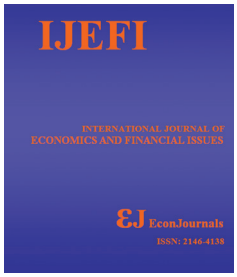

International Journal of Economics and Financial Issues

ISSN: 2146-4138

available at http: www.econjournals.com

International Journal of Economics and Financial Issues, 2016, 6(1), 192-198.

Innovation Networks Modeling Within the Concept of Open Innovations

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ABSTRACT

The urgency of the problem discussed in the article is caused by necessity to search for effective forms of innovation activities' implementation, providing a maximizing of innovative resources' impact by strengthening relationships between entities of the innovation process. The purpose of the article is to develop a model of innovation network, facilitating the acceleration of the diffusion of innovation by increasing its throughput capability and maximum use of the resources of the state innovation system. The leading approach to the study of this problem is the system approach, according to which the interaction of entities in the innovation process is considered as a complex mechanism of communications, ensuring the transformation of innovative ideas into marketable final product. In this paper, a model of innovation network, meeting the requirements of the concept of open innovation, based on the effect of increasing returns of resources is proposed and the mechanism and the necessary conditions for its functioning are described. The materials presented in the paper can be used to develop long-term development programs, both locally and at the regional and Federal levels, while building the innovative systems of the appropriate level and providing adequate conditions for their functioning.

Keywords: Innovation, Innovation Network, An Innovative System, Throughput Capability, The Diffusion of Innovations
JEL Classifications: G14, L11, O31, O34

1. INTRODUCTION

High instability of raw materials markets in recent years due to a number of macroeconomic factors exposed the vulnerability of economic systems, focused on low-tech industries. In this regard, it intensified the need to find effective forms and mechanisms of innovative processes, providing a high resources' return of innovation system. This task is complicated by the significant gap that exists between the three main parts of the triple helix model of innovation system: Science, business and government (Etzkowitz and Leydesdorff, 1995). The problem of inefficient functioning of this model is due to isolation of the scientific sphere and low return from investments in innovations that leads to sustainable institutional gap (North, 1991) between business and R and D. The lack of an effective institutional environment of innovative activity (undeveloped system of patent protection, the low efficiency of innovations' development institutes and other reasons) generate negative incentives for the implementation of their own development. Under these conditions, the companies, seeking to maintain a competitive position in the short term are oriented to borrow successfully implemented innovations. This creates a growing technological retardation from the leading centers of innovative developments (Perez and Soete, 1988).

At the same time a tough competitive environment both at the micro- and macroeconomic levels, high dynamics of economic processes and market requirements determine the need to find not just effective forms that accelerate the innovations' diffusion, but also mechanisms to ensure their flexibility and adaptability. In this regard, a particular relevance belongs to the application of open innovations' concept, in which the innovation process is considered to be an open system in which the active knowledge exchange takes place among the participants, contributing to innovations diffusion

acceleration. So, according to the concept's author, Chesbrough "..at its basic level, the logic of open innovations model is based on huge excess of knowledge, which should be used operatively, in order the company received them, could create additional value" (Chesbrough, 2003). The development of this concept defines the necessity of adequate to it forms' finding for innovative activities' implementation, different from the existing ones.

Until recently, an effective form of management was the firm (Coase, 1937), however, this approach is based on the assumption of transaction costs' optimization by stable relations' establishing of its structural elements' subordination. At the same time, a necessary prerequisite for the innovations implementation is the transformation of the environment, which disrupts the established market interaction. Therefore, the specificity of innovative processes' management requires a shift of emphasis towards the minimization of formal relations and expanding in use of hidden knowledge within the horizontal links (models evolution of the innovation process according to Roswell (Rothwell, 1994). There is a need to find new forms of innovation activity organization. The solution to this problem is the innovation network, which especially in conditions of information and communication technologies' development, globalization of world markets and the increased importance of implicit knowledge is the most promising form of innovative activity implementation.

In the article, the mechanism of functioning of innovation networks model is considered, ensuring maximum efficiency of innovative processes in the context of open innovations.

2. MATERIALS AND METHODS

2.1. The Methods of Study

In the process of the study general scientific methods of cognition, methods of statistical analysis, grouping and synthesis, abstract-logical, economic-statistical, economic-mathematical modeling and forecasting were used.

