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Transport and communication space development in open innovation model

El desarrollo del espacio de transporte y comunicación en el modelo de la innovación abierta

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Content

ABSTRACT:

The paper purpose is to reveal the main trends and specifics of open innovations model in the modern economic, logistical and transport systems management. The relevance of open innovations model introduction in macro and mesa - logistics systems management is shown. Basic concepts overview of the transport and communication space and transport and logistics systems is given. In particular, the specifics of the transport process and the mechanisms for increasing its efficiency are disclosed; the constituent elements are selected, the structure and functions of the transport and logistics system are presented. The main directions of the transport and logistics infrastructure modernization are proposed. On the basis of economic and mathematical modeling, key factors of transport activity were identified in terms of their contribution to gross value added by the "Transport" type of economic activity.

Keywords: open innovation, transport and logistics infrastructure, management, modeling, value added, transport

RESUMEN:

El objetivo del artículo es identificar las principales tendencias y características del modelo de la innovación abierta en la gestión de los sistemas modernos económicos, logísticos y de transporte. El artículo muestra la urgente necesidad de introducir un modelo de innovación abierta en la gestión de sistemas macrologísticos y mesologísticos. Se examinan los conceptos básicos del espacio de transporte y comunicación y los sistemas de transporte y logística. En particular, se describen los detalles del proceso de transporte, los mecanismos para aumentar su eficiencia; se destacan los elementos constitutivos; se presentan la estructura y las funciones del sistema de transporte y logística. El artículo sistematiza los principales problemas del espacio de transporte y comunicación de Rusia. Se determinan los factores clave de la actividad de transporte sobre la base del modelado económico y matemático en términos de su contribución al valor agregado bruto por el tipo de actividad económica 'Transporte'. Asimismo, se proponen los principales vectores de la modernización de la infraestructura de transporte y logística.

Palabras clave: innovación abierta, infraestructura de transporte y logística, gestión, modelado, valor agregado

1. Introduction

The world and Russian practice of recent decades has shown that the various strategies of fragmentary economic reform do not give the proper effect and are gradually disappearing into the past. The success of ongoing reforms and economic systems modernization provides structurally coordinated and balanced efforts to form a system of markets and institutions that would ensure progressive changes in key macroeconomic indicators. This requires in-depth theoretical insights into the management of economic and innovation change.

Studies of many researchers are devoted to the issues of theory and methodology of open innovation: G. Chesbrough (2007), M. Vanhaverbeke, M. Torkkeli & A. Trifilova (2010), J. West & S. Gallagher (2006), K. Kristensen & E. Skott (2008), M. Torkkeli, K. Kok & I. Savickaya (2009), D.S. Medovnikov & S.D. Rozmirovich (2011), S. S.Kudryavtseva, A. I. Shinkevich, A.V. Pavlova, A. D. Chudnovskiy, A. N. Nikolayeva, G. R. Garipova, F. Kh. Doronina & I.I. Ishmuradova (2016) and others.

The theory of open innovation is based on the following fundamental principles:

the use of external knowledge along with internal ideas and developments;

diversification of a new product channels for entering the market through its own networks, as well as through the sales system of external partners;

the "learning organization" model projecting;

formation of crowdsourcing system;

consideration of innovations as a factor for competitive advantage achieved by national, regional economic systems, as well as individual business entities;

ensuring innovative development based on network cooperation and interaction;

achievement of high innovative activity of economic systems;

prevalence of integrated systems of technological development («global-linked»).

In recent years, open innovation models have become an integral part of the innovation strategies for a number of countries and companies business models. Open innovations provide a broader basis for new ideas and technologies, become a strategic tool for exploring new growth opportunities, provide greater flexibility, self-organization and sensitivity to market changes. At the same time, the issue of open innovation model introducing into various sectors of the economy is becoming topical. The paper discusses the problems and prospects for transport and communication space formation in the Russian economic system in the transition to the model of open innovation.

2. Methodological Framework

2.1. Methods of the research

During the research the following methods were used: analysis, synthesis, system analysis, systematization and generalization of facts, method of comparison, description, analogies, economic and mathematical modeling, and component and factor analysis.

