development in modern economic systems are most limited

in their focus on previous (plan-factual approaches) or current trends (ranking and index approaches) without accounting for future possibilities for innovation development in economic systems and in their basis in economically developed countries, rendering them inapplicable developing countries.

To overcome these drawbacks, we present a new proprietary approach to the analysis of theoretical and methodological aspects of innovation development in modern economic systems that involves not only the evaluation of current levels but also the determination of potential avenues of innovation development in economic systems. Furthermore, unlike existing approaches, this approach can be applied at the national, regional, and global levels, making it universally applicable.

The proposed approach is based on the calculation of integral indicators of innovation development, en-

**Table 3.** Classification of approaches to the analysis of theoretical and methodological aspects of innovation development in modern economic systems

Criteria of comparison	Approaches to the analysis of theoretical and methodological aspects of innovation development in modern economic systems		
	Plan-factual approach	Ranking approach	Index approach
Approach representatives	(Vasin & Gamidullaeva, 2015), (Ng et al., 2015)	(Donate et al., 2016), (Turriago-Hoyos et al., 2015), (Filinova et al., 2015)	(Coccia, 2015), (Rumyantsev, 2015), (Kolychev & Prokhorov, 2015)
Determination of innovation development in modern economic systems through the approach	Innovation development in economic systems – plan realization	Innovation development in economic systems – ranking position	Innovation development in economic systems – index values
Levels of innovation development in modern economic systems considered through the approach	Comparison between factual levels of innovation development and normative values and previously compiled models and plans on innovation development in economic systems	<ul style="list-style-type: none"> <li>- Knowledge assessment methods (KAM – the Knowledge Assessment Methodology) (The World Bank, 2015);</li> <li>- ranking countries on innovativeness (Economist Intelligence Unit, 2015).</li> </ul>	<ul style="list-style-type: none"> <li>- Index of scientific &amp; technical potential as a component of integral indicators for evaluating a country's competitiveness (World Economic Forum, 2014);</li> <li>- System for evaluating innovation activity in a country based on indicators of the European innovation scoreboard (European Commission, 2014);</li> <li>Global innovation index (Management Today, 2013).</li> </ul>

sureing compatibility with the index approach. However, the new approach involves completing simpler calculations based on generally accessible statistical information on economic systems, and it generates results faster, creating additional advantages and making it more attractive when conducting research.

Let us conduct an evaluation of levels and perspectives of innovation development in present-day Russia using the proposed approach. To calculate the necessary indicators and index of innovation development for the Russian economy, let us use official Federal State Statistics Service statistics for 2010-2014. Statistical information and analysis results are given in Table 4.

Table 4 shows that in present-day Russia, according to 2010-2014 data, a small share of enterprises conduct scientific research and development and apply innovations – innovation enterprises (less than 1%). A small share of GDP expenditures is dedicated to financing scientific research (less than 0.5%), causing the number of innovations applied to significantly exceed the number of innovations created (135 times). This shows that in Russia, innovation development does not receive enough attention from the state or businesses.

At the same time, there has been growth in the number of innovation enterprises (2% over 5 years) and significant growth in scientific research financing (almost doubling over 5 years). However, in view

**Table 4.** Results of our analysis on innovation development in present-day Russia based on the proprietary methodology proposed

Indicators of innovation development in Russia	2010	2014	Integral	Assigned values
Indicators of current levels of innovation development in economic systems				
IE	3,536	3,605	-	-
Number of enterprises in thousands	4,823.3	4,886	-	-
<b>SE, %</b>	-	<b>0.07</b>	<1%	<b>1</b>
FS	225.762	425.302	-	-
GDP of Russia, RUB billion	82,055	126,186	-	-
<b>SF, %</b>	-	<b>0.34</b>	<0.5%	<b>1</b>
CT	-	1,409	-	-
IT	-	191,372	-	-
<b>IT/CT</b>	-	<b>135.82</b>	>100	<b>2</b>
Indicators of possibilities and perspectives on innovation development in economic systems for the near future				
<b>IE<sub>2014</sub>/IE<sub>2010</sub></b>	-	<b>1.02</b>	1.00-1.19	<b>3</b>
QP, one thousand people	742	727	-	-
<b>QP<sub>2014</sub>/QP<sub>2010</sub></b>	-	<b>0.98</b>	0.80-0.99	<b>2</b>
<b>FS<sub>2014</sub>/FS<sub>2010</sub></b>	-	<b>1.88</b>	>1.50	<b>5</b>

Note: Adapted from "Russia in numbers. Scientific research and innovations 2015: Bulletin of Rosstat" by Rosstat (2015). Retrieved from [http://www.gks.ru/free\\_doc/doc\\_2015/rusfig/rus-15.pdf](http://www.gks.ru/free_doc/doc_2015/rusfig/rus-15.pdf)

of inflation, this growth trend is brought down to zero and is thus nominal, and this is aggravated by a decline in the number of employees conducting scientific research (a 2% decline over 5 years). The equation for the 2014 index of innovation development in Russia takes the following form:

$$I_{\text{innov}}(\text{Russia}2014)=1+1+2+3+2+5=14.$$

The retrieved index of innovation development value shows low current levels and a lack of views on innovation development. Russian economic modernization strategies and an orientation toward innovation development have positive effects and should improve conditions in future years. From the developed

approach, we propose the following optimal model of innovation development for modern economic systems (Fig. 1).