2.2. Informational Base of the Study

The information base of the study are the data of the official statistical reporting on the enterprises' activity in manufacturing industries of Russian economy, provided by the Federal State Statistics Service, the materials of overview and analytical articles published in the press.

2.3. Stages of the Study

The study was conducted in two stages:

Stage 1 - Theoretical. At this stage, the collection, analysis and synthesis of theoretical materials was carried out.

Stage 2 - Modeling. This stage involved the collection and analysis of statistical data, the construction of economic and mathematical model.

3. RESULTS

3.1. Structural and Functional Content of the Model

In the socio-economic strategy of Russia for the period up to 2020 the mechanism of network interaction in the context of institutional gaps' overcoming in the framework of the "triple helix" is highlighted (Etzkowitz and Leydesdorff, 1995). The active extension of horizontal connections, so in the framework of open innovations' concept, demonstrating the high efficiency in the transition to innovative development path is proposed (China). Thus, the formation of innovation networks at various levels responds to the modern economic realities.

Analysis and synthesis of the existing theoretical approaches to the study of this institutional form has allowed to formulate the following definition of "innovation network" - it is a poly-center variety of innovation activities' independent entities, unified by communications ties and resource flows, providing through the resources' exchange the technology transfer and/or innovations' diffusion contributing to the network effects' emergence as a consequence of the economic effect of increasing returns.

The institutional nature of the phenomenon under consideration is determined by the following features (North, 1991):

- Behavior uncertainty reducing of the network participants, which is characterized by the stability of the behavior guidelines and rules and is reasoned by network self-regulation based on the plurality of communication links and common purpose of the participants, and external institutional effects of state innovation policy.
- The availability of specific formal and informal norms and rules of behavior, ensuring self-regulation of the network's functioning. The positive effect of the behavioral stereotypes on motivation of innovative activity is determined by the interest and voluntary participation of entities as well as by clear objectives, and transparency of cooperation in the network.
- The organizational form of the network, based on horizontal relationships of participants.
- Availability of the functions' institution (limit function is in exclusive access of its members to the existing resources, coordination function implies the existence of the guide pulse in the form of clear rules of behavior in this or that situation, the distribution function assumes an optimal reallocation of network resources due to a limited set of behavior rules). Specific from the point of view of institutional analysis is communication function implemented by innovative network, which ensures the diffusion of innovations based on information and resource exchange between participants. In its turn, the efficiency of communicative function's implementation is determined by the quality of exchange channels, which is characterized by the magnitude of transaction costs, and the intensity of flows in the network. At the same time the structure of exchange channels in the network implies a dynamic nature, caused by the continuous searching by network members of new more efficient channels of exchange. Efficiency of realization of communicative function is determined by the ratio of throughput capability of exchange channels and intensity of the network flows.

Within the concept of open innovations innovative networks are considered to be the outsourcing of certain elements of the innovation process, and the possibility of innovative networks'

functioning are due to the development degree and transparency of the concept of intellectual property, besides of it the rules of the functioning of innovative networks should be clear and understandable, otherwise, there will be substantial risks of information exchange, which will reduce the incentive to open innovation. At the same time inside the network, as in the context of open innovations the notion of intellectual property is not fully eliminated, but its management becomes transparent and profitable for both parties: The owner and user. Participants of the innovation network are independent economic agents that perform an active role in the innovation process, i.e. carry out independent innovation activity (stage of innovation process), or perform support functions. Thus, it is possible to identify the main roles of network participants: Customer, executor, investor and consumer of innovation or the participant that supports the innovation process (Shurkina et al., 2015).The different roles can be implemented by one or more parties in different time periods, depending on institutional conditions and optimization criteria of the innovation process, due to the multiplicity of relationships between them.

The objective of the network participants' utility function maximizing is determined by the increase in the number of relationships, but at the same time the network's unlimited capacity will lead to more complex network and, accordingly, to a reducing factor's leveling of innovative activities' transaction costs and participants' competition increase for limited network resources. Hence a parabolic dependence of the utility function from the number of participants in the network appears, i.e., the emergence of bifurcation points is expected, where the growth of costs associated with the increase in the number of network participants exceeds the increase of utility function, i.e., the effect of participation in the network will be zero and will decrease with the network's increasing:

$$F = R_i - C_{inn} = R_i - (M_i \times N \times \frac{N-1}{2}) = 0 \qquad (1)$$

Where, R - is the network's resource database that includes the total resource capacities of all types of resources and all members of the network, T - is the rate of passage of the innovation flow, M_i - is the parameter of productivity of the I - element of the network, N - is the number of participants in the network, N × - is the number of interconnections in the network.