2.2. Theoretical basis of the research

Theoretical basis of the research is formed by fundamental and applied works of foreign and domestic scientists exploring the innovative development of economic systems, open innovations; engaged in the problems of modeling the patterns of economic systems development at the micro, meso and macro levels, the developments of management tools for innovative and modern economic development, including in the field of transport and communication space management.

2.3. Stages of the research

The study was conducted in three stages:

1) the main theoretical positions' systematization of open innovation model;

2) trends analysis in the transport and communication space development in the Russian economy;

3) factors modeling of the transport complex innovative development.

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3. Results

3.1. Systematization of open innovations model's main theoretical positions

The tendencies of the world economies socioeconomic and innovative development in the last decade have shown that, in the context of competition and globalization processes intensification, the most promising form of cooperation between business entities is the transition to models of open innovation. The paradigm of open innovation determines the possibility and necessity for companies to use external ideas and knowledge along with internal sources of innovation. An open innovation brings together internal and external ideas into architecture and certain systems and means that companies apply external ideas and technologies, and give their unused ideas to other companies. This requires that every company makes its business model open, thereby organizing bilateral flows of knowledge, information, ideas and innovations: from the external environment to the company and from the company's internal environment to the outside. Thus, an open innovation is well-known information from various open sources about the nature and application of innovations.

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

Kingston notes that innovation is "the process of a new idea's or invention's transformation into socially significant products that have fundamentally new technical and economic indicators or the ideas transformation into specific subjects" (Kingston, 1984). Kingston notes that innovation is "the process of a new idea's or invention's transformation into socially significant products that have fundamentally new technical and economic indicators or the ideas transformation into specific subjects" (Kingston, 1984).

According to the point of view of B.-A. Lundvall "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" (Lundvall, Intaracumnerd & Vang, 2006).

Patel and Pavitt 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" (Patel & Pavitt, 1994).

Institutional approach to the definition of the national innovation system is traced by S.

Metcalfe - "it is a set of institutions that contribute to the creation and use of new technologies and the creation of conditional boundaries in which the state authorities implement national scientific, technical and innovation policies" (Metcalfe, 1995).

B. Kuzyk points to the unity of the hierarchical, functional and providing structure within the national innovation system. The hierarchical structure, according to the researcher includes 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, human resources, information support, management and organizational structures (Yakotsev, 2004).

By definition of Yu.V. Yakovec, innovation - "this is the introduction of new elements into various types of human activity, increasing 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).

Under the open innovative interaction, one should understand the establishment of economic entities' effective interrelationships with the external environment on the principles of open innovation paradigm and with the use of open business models, the result of which is a competitive innovative development aimed at implementing innovative solutions in society. In the model of open innovation, intensive partnerships between market participants, creation of alliances, corporate venture funds and scientific-educational-production clusters become more urgent; the terms of the innovation process all stages are shortened, as well as the duration of innovation introduction cycle into production.

Thus, under the model of open innovation, it is proposed to understand the business model in the knowledge economy based on the management of internal and external information flows, knowledge, R & D, innovations in a dynamic environment of innovations generation and commercialization through open innovation interaction.

3.2. Analysis of trends in the development of the transport and communication space in the Russian economy

In the transition to an innovative type of development, the country seeks to become one of the leaders in the global economy, which requires the adoption of adequate strategic solutions for the development of the transport complex for the long term. In these conditions, the strategic directions formation for the transport development should be carried out on the comprehensive analysis basis of the current state and problems of the transport system development in close relationship with the general directions and scales of the country's socio-economic development, as well as with global strategic trends in the economy (Hegai, 2014).

The uneven distribution of the transport and logistics infrastructure is a deterrent to the development of the country's single economic and transport-communication space and limits the use of resources in the regions (Dunaev & Nesterova, 2015).

The transport complex is characterized by a number of cost, volume and quality parameters that allow assessing the availability, competitiveness and efficiency of the country transport and logistics system as a whole. Consequently, transport is one of the main structure-forming sectors that have close links with all elements of the economic and social sphere.

The carried out author's analytical calculations showed that in Russia there is a high level of logistics costs and this leads to a low efficiency of production and trade. In the RF GDP, the share of logistics costs is 19%, in the EU countries - 9.2%, in the USA - 8.5%, on average in the countries of the world this figure exceeds 12% (from: gks.ru).