Fig. 1 shows that the proposed model can be visualized as a pyramid reflecting the dependence of past and current levels of innovation development in economic systems and their current potential and future development. This format allows one to conduct complex analyses in view of dynamics and tendencies of innovation development, modeling, and change forecasting. The model applies instruments of innovation development such as the financing of science and the creation and application of innovations by means of the development of economic system human capital.

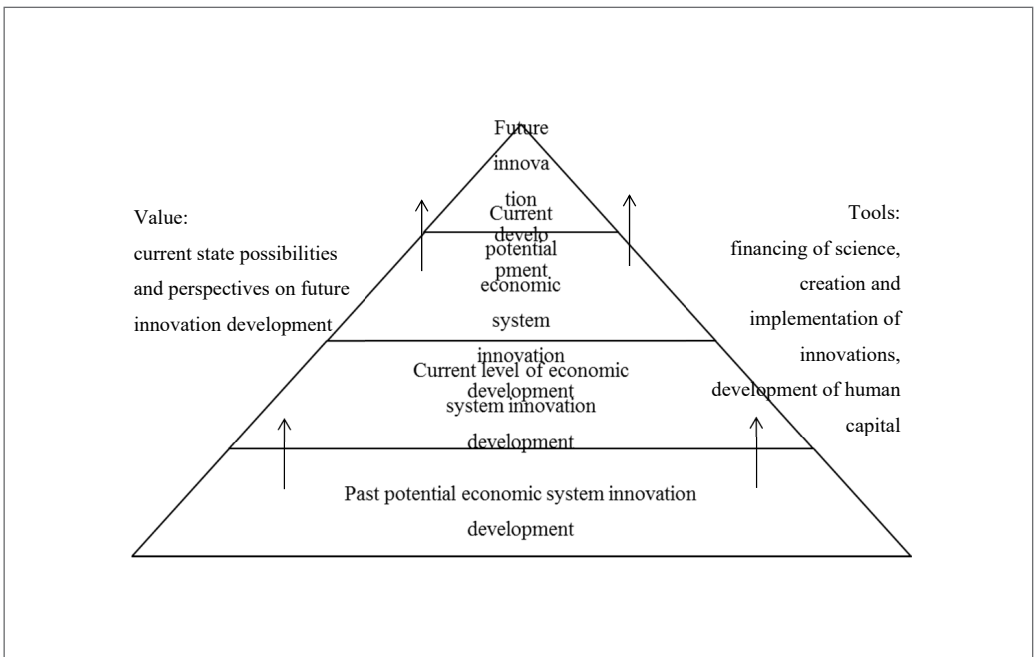


Figure 1. Optimal model of innovation development in modern economic systems

## Conclusion

We conclude that at present, there are three approaches to the analysis of theoretical and methodological aspects of innovation development in modern economic systems. These methods can be classified based on theoretical views of innovation development in modern economic systems and certain methods as follows: the plan-factual approach, whereby innovation development in economic systems is understood as the degree of plan realization; the ranking approach, through which innovation development in economic systems is measured based on rankings; and the index approach, by which innovation development in an economic system is understood as an index value.

These approaches present unique advantages and serious disadvantages by disregarding future innovation development and orientation in economically developed countries. As a means of overcoming these drawbacks, we presented a new approach that involves the simultaneous evaluation of current levels and determinations of potential innovation development in

economic systems. We apply the proposed methodology through an analysis of innovation development in modern economic systems based on the case of present-day Russia, revealing limited perspectives on future innovation development and probable improvements as a result of state modernization programs and innovation development strategies.

We present a new methodology for the analysis of innovation development in modern economic systems that involves the calculation of an index of innovation development that reflects current levels of innovation development in economic systems and possibilities for and perspectives on innovation development in economic systems to emerge in the near future.

Our validation of the proposed methodology through the case of present-day Russia revealed the country's weak innovation development plans but probable improvements to this situation as a result of state modernization programs and innovation development strategies. Our calculation of the 2014 index of innovation development for Russia revealed that inno-



vation development does not receive enough attention in Russia from the state and businesses.

The developed approach involves the use of an optimal model of innovation development in modern economic systems. The model applies instruments of innovation development such as the financing of science and the creation and application of innovations by means of the development of economic system human capital.

Our approval of the proposed methodology was ensured for the provision of its clarity and is limited the presented analysis of the Russian economy; the proposed model of optimal innovation development in economic systems is practically oriented but is theoretical in nature, limiting the results of the research conducted. Hence, in future research studies, the proposed approach should be used for the analysis of state views on innovation development in various economic systems and the creation of innovation development strategies for modern economic systems.

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