Here it is possible to find a critical mass of network members, which will result in a zero effect from participation in the network of given R_i and M_i:

$$N = \frac{\frac{1}{2}M_i \pm \sqrt{\frac{1}{2}M_i \times (\frac{1}{2}M_i - 4R_i)}}{2} \qquad (2)$$

In the framework of the structural-functional model, it is proposed to group the participants in the network according to the degree of direct impact on the result of the innovation process. There are basic and auxiliary members. The first group includes innovative network entities, playing an active role in initiating and implementing of innovative processes and executing its individual stages (customers, performers, consumers and investors). Auxiliary participants are entities that serve the investment activities of the main participants. The feasibility of such a division is determined by the specifics of regulation and management of the various stakeholder groups, as for the incentive of main participants it is necessary to develop a complex of direct management actions and measures to regulate the auxiliary members should be indirect by nature.

Structural model of the network is formed equally by members of the network and the nature of the relationships between them. Typing of relationships allow the network to allocate: Direct managed, tracked, and communication with ancillary parties.

Managed direct communications between the members of the network are connections between the main members of the network that arise under the implementation of successive stages of the innovation process. They are characterized by transparency of motivation and a high level of control by the direct entities of interaction. In the framework of a specific project's implementation they are sustainable in nature, limited in time, governed by formal partnership agreements. Outside the framework of the innovative project they can exist, but are informal in nature.

Monitored connections between innovation networks participants - are connections between the main actors of the innovation process, within the framework of inconsistent stages of the innovation process implementation. That is, the member of the network has the ability to take into account this type of communication, but the impact on it he can have only indirectly, by influencing the direct-driven communications.

Links to supporting participants in the innovation network - ensure the viability of the innovation process, the availability of resources and service of innovation activity (Zaraychenko, 2010).

Features of links in innovation network define a set of its properties based on the paradigm of the theory of networks (Yevin, 2010).

1. The degree of involvement or the intensity of relations (I_{inn}). The basic postulate of the network economy is the assertion that the network exists when the value of the product for the consumer increases with an increase in the number of network's users and when each user does not only derive from its use his own private benefits, but also provides the increase in total benefits for existing customers (Katz and Shapiro, 1985). This property of a network indicates the degree of use of communication network functions and is determined by the total number of participants:

$$I_{inn} = \frac{N(N-1)}{2} \qquad (3)$$

Where N is the total number of participants in the network.

2. The value of the network (C_{inn}). The value of a network is directly proportionally associated with the degree of connectivity: The increase in the number of interconnections increases the value of innovation network for its participants,

due to network effect and increase the share of added value and reduction of transaction costs:

$$C_{inn}=f(n) \quad (4)$$

3. The availability of the peaks is characterized by the actual relationships between the parties. This parameter determines the dynamics of the size of transaction costs arising from the implementation of the innovation process in the network.
4. Throughput capability of the network is the maximum flow of innovative products that the network is able to generate. This characteristic is determined by the total productive capacity of its elements, which can be expressed in the maximal number of R and D and innovation projects, the maximum production capacity of enterprises participating in network.
5. The intensity of the innovation flow is determined by the number of innovative products per unit time produced by the network.
6. The speed of innovation flow through the network determines the speed of the implementation stages of the innovation process and is determined by the time interval from the origin of the innovative idea to innovative product output to the market.

Heterogeneity of innovation processes, the uniqueness of each innovation network determines the need for typing of innovation networks for management purposes in the framework of open innovations.

3.2. Typing of Innovation Networks

Since, as it is noted, the network has a formal character only during the implementation period of an innovation project, it is obvious its dynamic structure and form of functioning. Depending on the entity initiating the innovative activity, two types of innovation networks can be distinguished: The initiator of innovation - the consumer and the initiator - the executor. The main characteristics of types of innovation networks are summarized in Table 1.

In the first case, the network is based on the momentum given by the consumer of innovations, it defines the structure of the participants of the managed communications indirectly affects the structure of the participants of non-consecutive stages of the innovation process through the tracked links, evaluates and regulates the functioning nature of the innovation network, carries the risks and additional transaction costs. This situation occurs at fostering of innovation on the part of the consumer demand.