An analysis of the transport and communication space development problems made it possible to identify and group the weak points of the Russian transport complex:

a) inadequate efficiency and quality of transport and communication space management;

b) low speed of domestic and international traffic communication;

c) uneven development of transport and logistics infrastructure.

At the same time, balanced spatial and territorial development makes it possible to enhance the competitiveness of macro and meso-socio-economic systems and ensures the effective use of productive assets.

3.3. Modeling of transport complex innovative development factors

In order to identify the impact of the transport complex on the Russian economy, economic and mathematical modeling of transport infrastructure development's main indicators was carried out in conjunction with economic ones. At the first stage, based on the component analysis, a grouping of transport performance indicators was carried out according to the degree of their contribution to gross value added by "Transport" type of economic activity. The dynamic series included 14 indicators for the period from 2007-2016. (from:gks.ru):

1. The gross added value of the "Transport" activity type, billion rubles;
2. Average annual number of employees of transport enterprises and organizations, thousand people;
3. The basic funds of transport enterprises (at the end of the year, at full accounting value), billion rubles;
4. Investments in fixed assets of transport enterprises, billion rubles;
5. Balanced financial result (profit minus loss) of transport organizations, billion rubles;
6. The volume of transport services to the population, billion rubles;
7. Degree of depreciation of transport organizations fixed assets, at the end of the year, %;
8. Index of tariffs for freight traffic, December in% to December of the previous year;
9. Index of tariffs for passenger transport services, December in% to December of the previous year;
10. Freight turnover, million tons of km;
11. Passenger turnover, million pass. km;
12. Provision of the population with cars, pcs. per 1,000 people of population
13. Emissions of pollutants, thousand tons / year
14. Density of highways with a hard surface, km per 1000 sq.km of territory

The results of the main components selection by the Kaiser method are shown in Table 1.

Table 1
Results of the selected main components

№ п / п	Eigenvalues	Percentage of total variance	Accumulated eigenvalues	Accumulated percentage of total variance
1	7,840731	60,31332	7,84073	60,3133
2	1,873909	14,41468	9,71464	74,7280
3	1,120141	8,61647	10,83478	83,3445

4	0,893737	6,87490	11,72852	90,2194
5	0,641167	4,93205	12,36969	95,1514
6	0,369996	2,84613	12,73968	97,9976
7	0,201510	1,55008	12,94119	99,5476
8	0,055013	0,42318	12,99620	99,9708
9	0,003795	0,02919	13,00000	100,0000

As a result of multidimensional statistical analysis, the initial indicators were divided into 3 groups of integral factors, the economic interpretation of which shows their qualitative and quantitative contribution to the gross added value formation by the "Transport" type of activity (Table 2).

The data in Table show that the gross value added formation by the "Transport" type of activity is most influenced by the indicators included in the first factor and having a correlation coefficient of more than 0.5 (the share of the total variance is 56%): fixed assets, investments in the fixed capital, the transport services volume to the population, the level of fixed assets depreciation, the index of tariffs for freight traffic, freight turnover, passenger turnover, the provision of cars to the population and the density of highways with hard surface. Therefore, in order to identify the quantitative contribution to the gross added value formation by the "Transport" type of activity, it seems appropriate to use these indicators.

Table 2

Basic results of factor analysis using the principal component method (using the Varimax raw rotation method)

Variables	**Factor 1**	**Factor 2**	**Factor 3**
	The first level of influence	**The second level of influence**	**The third level of influence**
Number of employees, thousand people.	-0,122351	**-0,777194**	0,240776
Main backgrounds, billion rubles	**0,890371**	0,159794	0,341571
Investments in fixed assets, billion rubles	**0,692143**	-0,272115	0,157908
Balanced financial result, billion rubles	0,315302	0,027565	**0,911471**
The volume of transport services to the population, billion rubles.	**0,958822**	0,104499	0,188395
Degree of depreciation of fixed			

assets,%	**0,819522**	0,183942	-0,441583
Index of tariffs for freight traffic, December in % as December of the previous year	**-0,844025**	0,255762	-0,182702
Index of tariffs for passenger transportations, December in% to December of the previous year	-0,276496	0,308943	**-0,501848**
Freight turnover, mln.t.km	**-0,900689**	-0,205667	-0,235075
кмPassenger turnover, mln.	**-0,891938**	-0,273937	-0,226922
Provision of the population with cars, pcs. per 1,000 people. of population	**0,943608**	0,164156	0,239877
Emissions of pollutants, thousand tons / year	0,321643	**0,841048**	0,165765
Density of highways with a hard surface, km per 1000 sq.km of territory	**0,978174**	0,103440	0,033662
The total variance	7,323463	1,772335	1,738983
Share of total variance	0,563343	0,136333	0,133768