In case the innovation process is initiated by fundamental or applied research that can cause economic interest, the innovation network takes place, initiated by the Executive. In this case, along with innovation rents received by the initiator, the latter takes on the additional transaction costs and risks associated with the uncertainty of the innovation process.

The institutional nature of innovation networks generates differences in the sources of their formation, which can have both formal and informal nature.

Informal innovation networks are networks which are formed spontaneously, they are not formally assigned relationship groups of economic agents, where the performance or non-performance of informal obligations is punished by exclusion from the network or limitation of informal rights within the network. That is, the stability of an informal innovation network is determined by the nature of the additional rent ratio (Bakhareva, 2012) from participating in the network and the expenses related to avoid the obligations of the informal duties within the network. In contrast to the formal innovation network, which is a legally enforceable set of relationships of the network's members, which is binding and the violation of which will lead to incurred fixed shape and volume of sanctions. The specificity of the institutional nature of informal institutions leads to the fact that they generate a higher level of creative activity (Shironin, 2010), innovations, which is especially important within innovation networks. Higher productivity of informal innovation networks is also due to their greater efficiency from the point of view of appearance and changes in the structure and composition, the nature of the relationships, as there are no formal requirements, rules, procedures that take significant time in formal networks.

Since informal institutions arise and develop, as a rule, where they are more effective than formal ones, i.e. on their basis specific problems of the institutional environment are solved, they are in a sense contribute to a more efficient allocation of resources and their more productive use, rather than existing in a society formal institutions (Manohina, 2011). This determines the fact that informal innovation networks provide a higher efficiency of the innovation process through interoperability "at the right time in the right place." However, the same property of informal networks gives rise to "anti-institutions," (Shinkevich and Galimullina, 2012) leveling the problems of functioning of innovation networks, or transforming them. An example of such an anti-institution within an informal network can be a discrimination of potential participants not taking into account their potential contribution.

At the same time, formal networks are more attractive from the point of view of protection of interests, which is especially important within the innovation process in terms of the need to

Table 1: Typology of innovation networks according to the criterion of the initiator

Network property	Network initiated by the executive of innovation	Network initiated by consumer of innovation
Initiator	The research organization of any form	Innovation-active enterprise
Incentives	The available scientific potential	The resulting market demand
Resources	Provides access to non-material resources	Provides material resources
Network effects	Increase of added value by increasing of innovative products' output	Increase of added value by reducing of transaction costs of innovative activity
The institutional base of the network effect	Scale effect	The effect of increasing of resources' returns

* Note. Developed by the author Developed by the author, based on Katz M.L., Shapiro C. (1985), North D. (1991), Muller, K., Ryan, A. (2008), Nizhegorodtsev, R.M. (2010).

protect patents and copyrights. In addition, at the macroeconomic level, the establishment of formal innovation networks defines the desired direction of innovation development at the national level, due to their higher controllability.

The list of advantages and disadvantages of formal and informal innovation networks is presented in Table 2.

Hence the relationship of the two main parameters of innovation networks comes, providing a continuous impact on the development direction of the institutional environment of innovative interaction: The number of participants in the network, which characterizes the value of the network (Muller and Ryan, 2008), and formalization degree of transactions of innovative network that determines the institutional nature of interactions within the network.

As the growth of the network increases the degree of formalization decreases, as the number of interconnections increases according to Metcalfe's Law, which generates a low degree of management and formalization of all possible transactions. In its turn, this situation leads to the reducing of transactions' efficiency implemented in the network. At the same time, the growth of formalization in the network attracts more resources through a higher degree of protection of intellectual and material property that leads to the growth of the resource content. And at the same time an increase in the number of participants with a high degree of formalization also increases the transaction costs of interaction between participants of the network (Figure 1).

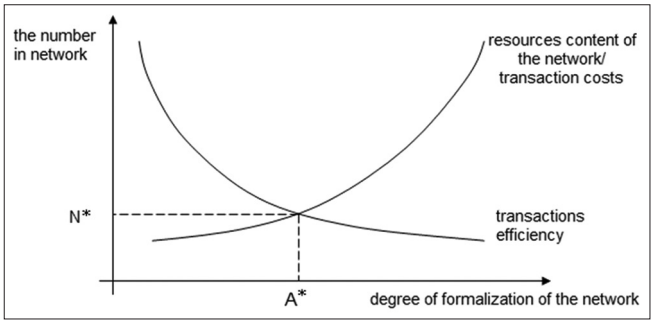
Hence the possibility of optimal characteristics' determining of the network arises: Number of participants and degree of formalization to ensure maximum efficiency of transactions and resource content of the network with minimal transaction cost, by solving the equation:

$$R(N, A) = TC(N, A) = E(N, A) \quad (5)$$

Where - R is the resource content of the network, TC - transaction costs of the network, E is the efficiency of transactions in the network, N is the number in the network, A - is the degree of formalization of the network.

Presented dependence is of particular relevance in the context of open innovation, as it determines the scope of the exchange of information in terms of cost effectiveness in its processing and conversion.

Figure 1: The optimal structure and degree of formalization of the network



3.3. The Mechanism of Innovation Networks Functioning in the Framework of the Concept of Open Innovations

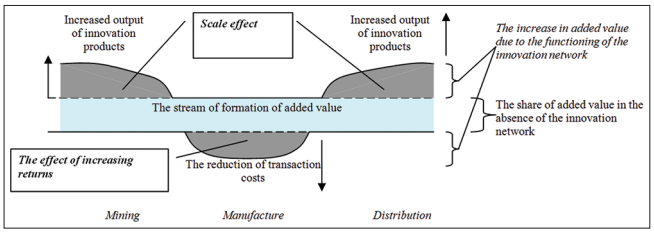
The complexity of the implementation of open innovations through the creation of innovation networks is to find appropriate mechanisms to encourage potential participants to form stable relationships. Under the proposed model, the object of control is the increase in the added value share generated in industry through innovation activity, in particular its part, obtained by operation of the innovation network. The basis for the construction of the network is the flow of innovations, advancing in different sectors of the economy: Mining, manufacturing, distribution. As the flow of innovative products moves it is accompanied by the increased level of added value generated by the innovation network. This distribution of added value is due to the increase in customer value of innovation on the one hand, and the reduction of transaction costs by reducing of the participants' interaction uncertainty in the network, on the other. Economic mechanisms underlying this process are different for individual stages of the innovation stream: For some segments the growth of added value occurs to a greater extent by reducing of transaction costs, but on the other - due to the increase of output volumes (Figure 2).

Extractive industries are characterized by the presence of necessary for innovation resources, their injection provides the increase of the production of innovative products, at the same time, the functioning of innovation networks can reduce investment transaction costs, which leads to an increase in the share of added value, so the scale effect is observed. Further, in manufacturing industries, in conditions of limited resources,

Table 2: Advantages and disadvantages of formal and informal networks

Properties of network	Formal network	Informal network
Advantages	A high degree of manageability, control, and predictability, clear structure, boundaries and parameters of operation, ability to manage in accordance with strategic economic objectives	Enhancing of interaction, high-speed exchange of information, A collective synthesis of knowledge, the exchange of latent knowledge, high flexibility and adaptability, high creative activity, an effective mechanism for allocation of resources
Disadvantages	Insufficient development of the institutional environment can lead to resistance of anti-institutes to formal rules of network functioning, lack of flexibility and adaptability, the high degree of formalization limits creativity which necessary for the innovation process, it may be contrary to the natural institutional structure of the existing informal networks	The emergence of "anti-institutions" makes brakes for innovation process, lack of control, unpredictable results of interactions, The complexity of detection, Resistance of formalization, Possible duplication of functions and processes within innovation activity

Figure 2: Model of innovation networks influence on the share of added value in stages of diffusion of innovations



the network ensures the reduction of transaction costs, which leads to the growth of added value, while the same volume of innovative products' output has a high added value - the effect of increasing returns of resources is observed. In distribution services the implementation of organizational and marketing innovations on the base of innovation network can improve the efficiency of innovation products' promotion, thereby increasing its sales volume, which in conditions of the decrease of transaction costs due to the network leads to increased quantities of added value, realizing the scale effect.