4. Discussions

Thus, economic and mathematical modeling showed that the largest contribution to the gross added value formation by "Transport" type of activity is made by: the provision of the population with cars (B-factor was 0.28), the volume of transport services to the population (0.25), the degree of wear fixed assets (0.19), passenger turnover (0.002) and cargo turnover ("minus" 0.0002, which indicates a negative impact). All coefficients are statistically significant at the 10% level except for the "passenger turnover" indicator.

At the final stage of modeling, using econometric analysis, a correlation was established between the growth rate of the economy (the index of GDP physical volume, as a percentage of the previous year) and the growth rate of freight turnover of motor transport, since more than half (61%) of the freight turnover accounted for this particular type of transport. The dynamic series was built from 2000-2016.

Calculation of elasticity coefficients by regression equations showed that the change in the growth rates of the Russian economy was more dependent on changes in the growth rates of freight traffic - the coefficient of elasticity was 0.04 (hence, the change in the growth of freight transfers by 1% leads to an increase in GDP volume index by 0.04%).

In addition, the taking into account the time factor - lags, allowed to establish that the change in the growth rates of the Russian economy leaded to a change in the volume of cargo in 1 year (in earlier periods, the analysis showed a dependence at 3 years). At the same time, with the

help of cross-correlation analysis, the influence of the economic growth rates on the changes in the volumes of freight traffic was revealed. The coefficient of cross-correlation of GDP physical volume and the growth rates of freight traffic amounted to minus 0.4, which indicates the average degree of mutual influence. In the face of sanctions, as well as recent crises, "emissions" for both economic growth and freight turnover have made their own adjustments to macroeconomic dynamics. In addition, the negative value of the cross-correlation of the GDP physical volume and the growth rates of freight traffic can be explained by the action of micro cycles in the economy. The reduction in the growth rate of the economy will not immediately affect the volume of freight traffic, since the effect of "delay mechanisms" will allow maintaining the volumes of freight traffic for some time, the production of which occurred before the slowdown in economic growth.

The previous researches, which were made by J. West & S. Gallagher (2006), G. Chesbrough (2007), K. Kristensen & E. Skott (2008), M. Torkkeli, K. Kok & I. Savickaya (2009), I. A. Zaraychenko, A. I. Shinkevich, M. Yu. Mitrofanova, T. I. Ladykova, Y. V. Nuretdinova, G. M. Kharisova & M. A. Zhukova (2017), A. I. Shinkevich, S. S. Kudryavtseva, M. N. Kozin, D. A. Shirev, I. A. Fedorova, R. R. Kharisova & V. A. Zlobin (2017) are devoted to modeling of innovative systems in difference sectors of economic.

However, the scientific papers devoted to the evaluation of innovative processes effectiveness in the transport sector are of a debatable nature.

5. Conclusion

Thus, the analysis of the theoretical, methodical and practical aspects of the transport complex in Russia made it possible to identify the following main areas of the transport and communication space development:

1) Construction or reconstruction of existing high-speed highways of the I and II technical category that provide the required speed of motor vehicles;

2) Construction of large bridges in high-speed roads;

3) Construction of high-speed railways;

4) Development of a system of national transport corridors, container transport and a system of traction arms;

5) Development of transit potential;

6) increase of transport complex ecological compatibility;

7) Formation of trans-logistical platforms as technologies for managing network interaction. The basis of the trans-logistic platform should be formed by a developed transport and communication environment that provides for the organization of multimodal transport, terminal-warehouse and IT-infrastructure, allowing for the integration and real-time management of business processes.

The obtained results of the research can be used in the development of measures to improve the efficiency of the transport and communication space in the innovation economy.

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