The key objective of managing in the innovation process is to reduce the duration of its initial stages, that is, to minimize the critical path of innovation across the network. In terms of the reduction of the innovation cycle a particularly important is the problem of the variability increasing of the network structure taking into account the specificity of different stages' results of the innovation process with the aim of temporal parameters' minimizing of innovations' implementation and optimization of the resource component of the system. Thus, the task of mathematical simulation of innovative networking takes the form of a solution of a linear programming problem with two objective functions:

a. The function of minimizing of time and resource costs:

$$R, T \rightarrow \min \quad (6)$$

b. The function of maximizing of the network effect from participation in network of the i^{th} agent, which is determined by the difference between the value of the innovation network (C_{inni}), and its costs associated with the input and participation in the network(R_i):

$$F = R_i - C_{inn} = R_i - (M_i \times N \times \frac{N-1}{2}) \rightarrow \min \quad (7)$$

or

$$F = C_{inn} - R_i = (M_i \times N \times \frac{N-1}{2}) R_i \rightarrow \max \quad (8)$$

Where R - the resource base of the network, including the total resource capacity of resources' all kinds of the network's all members, T - speed of the innovation flow, M_i - the parameter of productivity of the i^{th} element of the network, N - number of participants in the network, $M_i \times N$ - throughput capability of the network, N × - the number of relationships in the network.

4. DISCUSSION

To the problems of innovative development of economic systems at the mezzo and macro levels the works of authors such as Porter (1967), Williamson (1979), Smith (1994), Rothwell (1994), Perez and Soete (1988), Lundwall (1988; 1992), Hayek (1984), Dezhina (2007), Skorobogatov (2009), Sheko (1999), Shironin (2010) and others are devoted.

To the research and modeling of infrastructural maintenance of innovative activity in the industry works of Brian (2004), Bravar and Morgan (2007), Porfir'ev and other scientists are devoted. A considerable interest of economic thought is observed to the issues of institutional support of innovation and the effective functioning of the innovation infrastructure, which are described in works of Harrod (2008), North (1991), Ryabtsev and Alsufeva (2008), Radaev (1999), Polterovich (1998), Istomin (2009) etc.

The development of information and communication environment of interaction within the innovation process generates new currents of economic science - the network economy, scientific perspective of which are developed by Viber (2003), Castells (1999), Patyurel (1997), Reiss (1997), Katz and Shapiro (1985), Tretiak and Rumyantsev (2003), Timofeeva and Semenov (2006), Chistyakov (2008), Sayfieva (2008), Nizhegorodtsev (2010), etc. Nevertheless the category "network" in the context of innovative development is not fully disclosed. Found scattered mentions in this category do not have a clear economic content, which raises the need to develop a definition and understanding of the essential content of the category "innovative network." Besides, the methodology of the study, functioning and modeling of network structures are not still formalized, hence there is a need for further development of this scientific field.

5. CONCLUSION

The paper presents a theoretical model of innovation networks' functioning in the framework of open innovations' concept. The mathematical model of innovation networks' functioning defining a network effect from participation in the network is developed, the main features of the innovation networks are summarized and a methodological framework for their evaluation is presented.

The presented model can be used in the development of infrastructure programs of innovative development in the context of introducing of open innovations concept. The proposed model is a methodological basis of management and building of innovative interaction involving the free movement of intellectual property.

However this study does not exhaust the network interactions' study sphere within the concept of open innovation, and on the contrary generates new approaches in this problem's study.

REFERENCES

Bakhareva, T.V. (2012), The informal institutions as an object of scientific analysis. Bulletin of Saratov State Socio-Economic University, 5(44), 12-16.

Bravar, J.L., Morgan, R.R. (2007), Effective outsourcing. Understanding, Planning and Use of Successful Outsourcing Relationship. Moscow: Balance Business Books.
Brian, J.H. (2004), Outsourcing in Search of Competitive Advantage. Moscow: Williams.
Castells, M.E. (1999), Formation of the company networks. In: Inozemtsev, V.L., editor. Postindustrial New Wave in the West: An Anthology. Moscow: Academia. p494-505.
Chesbrough, H. (2003), Open Innovation. The New Imperative for Creating and Profiting from Technology. Harvard, MA: Harvard Business School Press.
Chistyakov, S. (2008), The features of the appearance of network structures. Economics of Education, 4, 228-229.
Coase, R.H. (1937), The Nature of the firm. Economica, New Series, 4(16), 386-405.
Dezhina, I.G. (2007), "Triple Helix" in the innovation system in Russia. Economy Questions, 12, 123-135.
Etzkowitz, H., Leydesdorff, L. (1995), The triple helix-university-industry-government relations: A Laboratory for knowledge based economic development. EASST Review, 14, 14-19.
Harrod, R. (2008), Theory of Economic Dynamics. Moscow: CEMR RAS.
Hayek, F.A. (1984), The principles of a liberal social order. In: The Essence of Hayek. Stanford: Hoover Institution.
Istomin, S.V. (2009), The nature of the institutional mechanism. Bulletin of the Chelyabinsk State University, 139(17), 46-52.
Katz, M.L., Shapiro, C. (1985), Network externalities, competition and compatibility. American Economic Review, 75(3), 424-440.
Lundwall, B. A. (1988). Innovation as an Interactive Process: from user-producer interactions to the national system of innovation. In: Dosi G. Ch. Freeman R. Nelson
Manohina, N.V. (2011), "Institutional trap" and an institutional vacuum in the Russian innovation environment. Bulletin of Saratov State Socio-Economic University, 5, 44-48.
Muller, K., Ryan, A. (2008), The growth of strategic networks – New models of value creation. Russian Management Journal, 6(4), 113-140.
Nizhegorodtsev, R.M. (2010), Cluster-network externalities and institutional filters in the modern knowledge economy. Manager, 7-8, 46-51.
North, D. (1991), Institutions. The Journal of Economic Perspectives, 5(1), 97-112.
Patyurel, R.F. (1997), Creating of network structures. Problems of Management Theory and Practice, 3, 76-81.
Perez, C., Soete, L. (1988), Catching up in technology: Entry barriers and windows of opportunity. In: Dosi, G., Freeman, C.H., Nelson, R., Silverberg, G., Soete, L., editors. Technical Change and Economic Theory. New York: Columbia University Press and Pinter. p458-479.
Polterovich, V.M. (1998), Institutional Traps and Economic Reforms. Moscow: Russian Economic School.
Porter, J.M. (1967), Organizations in Action. New York: McGrow Hill.
Radaev, V.V. (1999), Russian business: The structure of the transaction costs. Social Sciences and the Present, 6, 5-19.
Reiss, M.D. (1997), The boundaries of "unlimited" enterprises: Prospects for network organizations. Problems of Management Theory and Practice, 1, 92-97.
Rothwell, R. (1994), Towards the fifth-generation innovation process. International Marketing Review, 11(1), 7-31.
Ryabtsev, N.V., Alsufeva, E.A. (2008), Problems of institutionalizing innovation. Problems of Modern Economics, 3(27). Available from: http://www.m-economy.ru/art.php3?artid=24242.
Sayfieva, S.N. (2008), Key indicators of development of the knowledge economy in Russia. In: Ernzyakina, B.A., editor. The Theory and Practice of Institutional Transformations in Russia. Vol. 10. Moscow: CEMR RAS. p110-29.
Sheko, P.A. (1999), Innovation economic mechanism. Problems of Management Theory and Practice, 2, 71-78.
Shinkevich, A.I., Galimullina, F.F. (2012), Management of institutional traps within the triple-helix model of innovation in the field of chemical technology. Bulletin of Kazan State Technological University, 9(15), 311-312.
Shironin, V.S. (2010), Institutions and innovation: A view of cognitive science. Economy Questions, 5, 43-57.
Shurkina, E.Y., Petrova, E.V., Petrova, G.D., Shirokov, L.V., Astaf'eva, I.A., Gatsenbiller, N.Y., Kharisova, G.M., Masalimova, A.R. (2015), Designing a model of interaction of economic resources in the quantization conditions of economic area. Mediterranean Journal of Social Sciences, 6(2 S3), 129-135.
Skorobogatov, A. (2009), "Special path" of Russia and the stimulation of innovation activity. Economy Questions, 2, 119-130.
Smith, K. (1994), Interactions in Knowledge Systems: Foundations, Policy Implications and Empirical Methods. Oslo: STEP Group Report.
Timofeev, G.V., Semenov, E.M. (2006), Network structure of business as a form of supporting the positive effects of infrastructure. News of Volgograd State Technical University, 10(5), 313-318.
Tretiak, O.A., Rumyantsev, M.N. (2003), Network forms of inter-firm cooperation: The approaches to the explanation of the phenomenon. Russian Management Journal, 1(2), 25-50.
Viber, R.D. (2003), Empirical laws of the network economy. Problems of Management Theory and Practice, 3, 86-91.
Williamson, O.E. (1979), Transaction-cost economics: The governance of contractual relations. Journal of Law and Economics, 22(2), 233-261.
Yevin, I.A. (2010), Introduction to the theory of complex networks. Computer Studies and Modeling, 2(2), 121-141.
Zaraychenko, I.A. (2010), Prospective models of innovation and create new networks of conductive polymer and composite materials. Bulletin of Kazan State Technological University, 9, 759-767.